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VOLUME
NO. 3

1

NOVEMBER-DECEMBER 1976

FIRE TECHNOLOGY ABSTRACTS



U.S. DEPARTMENT OF COMMERCE
National Fire Prevention
and Control Administration

NOTE . . .

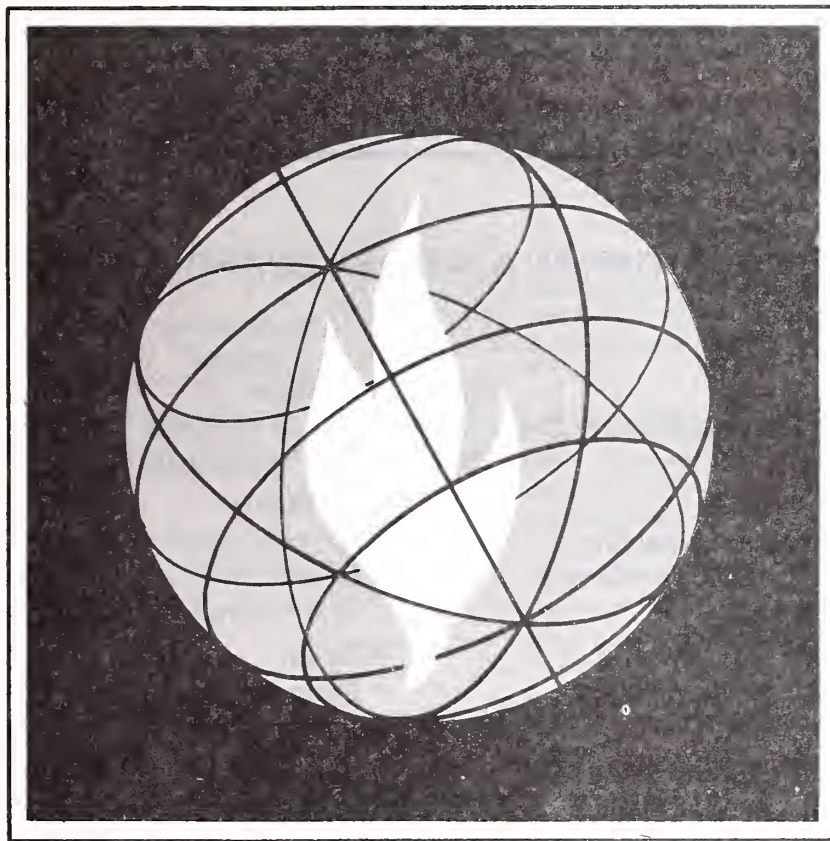
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FIRE TECHNOLOGY ABSTRACTS



U.S. DEPARTMENT OF COMMERCE
National Fire Prevention
and Control Administration
The National Fire Reference Service

Prepared by
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The Johns Hopkins University

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FIRE TECHNOLOGY ABSTRACTS

Fire Technology Abstracts is an abstracts journal being prepared bimonthly by the Fire Problems Program Group of the Applied Physics Laboratory of the Johns Hopkins University, Laurel, Maryland, USA, under the sponsorship of the National Fire Prevention and Control Administration (NFPCA) of the US Department of Commerce. It complements the Fire Research Abstracts and Reviews published under the auspices of the US National Academy of Sciences/National Research Council in cooperation with the NFPCA.

SCOPE AND COVERAGE

The aim of Fire Technology Abstracts is to provide comprehensive reference to the applied fire literature in the broad range of topics outlined in the "Table of Contents." Most topics are covered fully; a few topics, such as forest fires and mine fires, are referenced selectively, because they are covered systematically in other specialized indexing and abstracting serials. For such topics an appropriate notice has been entered under the respective category.

The information contained in Fire Technology Abstracts has been gleaned from a wide variety of sources (journals, books, reports, patents, codes, and standards), with particular emphasis on the report and patent literature, for which referencing heretofore has been inadequate. Although the English-language literature comprises the majority of the entries, the coverage includes selections from the world fire literature, identified in part through such sources as Safety in Mines Abstracts of the Safety in Mines Research Establishment (UK), identified in the abstracts as (SMRE), the Soviet Abstracts Journal, Series 68, "Fire Protection," identified as (RZh), and the card abstracts issued monthly by the Fire Literature Documentation Section of the German Fire Technology Research Center at the University of Karlsruhe, identified as (Fachdok).

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ARRANGEMENT

The journal is arranged in two sections: Abstracts and Indexes.

The Abstracts section contains complete bibliographic description required for retrieval of the item, along with a brief description of the contents of the item, usually consisting of the author's abstract, summary, or conclusions. The abstracts are classified under the 13 main categories listed in the "Table of Contents" and a suitable number of subcategories, which are subject to revision as the necessity for finer classification arises. The page-keyed categories and subcategories of the "Table of Contents" are repeated on the appropriate pages in the abstracts section to assist the reader in rapid identification of the topical field of interest.

The Index section consists of four indexes: author, subject, source, and report number. Each entry in each index is keyed to an abstract number. Annual cumulative indexes will be published.

The Author Index is an alphabetical list of all authors cited in the abstracts section, whether principal or secondary.

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The Report Index lists in alphabetical order the numbers of all the reports entered in each issue, including multiple numbers, as well as the accession numbers under which reports are available from document repositories.

These indexes (as indeed the entire journal) are composed and printed out by an IBM 360/91 computer, using the INFO-360 Document Writing Package of programs developed at the Applied Physics Laboratory. All but the subject index are produced directly from the printed portion of the entries. The subject index terms are typed in at the ends of the abstracts, but are not printed in the body of the journal. Author affiliations, whenever available, are also included in the records. These are not printed or listed, but are reserved for future use in developing directories and the like.

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Fire Technology Abstracts is a literature announcement service only and cannot respond to requests for the documents announced in the journal. For all literature citations an effort is made to provide the information needed by the reader to acquire the document. In general, however, the full text of many of the journal articles cited in the FTA can be purchased through the Original Article Tear Sheet service (registered tradename OATS) of the Institute for Scientific Information (registered ISI) in Philadelphia, PA. The full text of those abstracts terminating with (Fachdok plus number) can be purchased by citing the number and ordering from the Documentation Center of the German Fire Technology Research Center in Karlsruhe, FRG. The addresses of these two organizations are given below.

For books, monographs, conference papers, and proceedings the source is, in most cases, either the publisher or the sponsoring organization.

Dissertations are available in xerographic copy from University Microfilms of Ann Arbor, Michigan.

Patents can be obtained from the respective national Patent Offices.

US Reports are available for a fee from the National Technical Information Service (NTIS) or from the US Government Printing Office (GPO). If availability is not indicated, the issuing organization should be queried.

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FIRE TECHNOLOGY ABSTRACTS

Volume 1, Number 3

November-December 1976

1. GENERAL

a. FIRE PROTECTION ORGANIZATION

668. Obukhov FV, Filatov AV and Gavriley VM
ORGANIZATIONAL PROBLEMS IN IMPROVING THE CONTROL OF SOCIALIST PRODUCTION (PROBLEMY ORGANIZATSIY SOVERSHESTVOVANIYA UPRAVLENIYA SOTSIALISTICHESKOM PROIZVODSTVOM)
Moscow University Press, Moscow, USSR; pages 284-288, 1975 (Russian)

This book, which was compiled and published at Moscow University, contains an article entitled "Problems of Organization in Improving Administration of the Nation's Fire Fighting Service", the principal author of which is head of the Main Fire Protection Administration. Discussed in the article is the development of a set of predictions to solve the following problems: evaluation of the volume of work required to ensure fire protection of the national economy and the tendency of this volume to change as the national living standard increases; appraisal of the operational status; and development of ways and means to influence the operational situation. (RZh)

669. Jurkat MP
A REGIONALIZATION STUDY
Fire Chief; 20(8):72-74, 1976

A thorough study of fire protection in six communities in New Jersey shows how regionalization could provide fire protection at less cost and more efficiently. The study also provides a basic plan for merging the fire department functions on a step-by-step basis. 1 table. (Author)

670. Lucht DA
NFPCA DESIGNED TO ASSIST LOCAL AND STATE GOVERNMENTS
Fire Eng; 129(8):18, 21-22, 1976

In a talk presented at the annual meeting of the American Association for the Advancement of Science, held in Boston on Feb 24, 1976, the Deputy Administrator of NFPCA outlined one of the first products of the Administration to assist local and state governments to decide what to do about fire safety, the creation of a community fire protection master planning procedure. The various components of the plan are discussed in some detail, including identification and measurement of the community fire situation, identification and agreement on an acceptable fire risk, identification and evaluation of alternative combinations of public and private sector actions to

achieve the acceptable level of community fire risk, adoption and implementation of a community action plan, and monitoring of the effectiveness of the plan. The same types of analytical procedures are applied to buildings.

671. Okawa T
THE JAPANESE FIRE SERVICE
Internat Fire Chief; 42(3):8-13, 1976

This article is a paper presented by Chief T. Okawa at the 102nd annual meeting of the IFAC in Las Vegas, NV. Following a broad survey of the historical development of the Japanese fire service, which has undergone major reforms on several occasions, the author describes the organization and operating methods of the fire departments, which are shared in large measure by national, prefectural and municipal authorities. Financial problems are discussed, as are the specific problems of the individual fire departments, which have the tasks of fire prevention and protection, controlling hazardous materials and ambulance service, as well as measures to protect against earthquakes, protection of the fundamental rights of firemen, and others. 2 figs.

672. Rule CH
COULD REGIONALIZATION SOLVE YOUR PROBLEM?
Fire Chief; 20(8):68-71, 1976

More responsive and cost-effective delivery of fire and emergency medical services can be accomplished by consolidation or regionalization of two or a number of fire department jurisdictions. The planning, command, personnel, communication, funding, training, and logistics problems involved in such a procedure are examined.

673. Pfefferli W
THE FIRE SERVICE IN THE STATE OF BADEN-WUERTTEMBERG
Schweiz Feuerwehr Z; 102(8):303-308, 1976 (German)

On the occasion of a visit of a delegation of the Central Committee of the Swiss Fire Protection Association to the State Fire Protection School of Baden-Wuerttemberg in Bruchsal (FRG) and the inspection of several fire stations in the Karlsruhe administrative district, the author presents an outline of the organization of the fire protection service, its legal foundations, training, funding, and the problems arising in Baden-Wuerttemberg from community and territorial reform. 3 figs, 2 tables. (Fachdok 12/1006)

FIRE TECHNOLOGY ABSTRACTS

1. GENERAL

b. MEETINGS AND PROFESSIONAL ACTIVITIES

674. Anon

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, 368 pages, 1975

Sponsor: Fire Res Sta, Bldg Res Estab (UK)

For over 20 years the Commission W14 of the Conseil International du Batiment (CIB) has been a focus for fire research workers. It has conducted joint research projects and has provided a forum for the exchange of information and ideas between its members, representing countries all over the world. This symposium on the problems of smoke control in buildings was hosted by the Fire Research Station of the Building Research Establishment, UK. In the symposium, research workers, building designers, regulatory officials, fire brigade spokesmen and others met to pool their knowledge and experience. The volume of papers and discussion forming the proceedings of the symposium provide an authoritative and up-to-date source of information and opinion for the many specialists involved in the design of safer buildings. This volume contains the 26 papers presented at the symposium, all of which are separately abstracted. The individual abstracts can be found by consulting the source index under the appropriate "symposia" entries.

675. Anon

Dynamics of Fire Prevention Conf, Proc; 1976, Oct 18-20, Los Angeles, CA

Sponsor: Nat Fire Prev and Control Admin

The second national conference of the NFPCA was devoted to the theme of providing the fire community with assistance in planning, organizing, managing, and evaluating effective fire prevention programs. The major components of the conference were addressed in the first five sessions, followed by a sixth session to summarize the content of the previous sessions. The first session, A Proper Mix for Fire Prevention, emphasized the various facets and responsibilities of fire prevention, including industry, the firefighter, and the city manager. Session II, Fire Prevention Through Public Education, dealt with new developments in public fire education; professional qualifications for public education specialists; goals, objectives and functions of a public education program which reduces fire losses, and a special report on the NFPCA fire prevention programs. Session III, Fire prevention Through Building Design, took into account the significant impact on fire losses of the ways buildings are designed, constructed, and furnished, stressing the importance of building design in fire prevention to provide specific information on how to reach improvements in this area. Four papers were read in Session IV, Fire Prevention Through Inspection and Enforcement, namely: goals, objectives, and functions of fire inspection programs which reduce losses; a discussion of the qualifications required for fire inspectors; a discussion of the factors associated with the enforcement of fire codes, standards, and regulations. Fire Prevention through Fire and Arson Investigations and Fire Prevention in the United Kingdom was the theme of session V, in which three papers were presented: goals, objectives, and functions of fire/arson investigation programs which reduce fire losses; why arson is not a class 1 crime; and professional qualifications for fire investiga-

tors. The final, sixth session, Getting It Together in Fire Prevention, had as its primary object to illustrate the content of the previous sessions by drawing on examples of two successful fire prevention programs, one in Edmonds, Washington, the other in Fort Washington, Pennsylvania. The proceedings contains the texts of the twenty-four papers and ends with a list of conference participants. 110 pages.

676. Anon

Industrial Civil Defense Conf, Int, 3rd, Proc Record; 1975, Apr 8-12, Beirut, Lebanon

Sponsor: Internat Civil Def Org, Geneva, Switzerland

The complete record of the proceedings of the conference contains abbreviated versions of several papers relating to fire safety within the framework of civil defense planning: paper 13 - Protection and Security Problems in Petroleum and Petrochemical Industries; paper 14 - Security Regulations and Devices for Public Premises and Conveyances; paper 15 - Safety Measures in Highrise Buildings; paper 16-Modern Construction Materials and Their Use in Highrise Buildings; Research into Inflammability and Toxicity of Materials; and Rescue of Trapped Persons from Highrise Buildings by Helicopter. 107 pages.

677. Anon

THE SCIENTIFIC APPROACH IS THE FOUNDATION FOR SUCCESS

Pozhar delo; (5):14-16, 1976 (Russian)

A detailed report is given on an All-Union scientific and practical conference on the fire protection of public housing held in Moscow in 1975, in which builders, architects and fire specialists reviewed current and future problems of fire protection in the light of present-day trends in the development of urban construction. An important theme of the conference was fire protection of the future, which begins in the laboratories of chemists and workshops of the building industries, with particular emphasis on the scientific aspects of fire safety development.

c. LITERATURE AND NOTICES

678. Bennett D

IS THERE A NEED FOR A FIREMAN'S HANDBOOK?

Fire; 69(855):183, 1976

Following a discussion of the recent re-issue of the *Manuals of Firemanship (UK)* and their availability, the author proposes compilation of a "Fireman's Handbook", which would be a reference book satisfying the fireman's everyday needs. The contents should include the headings of fire service conditions, practical firemanship and fire prevention.

679. Jason NH

FIRE RESEARCH PUBLICATIONS, 1975. Nat Bureau of Standards, Center for Fire Res, Washington, DC; NBSIR 76-1120, 12 pages, Sep 1976

Availability: NTIS

Fire Research Publications, 1975 is a supplement to the previous editions, which covered the years 1969 - 1972 (NBSIR 73-736), 1973 (NBSIR 74-511) and 1974

1. GENERAL

c. Literature and Notices—Continued

(NBSIR 75-736). Only publications prepared by the members of the Center for Fire Research (CFR), by National Bureau of Standards (NBS) personnel or external laboratories under contract or grant from the CFR are cited. Articles published in NBS house organs also are cited. The standards publications include Technical Notes (TN), Building Science Series (BSS), and Standards Interagency Reports (NBSIR). (Author)

d. FIRE AND EXPLOSION INCIDENT CRITIQUES AND ANALYSES

680. Baldino A

TRAIN FIRE IN AN UNDERGROUND STATION*Antincendio protez civ*; 27(10):767-771, 1975 (Italian)

After a fire in a subway station in Naples, deficiencies and difficulties in organizing the fire-suppression attack and in evacuating people from underground stations were discovered. The presence of cables in the tunnels and of flammable materials used to finish car interiors makes such premises fire hazards, requiring special fire safety measures, such as the installation of fire hydrants in subway stations, emergency smoke removal systems, and others.

681. Anon

FIRE IN A SYNTHETIC RESIN VARNISH FACTORY*Brandverhuetung*; (118):57-59, 1976 (German)

The synthetic resin department of a varnish factory in the Federal State of Salzburg (Austria) was the scene of a fire which was instructive with respect to the manner of ignition. The production process is illustrated. Owing to overboiling, the contents of the reaction vessel ran over, releasing xylene vapors, which could have been ignited only by some remote source. The overflow from the vessel was then set afire by flame flashback. 2 figs. (Fachdok 12/0977)

682. Dimeo MJ

WHERE THERE ARE NO EMERGENCY EXITS*Fire Command*; 43(8):46-49, 1976

An NFPA fire analysis specialist examines the causes of prison fires and the advantages and liabilities of the prison fire environment, such as construction, lack of staff training, detection and alarm delays, lack of smoke ventilation, and evacuation. Nine actual prison fire scenarios are cited in evidence of the prison fire prevention and protection problems. 1 photo.

683. Gebhardt M

FIRE IN THE LIVING QUARTERS OF OCEAN GOING VESSELS - A MORTAL DANGER*Hansa*; 112(23):1937-1942, 1975 (German)

A description of fires in the living quarters of three dry-cargo ships leads to the following conclusions: all the fires built up rapidly (10-15 min) and spread outside the compartments where they broke out. All the fires were accompanied by rapid smoke logging of all decks, promoted by open gangways and doors. Conditions which threatened the lives of the personnel developed quickly. Fire-fighting teams were not able either to save the lives

of those cut off by the fires or to extinguish them on their own. The ships were built in accordance with the regulations of the International Convention for the Protection of Human Life at Sea of 1960, but the structural protection measures specified by the Convention did not prevent the rapid spread of flame and smoke. In 1972 the Federal Republic of Germany introduced the new regulations of the Professional Seaman's Union, strengthening the active protective measures, the most important of which is the shielding of gangways, corridors and quarters by incombustible bulkheads. It is stated that these measures are inadequate and it is recommended that automatic detection systems be installed in these areas. 2 refs. (RZh)

684. Scott RL

BROWNS FERRY NUCLEAR POWER-PLANT FIRE ON MAR 22, 1975*Nuclear Saf*; 17(5):592-611, 1976

This article reviews the Mar 22, 1975, fire at the Browns Ferry nuclear power plant. The fire originated in the electrical cable trays and burned for 7 hrs before it was extinguished by water. The use of water was delayed until the reactors were in a stable shutdown condition because of the possibility of shorting circuits, which might have caused further degradation of conditions that would have been more difficult to control. However, when water was authorized, the fire was quickly extinguished. The fire-fighting efforts and the damage by the fire are described. The loss of electrical power and control circuits resulted in the unavailability of emergency core-cooling systems and hampered efforts to provide normal cooling to the reactor fuel. The availability of alternate cooling methods is reviewed, the efforts to maintain cooling of the reactor fuel are discussed, and the basic reasons for the common-mode failures are described. Assessments of the fire were made by three groups in the U.S. Nuclear Regulatory Commission (NRC), as well as by an independent insurance group. Some of the details of these assessments are presented, in particular, some deficiencies that the NRC Office of Inspection and Enforcement found during its investigation and some of the lessons learned from the events as determined by the NRC Special Review Group. 14 figs, 8 refs. (Author)

685. Bielezke A

AN UNUSUAL CAUSE LED TO A FIRE IN AN OPTICIAN'S WORKSHOP*Unser Brandschutz*; 26(7):28-29, 1976 (German)

A fire with appreciable property damage occurred in an optician's place of business. A large quantity of highly combustible material, such as celluloid plates, frames for glasses, acetone and wooden fittings, was located in the workshop, contributing to rapid spread of the fire. An investigation of the cause of the fire showed that the explosion of an a-c meter in the workshop was responsible for the fire. Due to the continuous use of acetone, acetone vapors must have penetrated into the meter through the openings for the cable lead, resulting in the buildup of an explosive mixture. Ignition may have been by a spark. Then the acetone was ignited by the short-circuit spark. 4 figs. (Fachdok 12/0888)

FIRE TECHNOLOGY ABSTRACTS

1. GENERAL

d. Fire and Explosion Incident Critiques and Analyses—Continued

686. Kordina K, Krampf L and Seiler HF
AN EXAMINATION OF THE EFFECTS OF A BIG FIRE IN SOME CONCRETE BUILDINGS

Fire Prev Sci Technol; (14):4-17, 1976 (English; German and French summaries)

The types of concrete used in the construction of the buildings are detailed, and the damage which occurred in the fire is described. The performance of these materials is considered in relation to the mechanical and fire loadings present. This contribution is the translation of an article published in *Beton u. Stahlbeton*, Vol 67, Nos. 5/6, pp. 108-113, 129-134. 15 figs. (Author)

687. Butlin RN

ESTIMATION OF MAXIMUM EXPLOSION PRESSURE FROM DAMAGE TO SURROUNDING BUILDINGS. EXPLOSION AT MERSEY HOUSE, BOOTLE, 28 AUGUST 1975. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1054, 11 pages, 4 figs, 7 refs, Jul 1976

An explosion in the ground floor flat of a 16-story block caused severe damage to the flat, some other parts of the 16-story block, and resulted in the failure of many windows in surrounding property.

Calculations based on the decay of pressure with distance, and the dimensions and thickness of glazing broken in nearby buildings, indicate that the peak explosion pressure within the flat was between 46 and 81 kN/m² (6.5 and 11.5 lbf/in²). These pressures are substantially greater than those that would be expected from measurements made from explosions in single, empty compartments, and are also greater than that calculated from an equation making some allowance for turbulence, and indicate that a high degree of turbulence was generated by the complexity of the compartmentation and the contents of the flat.

These findings emphasize the importance of tests to be carried out by the Fire Research Station in a complex array of compartments and corridors and the development of appropriate mathematical expressions for the relationship between vent area and explosion pressure for a given set of conditions. (Author)

688. Burriss WH, Jr

EXPLOSION AND FIRE IN A-LINE FACILITY OF THE SAVANNAH RIVER PLANT. EI DuPont de Nemours and Co, Savannah River Lab, Aiken, SC; CONF-751084-1, 4 pages, Sep 1975

Availability: NTIS DPSPU-75-30-13

During routine operations to reduce uranyl nitrate hexahydrate to uranium trioxide, an excessive amount of organic solution entered denitrator pots and ignited. Damage from the resulting explosion and fire amounted to about \$300,000. No spread of contamination or serious injuries occurred. The facility has been restored to production with process modifications to prevent recurrence. (Author)

e. FIRE SCIENCE EDUCATION

689. Zwingmann R

BASIC FIRE EDUCATION AT THE BERLIN TECHNICAL UNIVERSITY

Beratende Ing; (6):17-18, 21-24, 1976 (German)

The Interior Design and Planning Institute of the Berlin Technical University is the first institute in the Federal Republic of Germany to take steps toward introducing preventive structural and industrial fire protection as a required subject in the curriculum. The fire protection information absolutely necessary for the architect is introduced at this institute. The present article gives the reasons why this must be done and explains what is taught about fire protection. 2 figs. (Fachdok 12/0903)

690. Sylvia RP

FIREMEN WILL FEEL ACADEMY IMPACT ON EDUCATION

Fire Eng; 129(8):44-45, 1976

The status of planning for the National Fire Academy's training and education program is reviewed. The scope of the program is indicated in a chart. Position papers are being written for the fire prevention, arson, data, instruction training and management education and training programs and for the two- and four-year college curricula and correspondence courses. The greatest progress has been made on the arson detection and investigation program. Ways of delivering the programs to the fire service are being examined, perhaps by classes and seminars at the Academy, where possible by working through state directors of fire service training. Model courses may be made available. A computerized record system for the Academy's training and educational program is being considered. 2 tables.

691. Sylvia RP

ARSON PROGRAM ON WAY TO FIGHT NATION'S MAJOR FIRE PROBLEM

Fire Eng; 129(8):48-49, 1976

An arson detection and investigation program will probably be the first educational program to be instituted by the National Fire Academy, as recommended by conferees at the Battelle Institute Conference in Jan, 1976. The four phases of the program are discussed, namely, detection, company officer training, arson investigation, and fire investigation. The scope of course development participation by representatives of the fire service, police service, and criminal justice system, as well as from the insurance industry and banking industry is being considered. The course may include the material needed for an arson investigator to become certified. 1 photo.

692. Sylvia RP

13 STATES GETTING PLANNING GRANTS

Fire Eng; 129(8):50-52, 1976

The planning assistance program of the National Fire Academy has provided funding for state use. Nine states have been recommended for grants to develop statewide fire education and training organizational designs and four states have been selected for the development of comprehensive five-year statewide plans for improving fire education and training. The objectives and procedures of the assistance program are discussed.

1. GENERAL

f. LEGISLATION

693. Schaffner LE and DeCicco PR
DEVELOPMENT OF A COMPREHENSIVE FIRE SAFETY LAW FOR NEW YORK; Paper No. 24
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 317-341
 Sponsor: Fire Res Sta, Bldg Res Estab (UK)

In January 1973, after two serious fires in highrise office buildings, New York City adopted a comprehensive fire safety law. For the first time in the City's history such legislation was made retroactive, affecting 900 existing buildings over 100 feet high and thousands under 100 feet. Mr. Schaffner, who was the Executive Director of the Mayor's Committee on Fire Safety in Highrise Office Buildings, describes conditions which led to the formation of the Committee, participation of industry, full-scale features of the law, and the compliance experience in existing buildings. In order to verify the applicability of the proposed requirement for stairwell pressurization in existing buildings, Professor Paul R. DeCicco of Polytechnic Institute of New York was asked to conduct full-scale fire tests in a 22-story office building. In addition, scale models (including stairwells) were tested to establish drag coefficients and means of control. Continuing studies on stairwell pressurization systems are being made in a 41-story building as well as in models which will lead to general design guidelines applicable to a wide variety of buildings. A report will also be made on model studies of smoke control measures for a major atrium-type hotel to be built in New York City. 22 refs. (Author)

694. Hinkel E
OPERATIONS OFFICER ACCORDING TO THE "STATE LAW ON FIRE PROTECTION AND TECHNICAL ASSISTANCE" OF RHEINLAND PFALZ
Brandschutz; 30(4):92-95, 1976 (German)

In this brief article an attempt is made to shed light on points not adequately classified by the fire protection law of June 27, 1974. This is true particularly of technical control, which is missing entirely in this law. On the other hand, a distinct regulation on "overall command" is introduced in the law; both operations control in the normal case or with joint operations by the professional and voluntary fire departments or operations by industrial fire brigades with the voluntary or professional fire departments, all these combinations are regulated in the law and discussed in the article. The law as it applies to the powers of the operations officer is criticized because of inadequate delineation of duties. The coercive measures available to the operations officer are classified. 4 figs. (Fachdok 12/0642)

g. RESEARCH AND DEVELOPMENT PROGRAMS

695. Stolp M, Zorgman H, Crommelin RD and Euser P
RESEARCH PROPOSAL ON SMOKE PROBLEMS IN BUILDINGS; Paper No. 26
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 355-368
 Sponsor: Fire Res Sta, Bldg Res Estab (UK)

In this research proposal concerning smoke problems presented by fire in buildings, the motivation is based on the annual loss of some fifty human lives (in The Netherlands) in consequence of smoke generation, as well as on an economic loss amounting to approximately 100 million florins per year. In order to obtain an overall view of the problem, the following questions may be posed: (1) How much smoke does a fire produce? (2) In what manner does smoke propagation take place? (3a) How much smoke can a human being tolerate under certain conditions? (3b) How much smoke can a material tolerate before suffering smoke damage? and (4) What measures are available for combating the smoke problem? In answering these questions it appears meaningful to subdivide smoke in terms of particles, gases and convective heat, and to apply to the fire a subdivision corresponding to its three stages of development, namely, the start of the fire, the stage of growth, and burning state (when the fire is fully developed). Each of these three stages is characterized by its own smoke production and smoke spread mechanism. The acceptability level decides which stage of development of the fire will have to be considered and how accurately smoke production and propagation will have to be known. Set up in this way, the proposal aims to present an overall approach to the smoke problem.

696. Anon
FIRE RESEARCH STATION'S ANNUAL REPORT FOR 1975
Fire; 69(853):80, 1976

The results of Fire Research Station studies of the economic aspects of fire and fire protection are to be used in the formulation of fire protection policies and to be of influence when considering the provisions of fire regulations for buildings. Some of the programs being pursued are the problems of escape from house fires, research and testing of detectors and contribution to international standardization of these devices; linking the extinguishing capabilities of foams with their physical properties; full-scale experiments on the behavior of many items of furniture and furnishings in fire; and the use of a suitable plastic (polyurethane or polyisocyanurate) foamed into reusable molds to form temporary shelters for large numbers of disaster survivors. 1 ref.

697. Zachary WB, Crossman ERFW and Quan EC
AN INTERIM REPORT ON THE FINDINGS OF THE SAN FRANCISCO HIGH-RISE STUDY. Univ of California (Berkeley), Fire Res Group; UCB FRG 76-5, 34 pages, 17 tables, Oct 1975

The interim report forms part of an ongoing project designed to acquire up-to-date knowledge of the experiences of people with fire incidents, availability of fire protection equipment, fire knowledge and preparedness, and attitudes and desires regarding fire protection. This information is needed to design an efficient and cost-effective fire protection system. The initial survey on which the present one is modeled was performed in Berkeley, California. Another study, still in the planning phase, is scheduled for the city of Worcester, Massachusetts.

Current research is concerned with extending and deepening the data base available from pioneer studies. Also see UCB FRG WP-76-10. (Author)

FIRE TECHNOLOGY ABSTRACTS

1. GENERAL

g. Research and Development Programs—Continued

698. Zachary WB, Crossman ERFW and Quan EC
THE SAN FRANCISCO RESIDENTIAL HIGH-RISE FIRE SAFETY INVESTIGATION. Univ of California (Berkeley), Fire Res Group; UCB FRG WP 76-10, 57 pages, 23 tables, 1976

This report forms part of an ongoing project designed to acquire up-to-date knowledge of the experiences of people with fire incidents, availability of fire protection equipment, fire knowledge and preparedness, and attitudes and desires regarding fire protection. Such information is needed to design an efficient and cost-effective fire protection system. The initial one on which the present one is modeled was performed in Berkeley, California. Additional study has since been done in the city of Worcester, Massachusetts. Current research is concerned with extending and deepening the data base from the pioneer Berkeley and NBS studies.

This report represents the bulk of the more salient findings in the San Francisco highrise survey. It will be followed shortly by a comparison of Berkeley, San Francisco, and selected Worcester results which will seek to establish some justifiably generalizable statements about occupant response to, and preparedness for, fires occurring in this country. A forthcoming report, to be filed with the National Technical Information Service, will contain additional analysis, conclusions, and information on the actual project techniques. See also UCB FRG 76-5. (Author)

2. DYNAMICS AND MECHANICS OF FIRE

a. FIRE BUILDUP, PROPAGATION, AND SPREAD

699. Rasbash DJ
A FLAME EXTINCTION CRITERION FOR FIRE SPREAD
Combust Flame; 26(3):411-412, 1976

A number of theories of flame spread over surfaces have been advanced, both for solid and liquid fuels, mostly fuel oriented and focusing on the rate at which fuel ahead of the flame becomes heated to a certain temperature that characterizes flame onset. The author suggests that it may be illuminating to focus on the flame as well as the fuel, visualizing the flame as extending within boundaries (near the surface of the fuel) at which a flame extinction condition prevails and regarding the movement of the flame forward over the fuel as the movement of one of these extinction fronts. The simple fire point theory is applied to the development of the criterion. 1 fig, 3 refs. (Author)

700. Delichatsios MS
FIRE GROWTH RATES IN WOOD CRIBS
Combust Flame; 27(2):267-278, 1976

The burning history of a wood crib ignited at the center of its base has been investigated theoretically and experimentally. A simple energy-balance model has proven successful in predicting the radial fire-spread rates and mass

burning rates for varying crib geometries with accuracies of $\pm 10\%$. Exceptions to the validity of the model were only noted for very densely packed cribs, for which significant lateral spread occurred simultaneously with vertical fire spread. Cribs consisting of sticks with thicknesses of 0.635 cm, 1.9^o5 cm and 3.17 cm were burned in the present experiments. Analysis of pressure modeling experiments has also shown that pressure modeling cannot, in general, model the fire growth rates in wood cribs. 8 figs, 2 tables, 15 refs. (Author)

701. Bullen ML
A COMPARISON OF FLASHOVER TIMES IN SMALL-SCALE FIRES USING TEST DATA
Fire Mater; 1(2):74-75, 1976

Reaction to fire standard tests on materials used as linings are not sufficient in themselves to predict the behavior of growing fires. However, flashover times with cellulose linings have been correlated qualitatively with the British test, but generally there is wide divergence in the test results from different countries. This short paper discusses some aspects of this problem. 2 tables, 7 refs. (Author)

702. Martin RE, Pendleton DW and Burgess W
EFFECT OF FIRE WHIRLWIND FORMATION ON SOLID FUEL BURNING RATES
Fire Technol; 12(1):33-40, 1976

Burning rates of Douglas fir wood were measured using crosspiled sticks 1/4, 1/2, 3/4 and 1 inch in cross-sectional dimensions. The 1/4-inch crosspiles (cribs) burned up to 4.2 times as fast with whirlwind as without, and 1-inch cribs, as low as 1.4 times as fast with whirlwind formation as without. Differences between size classes of crib sticks were inconsistent, perhaps due to variation in wood density, high packing ratios, and crib shape. 6 figs, 2 tables, 14 refs. (Author)

703. Nakakuki A
FLAME SPREAD OVER SOLID AND LIQUID FUELS
J Fire Flammability; 7(1):19-40, 1976

The mechanism of flame spread over solid and liquid fuels was studied. The horizontal flame spread over solid fuels, especially for plastics, is discussed. The various heats transferred from the flame to the fuel ahead of the flame front are estimated from the experimental data. The conductive heat through the gas phase is seen to be dominant. The heat from the flame to the unburnt fuel, calculated by the equation derived by Lastrina *et al*, agreed roughly with the value estimated from the data. The flame spread over liquid fuels is discussed. In flame spread over non-volatile liquid, the fire point and the convection of the liquid are known to give effects on the flame spreading velocity. The flame spread over the volatile liquid under various ambient pressures and oxygen-enriched atmospheres is analyzed by the theory of flame propagation in the Bunsen burner and tube. 12 figs, 4 tables, 27 refs. (Author)

704. Tu K-M and Davis S
FLAME SPREAD OF CARPET SYSTEMS INVOLVED IN ROOM FIRES. Nat Bureau of Standards, Center for Fire Res; NBSIR 76-1013, 41 pages, 23 figs, 4 tables, 4 refs, Jun 1976
Availability: NTIS

FIRE TECHNOLOGY ABSTRACTS

2. DYNAMICS AND MECHANICS OF FIRE

a. Fire Buildup, Propagation, and Spread—Continued

This study was designed to test the hypothesis that given a situation where a chair or other item of furniture becomes the first item to burn in a room (providing the ceiling and walls are noncombustible), there is little reason to expect involvement of the carpet in the fire beyond the immediate vicinity of the burning object. Four small-sized carpet fire tests and eight full-scale burn room fire experiments were conducted. Experimental data for temperature distribution and incident heat flux to the floor covering were measured in the rooms. General analysis of the experimental results obtained shows this to be the case. It also is evident that the critical radiant flux of the floor covering system is predictive of the extent of burning. From this study, carpet systems used in rooms will not normally spread fire provided they meet the requirements of DOC FF 1-70 (the pill test). (Author)

705. Bullen ML

A COMBINATION OVERALL AND SURFACE ENERGY BALANCE FOR FULLY-DEVELOPED VENTILATION-CONTROLLED LIQUID FUEL FIRES IN COMPARTMENTS. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1051, 43 pages, 15 figs, 7 tables, 1 ref, Jun 1976

As part of the research to extend the understanding of fully-developed wood fires to non-cellulosic fuels, the outline of a theoretical energy balance for a liquid fuel fire in a compartment is presented. A computer solution of the heat balance is described and the results of simulated fires are given to illustrate the uses of the model and the limitations of the assumptions made in the theory.

The results show systematic departures from the well-known assumption of the constancy of the ratio of burning rate to ventilation rate; this can account for some of the scatter commonly found in measurements of this ratio. (Author)

b. FLAMMABILITY, IGNITION, AND EXTINCTION

706. Damant GH

FLAMMABILITY ASPECTS OF UPHOLSTERED FURNITURE. Part II.

Fireline; :9-11, June, 1976

The second part of this report of work performed by the California Bureau of Home Furnishings on furniture composites indicates the interaction of dissimilar upholstery materials when tested in the form of prototype mock-up furniture systems. In addition, the positive flammability effect of using filling materials which comply with California furniture regulations versus conventional filling materials is indicated.

c. FLOW OF COMBUSTION PRODUCTS

707. Brown VL

THE NATURE OF SMOKE AND ITS SIGNIFICANCE IN A FIRE; Paper No. 1

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 5-11

Sponsor: Fire Res Sta, Building Res Estab (UK)

Smoke is probably the most significant and dangerous phenomenon associated with fires in buildings. It poses serious problems for persons trying to escape and for firefighters who may need to rescue people as well as fight the fire. In designing new buildings, therefore, it is of vital importance from a safety viewpoint to make effective arrangements both to contain smoke and extract it. It is essential that architects and engineers have a good basic understanding of smoke behavior and of the advantages and disadvantages of the various existing control methods. (Author)

708. Archer AJ

SMOKE AND ITS PROBLEMS IN THE FIRE STATION; Paper No. 2

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 13-19

Sponsor: Fire Res Sta, Bldg Res Estab (UK)

Fire situations present a hazard to life both when members of the Fire Service are engaged in fire fighting or members of the public are making their way to safety when danger arises. The rapid buildup of heat and smoke which can occur in these situations demands that attention should be paid to a more positive approach to smoke control. Common features can be identified in a cross section of different fires; one concludes that these problems can be resolved and, furthermore, that the future concepts of building developments should give smoke control a high priority at the design stage. (Author)

709. Robertson AF

ESTIMATING SMOKE PRODUCTION FROM ROOMS AND FURNISHINGS; Paper No. 3

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 21-32

Sponsor: Fire Res Sta, Bldg Res Estab (UK)

In the absence of specific analytical methods for measuring the hazards of fire gases, there is a trend towards the use of smoke production as a partial measure of this hazard. It is suggested that present smoke test methods may be best used to provide indications of the possible smoke production, i.e., product of specific optical density and fire exposed area, characteristic of fully involved furnishing and interior finish products. It is demonstrated that very large quantities of smoke will result from combustion of only small quantities of most combustibles. Because of this there is little opportunity for elimination of the smoke hazard during fires through establishment of any but the most drastic limitations on the smoke development characteristics of materials considered acceptable. Measures for limiting ignition and development of fires, together with containment and disposal of smoke when fires occur, appear the most promising methods for reducing hazards due to smoke. 2 figs, 5 tables, 10 refs. (Author)

710. McCaffrey BJ and Quintiere JG

FIRE-INDUCED CORRIDOR FLOW IN A SCALE MODEL STUDY; Paper No. 4

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 33-47

Sponsor: Fire Res Sta, Bldg Res Estab (UK)

2. DYNAMICS AND MECHANICS OF FIRE

c. Flow of Combustion Products—Continued

The airflow induced within a corridor by a room fire was studied for a scale model configuration. The effect of corridor exit opening was determined for a fixed room door opening and temperature gradient. Velocity and temperature measurements were made. At the room doorway and corridor exit the thermally stratified flow would enter and leave with a sharp boundary between the counter-current flows. However, within the corridor the flow was more complex, giving rise to a large recirculating zone traversing the corridor length and trapped between the hot ceiling jet and entering cold flow. Smoke tracer visualization techniques illuminated these complex flow patterns along with mixing caused by shedding vortices. These flow results are quantitatively presented and their nature is discussed. The total mass flow rate induced into the corridor was measured and compared to theoretical results. At this time, the implications of these complex corridor flows in a scale model must be limited until they are verified in similar full-scale experiments and their nature is more thoroughly understood. 5 figs, 8 refs. (Author)

711. Wakamatsu T

UNSTEADY-STATE CALCULATION OF SMOKE MOVEMENT IN AN ACTUALLY FIRED BUILDING; Paper No. 8

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 81-97

Sponsor: Fire Res Sta, Bldg Res Estab (UK)

We have already developed three calculation methods for predicting smoke movement and designing smoke control systems; these are (1) simplified steady-state, (2) steady-state (on a whole system of a building) and (3) unsteady-state method. The methods of (1) and (2) have been developed mainly for designing smoke control systems. The unsteady-state calculation method could be useful in checking reliabilities of predicting smoke movement by the former methods, or in analyzing fire and smoke behavior in actually fired buildings. In this method, pressures, air and smoke flow quantities, concentrations of smoke or gases and temperatures, which are variant with time, can be calculated for every compartment in a building. We have checked and discussed reliabilities or accuracies of the methods stated above by means of field experiments or cross comparisons of calculated results by these methods. Furthermore, we have analyzed smoke movement in two actually fired buildings by the unsteady-state calculation method. One of them has been published in the Occasional Reports of JAFSE, No. 1 (CIB/W14/60/74(J)). This paper presents another example as an application of analyses by the calculation method for a five-story hospital building. In the example analysis, air and smoke flows are considered along approximately 440 flow paths, and concentrations of smoke or gases and temperatures are calculated for approximately 120 compartments, including the fire compartment. 8 figs, 1 table, 1 ref. (Author)

712. Shannon JMA

COMPUTER ANALYSIS OF THE MOVEMENT AND CONTROL OF SMOKE IN BUILDINGS WITH

MECHANICAL AND NATURAL VENTILATION; Paper No. 9

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 99-126

Sponsor: Fire Res Sta, Bldg Res Estab (UK)

The method predicts smoke flow in naturally ventilated and/or air-conditioned buildings. The program simulates the building as a complete pressure/smoke flow system. Being a simulation, it is capable of not only the conventional constant pressure/temperature/flow 'steadystate' analysis, but also a 'dynamic' analysis in which the temperature and pressure distributions vary appropriately with time throughout the building. The fire is described in terms of its volume, temperature and smoke production characteristics with time. The usual factual tabular results are augmented by graphical output. The resulting pollutant concentration is shown on a Visual Display Unit (VDU) as a number of dots (proportional to the concentration) in the appropriate parts of each room of a schematic section of the building. This visual aspect considerably aids a proper understanding of the building operation. The VDU output completes a feedback loop and the program can be run in an interactive mode also. The characteristics of any air path and/or fan system can be changed and fire(s) can be started in as many rooms and at any time desired through the calculation. Thus, the designer can investigate, in detail, for this particular building, the results of several approaches to controlling smoke movement. 12 figs. (Author)

713. Appleton IC

A MODEL OF SMOKE MOVEMENT IN BUILDINGS; Paper No. 10

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 127-137

Sponsor: Fire Res Sta, Bldg Res Estab (UK)

For some time investigations have been continuing at FRS (the Fire Research Station (UK)) into the physics of the movement of smoke in buildings and the effectiveness of various smoke control measures. To coordinate this work, FRS commissioned SCICON (Scientific Control Systems Ltd (UK)) to develop a model of smoke in buildings, based on physical equations derived at the station and to write a computer program. This paper is a summary of the SCICON reports of the computer model and its subsequent usage. 6 refs. (Author)

714. Pyle WC

SMOKE CONTROL BY MECHANICAL VENTILATION; Paper No. 11

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 139-148

Sponsor: Fire Res Sta, Bldg Res Estab (UK)

A look is taken at the current trends and the present state-of-the-art of smoke control technology in the UK from the viewpoint of the Building Services Engineer, involving a general consideration of the principles and concepts for the control of smoke in buildings by mechanical ventilation and, in particular, related to engineering aspects of primary concern to the engineer responsible

2. DYNAMICS AND MECHANICS OF FIRE

c. Flow of Combustion Products—Continued

for the design of building services. The review is confined to the aspects of smoke control as distinct from prevention, and to smoke control by mechanical ventilation as distinct from natural ventilation. The principal aspects under consideration are the factors on which the requirements for smoke control are based, and the possible methods for achieving these requirements by mechanical ventilation by the implementation of measures such as dilution of smoke, pressure differentials, smoke removal, but excluding examination of the mechanism of smoke spread and the related principal factors involved in the motivating force of the fire, buoyancy effect, weather effect and air-handling effect, all of which are outside the scope of this particular paper. 7 refs. (Author)

715. Gilbert L

THE FIREMAN'S VIEWPOINT ON THE CONTROL OF SMOKE MOVEMENT; Paper No. 22

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 299-306

Sponsor: Fire Res Sta, Bldg Res Estab (UK)

On the basis of personal fireground experience, the author proposes seven points for close examination on a research project to combat the problem of smoke as a killer in fires: the need for more research to replace the smoke-producing materials; the need for legislative control over the building contents and for international standards of reasonably safe materials; the urgent need for a simple, cheap, and effective home smoke detection system; in public places automatic smoke detection should be regarded as an integral part of escape means and a legislative requirement; the need for a small, compact breathing apparatus for firemen and others; the need to bring the home under the scope of fire safety legislation; and the need for a distinctive fire alarm signal which would be standard throughout the world. 3 figs, 1 table.

716. Silcock A

SOME PRACTICAL PROBLEMS OF SMOKE MOVEMENT IN BUILDINGS; Paper No. 23

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 307-316

Sponsor: Fire Res Sta, Bldg Res Estab (UK)

Outlined in this paper are problems relating to the less predictable ways in which smoke can travel through buildings. These problems may arise owing to concealed voids and cavities in the structure, or may result from the particular circumstances of fire development, the performance of the building and its components in the fire, and also from the actions of the occupants. 6 figs, 1 table, 3 refs. (Author)

d. INSTRUMENTATION

717. Greenberg S

QUANTITATIVE DETERMINATION OF SMOKE AND TOXIC PRODUCT POTENTIAL OF MATERIALS WITH**THE AMINCO-NBS SMOKE DENSITY CHAMBER**;

NASA Spec Publ No. 379
Space Simulation Conf, 8th, Proc; 1975, Nov 3-5, Silver Spring, MD

The Aminco-NBS Smoke Density Chamber is discussed in terms of design and application. The instrument uses a collimated vertical light beam in conjunction with an ultra-linear photomultiplier microphotometer to measure quantitatively smoke obscuration produced by standard area samples under high-energy pyrolysis. Results are expressed in dimensionless Specific Optical Density. 48 refs. (Author)

718. Martin SB

CHARACTERIZATION OF THE STANFORD RESEARCH INSTITUTE LARGE-SCALE HEAT-RELEASE

CALORIMETER. Stanford Res Inst, Menlo Park, CA; NBS GCR-76-54, 81 pages, 22 figs, 6 tables, 8 refs, Oct 1975

Availability: NTIS

A scaled up version of the NBS heat release rate calorimeter was constructed at SRI. It can measure specimen sizes up to 18 x 24 inches over an incident radiant flux range of 1.5 to 7.0 W/cm². The performance of the instrument is evaluated and various calibration procedures are described. The effect of specimen size and irradiance is investigated and data are compared with those taken in the NBS instrument. The use of the heat release rate calorimeter as a research tool is discussed. In particular a "limiting thermal index" and a "thermal sensitivity index" are defined. (Author)

e. METEOROLOGY

f. RADIATION

719. Tamanini F

THE PREDICTION OF REACTION RATES AND ENERGY TRANSFERS IN TURBULENT FIRE PLUMES.

Factory Mutual Res Corp, Basic Res Dept; FMRC 22360-3, 44 pages, 5 figs, 3 tables, 22 refs, May 1976

An improved version of the k-e-g model of turbulence is applied to the case of buoyancy-controlled turbulent diffusion flames. The model accounts for the generation of turbulence due to the gravity field and describes the fluctuations of a conserved scalar quantity by introducing a polynomial probability density function (PDF). The polynomial PDF has the advantage of being much easier to handle numerically than a Gaussian. A combustion model is assumed which postulates infinitely fast chemical kinetics and determines the local burning rate by solving for the source term the fuel conservation equation in which convection and diffusion of fuel have been determined from calculated profiles of mean fuel mass fraction. The local emission of radiation by the flame is assumed to be proportional to the local volumetric burning rate. Predictions of the radiation emitted by horizontal slices of the flame agree with experimental measurements. While flame heights are correctly predicted, the model underestimates the lateral spread of the flame, despite the fact that total agreement between experiment and model predictions was obtained in an earlier study for a non-reacting thermal plume. The flame result is attributable to lack of modeling of the large-scale eddies and their control

2. DYNAMICS AND MECHANICS OF FIRE

f. Radiation—Continued

over transition to turbulence. Model predictions of an effective flame radius, which is representative of the net width of the region where reaction is taking place, agree with the values of the same quantity obtained from radiation measurements. Areas in which the modeling technique needs to be improved are also discussed. (Author)

720. Modak AT

THERMAL RADIATION FROM POOL FIRES. Factory Mutual Res Corp, Basic Res Dept; FMRC 22361-5, 56 pages, 6 figs, 17 refs, Aug 1976

For an axisymmetric horizontal pool fire of specified flame shape, effective flame radiation (Schmidt) temperature and a gray flame absorption coefficient, this analysis computes 1) radiative energy fluxes to surfaces located external to the fire in any arbitrary orientation, 2) variations of radiative heat flux along the fuel surface, from fire center to fire edge, 3) the total radiative heat transfer from the flames to the fuel surface, 4) forward radiative heat transfer from the fire to the virgin fuel bed external to the fire, 5) the angular distribution of the radiative flux emitted by the pool fire and 6) the total radiative power output of the fire. The calculations are in excellent agreement with experimentally measured radiative fluxes at different locations on the pool surface and outside the fire. The radiative flux from the flames to the burning fuel surface is shown to be maximum at the center of the fuel bed and to decrease markedly toward the edge of the fire. The forward radiative heat transfer from the flames, to the virgin fuel bed external to the fire, is shown to be highest at the leading edge of the fire and to decay rapidly with increasing distance from it. Necessary conditions for validity of isotropic flame radiation are also established. (Author)

g. THERMAL CONDUCTIVITY

3. BEHAVIOR AND PROPERTIES OF MATERIALS

[For literature on fire and flame retardants, fire and flame proofing, etc see Chemical Abstracts.]

a. CHARACTERISTICS AND THERMAL BEHAVIOR OF MATERIALS

721. Thomsen AB

THE DETECTION OF THERMAL INCLUSIONS IN MINERAL WOOL

Brandforsvar, FoU-Brand; (1):13-15, 1976

The cause of most fires in mineral wool factories is unknown. It is assumed that 60% are caused by processing, during fabrication, included particles which are still hot from the production line. The manufacturing process and some fires are described. The goals of investigation, the manner of testing, the reflection method, stationary measurements, ambient effects and temperatures are discussed. These are the aspects used by the author to get at the heart of the problem. 5 figs, 2 tables. (Fachdok 12/0681)

722. Lee CK

FLAME PROPAGATION CHARACTERISTICS OF CYLINDRICAL PMMA RODS

J Fire Flammability; 7(1):104-111, 1976

Flame velocity measurements were made on cylindrical PMMA rods of diameters from 3/4 to 1-1/2 inch burning vertically downward and horizontally. Pyrolysis zone lengths were also measured to calculate pyrolysis zone surface regression rates and gaseous fuel velocities. The present experimental data together with the flame spread data of M Sibulkin and CK Lee on burning PMMA rods of diameters from 1/16 to 1/2 inch showed that the flame spreading process could be divided into an intermediate thermal regime and a thermally thick regime which were defined by their individual burning characteristics. The non-dimensional parameters derived by FA Lastrina *et al*, which characterized the thermal thickness of a fuel bed, was verified by the present experimental data. 3 figs, 8 refs. (Author)

723. Quinn EJ and Dieck RL

FLAME AND SMOKE PROPERTIES OF FILLED AND UNFILLED POLY(ARYLOXYPHOSPHAZENE) HOMOPOLYMERS

J Fire Flammability; 7(1):5-18, 1976

A large number of filled and unfilled poly(aryloxyphosphazene) homopolymers were tested using the oxygen index and a NBS smoke density test method. They did not burn when exposed to air, but tended to melt and evolved smoke when exposed to flame. The behavior of three different mixtures of poly(aryloxyphosphazenes) and aluminum trihydrate, CaCO₃, and silica hydrate at various mixing ratios (10, 25 and 50 phr) is described. The values are compared in tables. Polymers with alkoxy-substituted phenols on a phosphor-nitrogen base exhibited striking reductions in smoke evolution compared to the alkyl-substituted polymers. 6 tables. (Fachdok 12/0824)

724. Moulder JL

METAL FIRES - SCIENCE AND SAFETY

Dimensions/NBS; 60(1):10-11, 1976

Metals will burn, usually with destructive force, generating large amounts of heat and light. The National Bureau of Standards has undertaken a study of the basic mechanisms of metal combustion to help prevent accidental metal fires. Research results of the NBS Boulder laboratory team are reported in brief. 1 photo.

725. Woolley WD, Ames SA, Pitt AI and Murell JV

FIRE BEHAVIOR OF BEDS AND BEDDING MATERIALS

Fire Mater; 1(2):63-73, 1976

Full-scale fire tests on domestic beds fully equipped with bedding materials have been carried out in an experimental compartment-corridor facility at the Fire Research Station, Borehamwood, UK. Mattresses made of hair, spring interior, foam rubber and polyurethane of various types, together with mattress covers of cotton, flame-retarded cotton or proofed nylon were studied. The effectiveness of protective hair or glass fibre interlining was examined. The study has shown that a rapid development of fire in bed and bedding materials can take place with

FIRE TECHNOLOGY ABSTRACTS

3. BEHAVIOR AND PROPERTIES OF MATERIALS

a. Characteristics and Thermal Behavior of Materials—Continued

certain combinations of mattresses and their covers. The type of cover is extremely important in overall fire development, particularly with polyurethane mattresses. A substantial improvement in the fire behavior of many of the principal types of beds tested can be achieved by a careful selection of bedding materials, such as the type of mattress cover, and in certain cases by the use of protective interlinings. 13 figs, 7 tables, 3 refs. (Author)

726. Gumbrecht K

FIRE PERFORMANCE OF CONVEYOR BELTS

Glueckauf Forschungsh; 37(4):142-147, 1976 (German)

Major fire experiments in the large fire tunnel of the Tremonia experimental mine (FRG) revealed fire-response differences between SBR, PVL and CR belts. On the basis of these large-scale tests a laboratory method was developed. This test in the so-called laboratory fire tunnel was incorporated into standard DIN 22118 for belts with two textile liners. A committee of experts specified two test methods for member countries of the European community, the friction drum and the propane rust tests. An effort is being made to develop a laboratory method which would yield the same results for belts with steel wire liners as the fire tunnel test. 15 figs, 10 refs. (Fachdok 12/1030)

727. Modak AT and Croce PA

PLASTIC POOL FIRES. Factory Mutual Res Corp; FMRC 22361-3, 39 pages, 7 figs, 4 tables, 20 refs, Jun 1976

Experimental results relating flame radiation feedback mechanisms to the burning behavior of 51 mm-thick, solid, horizontal, square, polymethyl methacrylate (PMMA) pools are discussed. Data for sizes ranging from 25 mm x 25 mm (1 in. x 1 in.) to 1.22 m x 1.22 m (4 ft x 4 ft) show that the burning rate per unit surface area of plastic pool fires increases with scale and is dominated, at the larger scales, by thermal radiation from the flames. The total radiative power output of the flames represents 42 percent of total heat release rate of the larger PMMA fires. Local burning rates for the larger plastic pools are maximum at pool center, corresponding to maximum radiative heat transfer from the flames, and decrease monotonically to the edge of the pool. Relatively long time periods are required to establish steady burning in the intermediate sized pools. The long "burn-in" time to reach steady state is associated with increasing radiative heat flux from the flames to the pool with time. The magnitude of the time-dependent radiative heat flux to the pool is calculated on the basis of a one-dimensional analysis for a semi-infinite slab. The variation of local burning rates along the pool surface is formulated in terms of a cylindrical flame model. Physical implications of the assumptions made in the analysis and their limitations are reviewed critically. (Author)

728. Alderson SE and Breden LH

EVALUATION OF THE FIRE PERFORMANCE OF CARPET UNDERLAYMENT. Nat Bureau of Standards, Center for Fire Res; NBSIR 76-1018, 69 pages, 40 figs, 2 tables, 7 refs, Sep 1976
Availability: NTIS

A series of carpet underlayments was evaluated for fire performance in a corridor configuration using the same carpet corridor tests. In a series of small-scale tests, such as the smoke density chamber and the radiant panel, the flammability properties of the carpet tended to mask the flammability properties of the underlayment. The exception to this masking effect was the results from the flooring radiant panel test, where the thermal conductivity of the underlayment influenced the burning characteristics of the carpet. High concentrations of toxic combustion products were observed at the time of flashover in the corridor, with both cellulosic and synthetic underlayments. Smoke optical density values for the various carpet-plus-underlayment combinations were approximately the same in the flaming mode, except for the integral pad system, which has a higher value. (Author)

729. Rogowski BFW

PLASTICS IN BUILDINGS - FIRE PROBLEMS AND CONTROL. Building Res Estab (UK), Fire Res Station; BRE CP-39-76, 14 pages, 4 tables, 14 refs, Jun 1976

This paper reviews the more common applications of plastics as sheets and films, composites, and individual components in building construction and discusses the effect of their fire performance on factors such as density, thickness and method of use. Test methods appropriate for assessing the probable fire performance of constructional elements or lining materials incorporating plastics are listed and the possibility of different types complying with current Building Regulations requirements is indicated in the tables. (Author)

b. COMBUSTION, EXPLOSION, AND FLAMMABILITY TESTS AND METHODS

730. Bernskiold A

IGNITION AND BURNING PROPERTIES OF TEXTILES - A STUDY OF TEST METHODS

Brandforsvar, FoU-Brand; (1):1-6, 1976

After evaluating international cooperation in the field of test methods, the author reviews kinds of textiles, properties to be examined, methods for determining ignition time, classification of textiles on this basis, flame, parameters, melting points, smoke emission, then flame propagation, methods of determining propagation and determination of burned areas on textiles impregnated with fire-resistant agents. In so doing, the author investigates all aspects and evaluates their significance. 22 figs, 24 refs. (Fachdok 12/0752)

731. Damant GH

FLAMMABILITY ASPECTS OF UPHOLSTERED FURNITURE, PART I

Fireline; :8-10, May 1976

This paper summarizes some of the work performed by the California Bureau of Home Furnishings on furniture composites, indicating the interactions of dissimilar upholstery materials when tested in the form of furniture cushions. 15 refs.

FIRE TECHNOLOGY ABSTRACTS

3. BEHAVIOR AND PROPERTIES OF MATERIALS

b. Combustion, Explosion, and Flammability Tests and Methods—Continued

732. Damant GH
FLAMMABILITY ASPECTS OF FLEXIBLE POLYURETHANE FOAMS COMMONLY USED IN UPHOLSTERED FURNITURE

J Consumer Prod Flammability; 3(2):73-127, 1976

Some flammability characteristics were investigated in detail. Smoldering tendencies were investigated using burning cigarettes, smoldering fabric strips, and combinations of the two. Flammability characteristics under a variety of conditions were investigated. The flammability tests included the methenamine tablet, vertical flame, horizontal flame, 450 flame, and the oxygen index. In addition, an attempt was made to correlate the test values. The test apparatus, procedures and results are illustrated in figures; the data and values are compared in tables. 14 figs, 37 tables, 54 refs.

733. McCarter RJ
SMOLDERING OF FLEXIBLE POLYURETHANE FOAM
J Consumer Prod Flammability; 3(2):128-140, 1976

Various flexible polyurethane foam samples were studied for their smoldering behavior. All began to smolder when exposed to burning cigarettes and smoldering fabric, representing hazardous fire sources, some especially so because they sustained smoldering. The studies covered oxygen index, density, permeability, and charring tendencies. Correlations between smoldering and charring tendencies (as opposed to melting) were noted. Strong differences were observed for foams with different base polyols and for foams with fire-retardant additives. 1 fig, 9 refs.

734. Brauman SK, Fishman N, Broly AS and Chamberlain DL
SMOKE GENERATION FROM THE BURNING OF SOME POLYMERIC MATERIALS
J Fire Flammability; 7(1):41-58, 1976

By use of a small-scale, gravimetric collection technique, smoke particulates from burning polypropylene, polystyrene, and crosslinked polyester samples have been collected and analyzed. The effects of fire-retardant additives on the smoke particulate yields have been examined, and the influences of mass burning rate, oxygen concentration, thermal environment, and sample geometry on the smoke particulate generation have been considered. Several conventional fire-retardant additives were found to increase the amount of smoke particulates generated from the polymer systems studied. Most often these increases in smoke generation cannot be attributed merely to inclusion of the elements of the retardant in the smoke, but can be attributed, in some cases, to chemical effects in the gas phase due to volatile halogen from the retardant additive, and in other cases, to increased mass burning rates. 10 figs, 2 tables, 9 refs. (Author)

735. Fountain R
FIRE RETARDANT ANALYSIS OF AN FRP COMPOSITE BEFORE AND AFTER THE TUNNEL TEST
J Fire Retard Chem; 3(1):22-33, 1976

Two defined FRP composite systems used in bathroom fixture applications were subjected to the ASTM E-84 Tunnel Test. The materials contained flame retardants

which were measured via elemental analysis before and after burning the composite in the tunnel. Comparisons were made between (a) the manner in which the phosphorus and chlorine elements were distributed and consumed by burning and (b) the type of analyses (surface or bulk). The two composites had different structural reinforcement and hence different burning rates. 7 figs, 6 refs. (Author)

736. Anon
TESTING PLASTICS FOR FIRE BEHAVIOR: THE SMOKE IS BEGINNING TO CLEAR AWAY
Mod Plast; 53(3):46-48, 1976

The results of research programs devoted to the study of the behavior of plastics products in real fire situations are summarized. Research at many levels shows promise of practical new ways to evaluate fire performance. The needs for future research, especially of the hazards to be tested, are considered. A reliable small-scale test and the test equipment needed to perform it are outlined. 1 fig, 3 photos.

737. Anon
TESTING PLASTICS FOR FIRE BEHAVIOR: SMOKE HAZARDS GET MORE ATTENTION
Mod Plast; 53(5):47-49, 1976

Some of the research programs being devoted to the smoke hazards from plastics, including the bio-assay approach of the University of Utah's Flammability Research Center, the sensory-pulmonary effects of smoke being studied at the Johns Hopkins University's Applied Physics Laboratory, and others, are reviewed within the framework of the fire behavior of plastics. This is the second part of an article on this theme; part 1 appeared in *Mod Plast*, 53(3):46-48, 1976 (see the source index). 1 fig, 1 photo.

738. Finck HW
PROBLEMS INVOLVED IN MEASURING THE SMOKE DENSITY OF PLASTICS
Kunstst; 66(6):375-378, 1976

The operation of most smoke-density measurement instruments is based on the principle of smoke-particle attenuation of the light beam of a photometer. The factors which influence the measured values of the device are listed, including ventilation, ambient temperature, and weight of the specimen; the latter is well suited for delineation of a suitable measurement range for comparative investigations. The melting viscosity of the plastics being investigated does not exert any measurable influence on the results. The article concludes with a survey of the smoke generated by some important thermoplastics. 4 figs, 3 tables, 13 refs. (Author)

739. Segal L and Drake GL
THE HORIZONTAL FLAME-PROPAGATION RATE OF UNDYED COTTON FABRICS
Text Res J; 46(4):238-246, 1976

Differentiation of the flammabilities of nonflame-retardant, all-cotton fabrics cannot be accomplished by the usual test procedures, as these merely provide the means for determining when a fabric exceeds a certain set standard. The desired differentiation, however, can be ob-

FIRE TECHNOLOGY ABSTRACTS

3. BEHAVIOR AND PROPERTIES OF MATERIALS

b. Combustion, Explosion, and Flammability Tests and Methods—Continued

tained by measurement of the flame-propagation rate using the Ahiba Flammability Tester with the sample in the horizontal position. Eight nonflame-retardant, undyed cotton fabrics of different constructions were studied. The weights of the fabrics fell into four groups: 3.1, 3.6-3.8, 4.1-4.4, and 7.5 oz/yd². Specimens were cut from the warp and filling directions of the fabrics; one set of specimens was oven-dried prior to testing, while another set was conditioned to equilibrium moisture content at 65% relative humidity and 70°F. Burning was different in the warp and filling directions. Differences in flame-propagation rates were found that were not weight-dependent. In general, flame-propagation rate was not constant over the length of the specimen; in the warp direction the rates increased with distance from point of ignition, while in the filling direction constant and decreasing rates were also found. Flame-propagation rate was not effected to the extent expected by changing from oven drying to conditioning to equilibrium moisture content; only four of the eight fabrics showed significant changes. Burning in the filling directions of two fabrics was markedly changed; smaller differences were found in the warp direction only of a third fabric and in both the warp and filling directions of a fourth fabric. 10 figs, 3 tables, 17 refs. (Author)

740. Buckland IG, Butlin RN and Annable DJ
GAS EXPLOSIONS IN BUILDINGS. PART VI. REMOTE-CONTROLLED GAS SAMPLING PROBE AND CLOSURE VALVES FOR A GAS EXPLOSION CHAMBER. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1052, 11 pages, 9 figs, 4 refs, Jun 1976

The Engineering Services Section have designed, in collaboration with ITH Section, a new Sampling Probe System for the 28-m³ explosion chamber at Cardington. The system is remotely operated with digital indication of the probe position. The gas mixture in the cell can be sampled at any point between the ceiling and the bottom of the extended probe. After filling the chamber the probe is retracted, thus avoiding the possibility of the probe affecting the characteristics of an ensuing explosion. All the gas inlet and exhaust valves on the rig are remotely operated using the same power source, for reasons of safety and convenience. See also Fire Res Note 988. (Author)

741. Butlin RN
PRODUCTION OF GAS LAYERS FOR LARGE-SCALE GAS EXPLOSION STUDIES. PART 1. PRELIMINARY INVESTIGATIONS. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1004, 16 pages, 20 figs, 11 refs, Apr 1976

A series of experiments on the formation of roof layers of buoyant flammable gas, using mixtures of natural gas and air and also 100% natural gas, is described in which both vertical and horizontal distribution of gas concentration were determined.

Mixing of the introduced flammable gas with air in the explosion chamber was reduced by the adoption of appropriate input conditions. The distribution of gas in horizontal planes in all mixtures was found to be uniform, but the vertical distribution of gas indicated the formation

of diffuse layers, particularly when introducing 100% natural gas. The effects of filling rate and also the change of concentration with time in a quiescent layer are described. (Author)

742. Kline GM
FACTS BEHIND THE 'CONSPIRACY' IN FLAMMABILITY - TEST TERMINOLOGY
Mod Plast; 53(6):64-66, 1976

Civil suits emanating from Federal Trade Commission proceedings in 1973 imply that industry and ASTM conspired to write standard methods to make plastics look good in laboratory tests. The historical truth is, however, that even in the earliest days of test development printed instructions cautioned against correlating these laboratory results with real fire situations. Some of the history of the development of the flammability test methods for plastics is reviewed here to refute these charges. 3 refs.

c. FIRE AND EXPLOSION HAZARDS OF MATERIALS

743. Woolley WD and Ames SA
EXPLOSION HAZARD OF FOAMS
Brandaus; 84(7):247-251, 1976 (German)

In November 1974 an explosion and fire in a warehouse for foam mattresses in Chatham, England, claimed four lives and four injured persons. The explosion occurred when firemen were looking for the cause of the heavy smoke in the storage area. As a result of this event, ignition tests were carried out at the Fire Research Station in Borehamwood with specimens of this and a similar foam; the tests are reported on in detail in this article. The specimens were heated with small ignition sources (matches, cigarettes) and studied with respect to flammability and behavior under smoldering conditions. The incompletely burned gases (smoldering) were tested for combustibility and explosivity. 4 figs. (Fachdok 12/0979)

744. Hackstaff BW
FIRE HAZARDS WITH FOAMED PLASTIC INSULATION
Brauwelt; B115(38):1247-1249, 1975

Polyurethane foam insulation is probably the most effective and efficient insulation presently known to man. When properly formulated and applied, and protected against accidental ignition and the weather, it should function very well. Burning characteristics of polyurethane foams had not been fully delineated by earlier laboratory tests and test methods which had determined that many foams were of "non-burning" or "self-extinguishing" character. That the earlier tests were totally inadequate is well known to a number of brewers who suffered from disastrous and costly fires. New test methods, formulations and application procedures are being or have been developed to permit polyurethane foams to be used with safety and assurance. 5 figs, 5 tables. (Author)

745. Krzystalik P and Sliz J
EVALUATION OF THE DUST EXPLOSION HAZARD IN THE WOOD INDUSTRY
Arch Termodyn Spal; 7(2):243-253, 1976 (Polish; English and Russian summaries)

FIRE TECHNOLOGY ABSTRACTS

3. BEHAVIOR AND PROPERTIES OF MATERIALS

c. Fire and Explosion Hazards of Materials—Continued

The flammability and explosivity of three kinds of dust formed by the grinding of wood industry products, namely, wood dust, fiberboard dust, and dust from lacquer coatings, are compared. Despite the difference in grain material, the explosion dynamics of these dusts are similar. Wood-dust explosions were found to spread easily, and therefore appropriate safeguards must be provided for in plants of the wood-processing industry. 6 figs, 4 tables, 6 refs. (Author)

746. Factory Mutual
METAL DECK ROOFS AND FOAMED PLASTIC INSULATION
Constr Specifier; 29(5):46-53, 1976

Reviewed in this paper are the test programs conducted by Factory Mutual to determine the fire hazard of roof coverings over metal roof decking and of foamed plastics in rigid form as building insulation. These extensive test programs have produced new information that has led to the development of adequate protection standards, which are identified and recommended to designers and contractors. 6 figs.

747. King RW
THE DANGERS OF SUDDEN BOILING OF SUPERHEATED LIQUIDS
Fire Prev Sci Technol; (15):17-21, 1976 (English; German and French summaries)

This paper examines physical explosions caused by the sudden boiling of superheated liquids. It shows how two immiscible liquids, such as water and benzene, neither of which are boiling, can produce a superheated mixture which "explodes" when the two come together. The phrase "latent superheating" is coined to describe the phenomenon. 8 figs, 4 refs. (Author)

748. Dobrovol'skiy IP, Belov VA and Zuev AS
THE FIRE HAZARD OF SOME PRODUCTS OF THE PAINT AND VARNISH INDUSTRY
Lakokrasoch materialy i ikh primeneniye; (6):77-78, 1975 (Russian)

The fire hazard characteristics of 19 varnish and paint products are given, such as the flash point, ignition and self-ignition temperatures of vapors in air, the ignition temperature limits for vapors in air, and the combustibility classification and the nature of burning substances interacting with water-and-foam extinguishants. A method of processing experimental data is described. 1 table. (RZh)

749. Carhart HW, Alroth F, Burgess DS, Hoy HC and Leonard JT
FIRE HAZARD CLASSIFICATION OF CHEMICAL VAPORS RELATIVE TO EXPLOSION-PROOF ELECTRICAL EQUIPMENT (FINAL REPORT). Nat Acad Sci, Committee on Hazardous Materials, Washington, DC; USCG D-71-76, 52 pages, May 1976
Availability: NTIS AD-A026 215/4GA

At the request of the US Coast Guard, a detailed study of flammability has been made by the Electrical Hazards Panel of the Committee on Hazardous Materials in order to assign tentative classifications to 388 chemicals of com-

merce according to the classification groups given in the National Electrical Code, NEC 500. The method used was based on available physical and flammability properties, and chemical structure as an adjunct (by homology and analogy) where data were limited. (Author)

750. Gouldson EJ, Woolerton GR and Checkland JA
FIRE HAZARD EVALUATION OF CABLES AND MATERIALS
International Wire and Cable Symp, 24th, Proc; 1975, Nov 18-20, Cherry Hill, NJ, pages 6-36
Availability: NTIS AD-A017 787/3GA
Sponsor: US Army Electron Command, Fort Monmouth, NJ

Test methods currently used for testing cables and cable materials are discussed and improved techniques are proposed. The virtues of the proposed techniques are illustrated by means of a typical fire-retardant cable-compound development. Finally, the concept of a fire hazard rating system is introduced as a rationalization of the interpretation of cable and materials flammability testing. 19 refs. (Author)

d. NATURE OF COMBUSTION PRODUCTS

751. Manley TR and Glennie BR
MEASUREMENT OF SMOKE FROM SMOULDERING POLYMERS
SPE Annual Technical Conf, Proc; 1976, Apr 26-29, Atlantic City, NJ, pages 396-397
Availability: NTIS AD-A017 787/3GA

Plastics are being used increasingly in furnishings and buildings. They are sometimes blamed for the increasing number of casualties from the ingestion of smoke. Several test methods have been devised to measure the amount of smoke produced when materials burn, but the related problem of smoke produced in the early stages of a fire from smoldering materials has received less attention. An apparatus for the measurement of smoke from smoldering materials, with provision for analysis of the toxic gases concomitantly produced, has been constructed. Some preliminary results are presented and compared with those from a commercial burning test apparatus. The apparatus developed is described along with its operation techniques. (Author)

752. Hilado CJ and LaBossiere LA
EVALUATION OF SOME COMMERCIAL MATERIALS USING THE USF/NASA FIRE TOXICITY SCREENING TEST METHOD
J Consumer Prod Flammability; 3(2):141-149, 1976

Twenty commercial materials, including polyurethane foams, neoprene foam, cotton fibers, polyester fibers, wool fibers and fabrics, were investigated for their toxic-gas emission hazard by the USF/NASA fire toxicity screening test method, in order to determine the best-suited test method for characterization of these materials. The procedures developed for this purpose are described, and the results are presented in the form of tables. Wool turned out to be the most toxic, followed by cotton, polyester, and neoprene. The aromatic polyamides and polyurethane were the least toxic. 1 fig, 3 tables, 9 refs.

3. BEHAVIOR AND PROPERTIES OF MATERIALS

d. Nature of Combustion Products—Continued

753. Muller R and Couchoud P
ANALYSIS OF THE PYROLYSIS AND COMBUSTION GASES OF TEXTILE FIBERS
Melliand Textilber; 57(10):807-810, 1976 (German)

The formation of the "main toxins" (CO, HCl, HCN) and the O₂ consumption when the most important textiles are treated in an air stream at 400 to 1000°C was determined by comparison. The IR method selected makes it possible to determine both the developmental kinetics of these gases and the total quantity. All natural and synthetic textile fibers, except for heat-resistant fibers, exhibit a high tendency to decompose at temperatures between 500 and 1000°C and, in general, the behavior of wool is not very different from that of nylon 6.6. At 400°C the kinetics are low and the gas evolution consists mainly of CO with high O₂ consumption in the case of cellulosic fibers, of HCl in the case of chlorine-containing fibers, and HCN for acrylic fibers. 1 table, 1 ref. (Author)

754. Kracklauer J, Sparkes C and Legg R
NEW SMOKE TEST - FAST, SIMPLE, REPEATABLE
Plast Technol; 22(3):46-49, 1976

After reviewing the three dominant optical tests and some of the problems that can be encountered, the authors introduce a new smoke test for plastics designed for practical use in lab screening of large numbers of samples. The new test differs from those most commonly used in the plastics industry in that it measures smoke evolution gravimetrically, by the weight of the smoke particulates produced, rather than optically, by the light obscuration caused by the particulates. 2 figs, 4 tables, 5 refs.

755. Nikitina NS, Turkov AS and Saranchuk AD
METHOD OF DETERMINING THE SMOKE-GENERATING CAPACITY OF CONSTRUCTION MATERIALS
USSR Patent No. 463,900; Cl G01n 25/24, G01n 21/12, Appl 5 Apr 1973, Discl 4 Sep 1975, Assignee: VNII protivopozhar oborony

The method consists in burning specimens of the material under study, measuring its burning rate, tapping a mixture of the combustion products and air into a pipeline, measuring the flow rate and optical density of the mixture, and determining the smoke-generating capacity of the material from the measurement data. The distinctive feature of this method is that, to increase the accuracy of determination of the smoke-generating capacity, the specimens are burned in an air flow, while the mixture of combustion products and air must be drawn out into the pipeline. 1 drawing fig. (RZh)

756. Watts PR and Goldstone B
THE ASSESSMENT OF SMOKE PRODUCTION BY BUILDING MATERIALS IN FIRES. PART 4. LARGE-SCALE TESTS WITH WALL LINING MATERIALS. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1013, 9 figs, 4 tables, Jun 1976

Quantitative measurements have been made of the smoke production, in vision-obscuring terms, of 5 materials exposed both in the Fire Propagation Test Apparatus and also in much larger quantities (8 m²) as the linings

of a compartment containing a substantial fire, itself producing little or no smoke.

The range of smoke production was very large, extending over three orders of magnitude. Both methods gave similar values for the smoke production of materials producing much smoke, but for materials producing little smoke the large-scale tests registered less smoke than the Fire Propagation test method. Nevertheless, there was a strong correlation between the values of smoke production from the two methods under the conditions examined. (Author)

e. PROTECTION AND MODIFICATION OF MATERIALS

757. Hanslin R
PRINCIPAL FEATURES OF FIREPROOFING IN GENERAL. INTUMESCENT COATINGS: WHAT CAN BE EXPECTED OF THEM: THEIR LIMITATIONS
Apave; 57(193):89-91, 1976 (French)

The entire problem of fire-resistance of materials and structures with fire-proof coatings and sheaths, especially intumescent systems, is reviewed, including the effects of building fires on structures, the outlook for intumescent systems, the cost of a three-layer system, the unknown features of present-day insulating coatings, lifetime of coatings, and experimental fire studies. 6 refs.

758. Hill BJ
FLAME-RESISTANT FIBRES AND FABRICS: A REVIEW OF THE WORK AT LAMBEG INDUSTRIAL RESEARCH ASSOCIATION
Fire Mater; 1(2):52-56, 1976

This paper discusses the relative merits of a number of flame-resistant fabrics. The information quoted draws heavily from a five year program of research carried out on the subject by Lambeg Industrial Research Association (Northern Ireland). The fabrics concerned were made either from flame-resistant fiber or by flame-resistant treatment of fabrics. The textile problems which can arise in the production of these fabrics are considered and means of avoiding them suggested. Test methods for flammability are discussed briefly and the subject of toxic gases generated from flame-resistant materials in fire situations is introduced as an area which needs further study. The paper is essentially a situation report describing the present state of knowledge, indicating gaps therein, the limitations of the fibers, fabrics and finishes available and hence areas for future work. 7 tables, 1 ref. (Author)

759. Plate W, Lorenz W and Harder A
ECONOMIC USE OF MATERIALS FOR STRUCTURAL FIRE PROTECTION ON SHIPS
Seewirtschaft; 7(11):684-686, 1975 (German)

Steps for reducing the fire hazard on ships and the toxicity of synthetic materials are considered. Particular attention is devoted to problems of manufacturing plywood boards with different layers of veneer coatings. Requirements with respect to esthetics, fire safety and human health when using various kind of materials in construction are discussed. It is emphasized that standards for the use of no more than 45 kgs/m² of combustible materials in living and service quarters on ships have been

3. BEHAVIOR AND PROPERTIES OF MATERIALS

e. Protection and Modification of Materials—Continued

established in some countries. The requirements that must be met by composite materials manufactured for ships are enumerated.

760. Anon
A NEW FIRE-RESISTANT BUILDING MATERIAL
Technocrat (Japan); 8(10):72-73, 1975

A new material based on calcium silicate is being used in construction for walls and ceilings as having good thermal-insulation properties and heat stability. The material is produced in rather thick slabs because of the production techniques, although it is more economical to produce slabs with a thickness of 5-10 mm. The State Industrial Research Institute of Japan in Osaka has developed a production technique for slabs of the desired thickness which have, in addition, increased strength owing to the addition of a polymer resin. The calcium silicate is mixed with a resin emulsion, is shaped and molded at a temperature of 180°C and a pressure of 20-30 kg/cm², yielding a homogeneous material. When 20% PVC resin is added, a material is obtained with a bending strength of 50 kg/cm², compression strength of 70 kg/cm², and shock strength of 517 kg/cm² at a specific volumetric weight of 0.5-0.7 and is not subject to self-ignition. Increasing the PVC content to 30% increases the strength of the material, but also increases the specific weight. The shock resistance can be increased by a factor of five by adding 10% fiber glass and by a factor of 10 by adding 5% vinyl fiber. The mechanical strength of the material can be doubled by adding 20-30% gypsum when mixing the PVC resin and calcium silicate. 2 tables. (RZh)

761. Taubkin SI, Katts NV, Kolganova MN, Kochura ST and Rychikhina SE
METHOD OF PRODUCING A METALLIZED FABRIC
USSR Patent No. 329,814; Cl D06m 15/24, Appl 22 Apr 1969, Discl 16 Sep 1975, Assignee: VNII protivopozhar oborony, Mosk tekstil'n in-t

A method of producing a metallized fireproof fabric for the manufacture of special clothing is described. The method consists in transferring metal onto the fabric from a vacuum-metallized film coated with a nonpolar compound. What is different in this method is the use of an aqueous solution of methyl cellulose as the nonpolar compound to simplify the manufacturing process. (RZh)

762. Louzon E
PROCEDURE FOR PRODUCING AND EMBELLISHING A FLAMEPROOF OR INCOMBUSTIBLE COMPLEX TO BE USED FOR DECORATING OR STRUCTURAL WALL FINISHINGS
French Patent No. 2,251,183; Cl B44C 3/02, E04F 13/08, Appl 14 Nov 1973, Discl 6 Jun 1975

A patent is disclosed for a composite material to be used for decorative finishing of walls inside buildings. The base is to be made of glass fabric or some other mineral fabric. A decorative layer consisting of glass fibers, paints, and various kinds of binders is applied to the fabric by various methods (sewing, cementing, hot calendering). Three examples are given for the production of the material along with a description of the components used and the different features of the technological

process. The material is manufactured by a continuous method and is put out in the form of 30-m packaged rolls.

763. Hugh A, Robinson G and Morley W
IMPROVEMENTS IN OR RELATING TO FIRE RETARDANT MATERIALS
UK Patent No. 1,401,634; Cl B5L, (B32B 33/00), Appl 30 Jun 1972, Discl 30 Jul 1975

Sandwich materials consisting of alternating layers of wood (paper, plastics or metal) and of a material capable of sublimating or sublimating and swelling, e.g., the product with the trade name of Thermo-lag, are described.

764. Abbott NJ, Schoppee MM and Skelton J
HEAT RESISTANT AND NONFLAMMABLE MATERIALS. Fabric Res Labs, Dedham, MA; AFML TR-76-47, 127 pages, 68 figs, 19 tables, 8 refs, Apr 1976

The tensile properties of spun-yarn, flight-suit weight HT-4, Durette, Nomex I, Kynol, cotton, nylon and polyester fabrics have been measured during exposure to bilateral radiant heat fluxes in the range 0.2 to 0.9 cal/cm²/sec. Specially designed test equipment allows testing at times as short as a few seconds after initiation of exposure. All fabrics tested lost at least 50% of their strength in the first 6 seconds of exposure at flux levels of 0.4 cal/cm²/sec and at least 75% of their strength after 6 seconds at 0.7 cal/cm²/sec and above. Of those fabrics tested, HT-4 provides the greatest degree of protection and polyester provides the least protection against a high heat flux.

Studies were also made of launderability of HT-4 fabric, abrasion of Kevlar webbing, weaving of BBB fabric, and other analyses requested by AFML. (Author)

f. STABILITY OF MATERIALS AT ELEVATED TEMPERATURES

765. Meyer-Ottens C
SPALLING OF CONCRETE STRUCTURAL COMPONENTS EXPOSED TO FIRE
Dtsch Ausschuss Stahlbeton; (248):1-40, 1975 (German, English summary)

An effort is made to review the causes of explosive spalling in dense concrete exposed to fire. Spalling due to steam flux in wet concrete when heated, to thermal stress, and to the mineralogical structure of the aggregates is considered. Tensile stresses resulting from the escape of steam by friction at the walls of pores in heated concrete are found to be the most important reason for explosive spalling. Spalling does not occur if steam does not escape. The second reason for spalling is thermal residual and composed stresses. The resultant sudden surface cracking has a considerable influence on spalling. Normally, however, stresses and surface cracking do not produce spalling. Spalling from the mineralogical structure of aggregates is of minor importance. Physical and chemical variations in aggregates and cement stone during fire exposure always lead to concrete fatigue, when structural disintegration occurs regardless of explosive spalling. Knowing the causes of spalling makes it possible to take measurements to reduce or prevent spalling. The minimum dimensions required to prevent destructive spalling are

FIRE TECHNOLOGY ABSTRACTS

3. BEHAVIOR AND PROPERTIES OF MATERIALS

f. Stability of Materials at Elevated Temperatures—Continued

compared with those proposed by Kordina and by the CEB/F/P commissions to obtain a definite fire resistance time. 46 figs, 13 tables, 94 refs. (Author)

766. Contini P

THE FIRE RESISTANCE OF NORMAL REINFORCED AND PRESTRESSED CONCRETE STRUCTURES AND RELATED FIB/CEB RECOMMENDATIONS. PART 2.

Not AICAP; 3(4):2-8, 1976 (Italian)

The recommendations mentioned in the title, in the form of tables, permit the design of both cross- and parallel-reinforced ceilings, both simple and continuous support beams, and both stressed structural members, as well as columns and partitions. For their use the designer does not need to know the high-temperature behavior of the concretes and steels, or the heating and heat-transfer phenomena in bearing structures. The values given in the tables correspond to the present state of knowledge in the field of fire-behavior research, which is adequate for the present. The progress of inquiry and study will make it necessary to revise the data and values indicated in the tables, which are applicable, with prudence, to current cases. In order to stabilize the fire-resistance characteristics, analytical methods have been developed that take into account interaction between framework members, which will result in a certain economy. Finally, as regards specific cases, test results of the fire resistance for sample structures are taken into account for entry into the tables. 4 figs, 6 tables.

767. Sahota MS

HEAT AND MASS TRANSFER IN POROUS CONCRETE STRUCTURES SUBJECT TO FIRE. Univ of California (Berkeley), Fire Res Group; UCB FRG 76-15, 155 pages, 18 figs, 4 tables, 52 refs, Sep 1976

The transient solution of two-phase, two-component flow in one-dimensional or axisymmetric porous concrete structures exposed to time-dependent nonlinear mixed boundary conditions has been obtained. The basic mechanisms considered in the theory are: heat conduction through all the components, the molecular diffusion of the gaseous components, and the pressure-driven convective flow governed by Darcy's law. The governing heat- and mass-transfer equations are solved numerically by an implicit finite-difference scheme. A simplified technique for calculating the temperature field is developed and the results compare favorably with the complete analysis. The temperature fields for dry and wet cases do not differ significantly for normal amounts of moisture content in concrete. The two-dimensional transient solution for a rectangular element with heat conduction alone for time-dependent nonlinear mixed boundary conditions was also obtained using a minimum of numerics. General results are given for two limiting fire histories, the American Society for Testing and Materials E-119 time-temperature curve and a short-duration high-intensity time-temperature curve. Comparisons are made between experimental and theoretical temperature fields in a wet, porous, alumina powder system for the heat and mass transfer. (Author)

768. Bresler B

RESPONSE OF REINFORCED CONCRETE FRAMES TO FIRES. Univ of California (Berkeley), Fire Res Group; UCB FRG 76-12, 20 pages, 8 figs, 3 tables, 12 refs, Aug 1976

Mathematical models developed for predicting the thermal and structural response of reinforced and prestressed concrete frames in fire environments are substantiated by laboratory tests and case studies. Suggestions for a more rational design of structures for fire resistance are included.

This paper was published in a preliminary report of the *Tenth Congress of the International Association for Bridge and Structural Engineering*, Tokyo, September 6-11, 1976.

See also UCB FRG 76-12. (Author)

769. Bresler B, Thielen G, Nizamuddin Z and Iding R

LIMIT STATE BEHAVIOR OF REINFORCED CONCRETE FRAMES IN FIRE ENVIRONMENT. Univ of California (Berkeley), Fire Res Group; UCB FRG 76-12, 25 pages, 8 figs, 3 tables, 13 refs, Aug 1976

A fire-safe design procedure, with special emphasis on defining damage levels and on assigning limit states of structural behavior to these damage levels, is presented and discussed. A prototype reinforced concrete frame is analyzed for two time-temperature actions, and the resulting thermal and structural responses of selected beam and column elements are discussed. These results are used to illustrate the development of limit state design criteria.

This paper was submitted for publication in the proceedings of the *Regional Conference on Tall Buildings*, Hong Kong, September 20-22, 1976.

See also UCB FRG 76-12. (Author)

770. Ellingwood B and Shaver JR

ANALYSIS OF REINFORCED CONCRETE BEAMS SUBJECTED TO FIRES. Nat Bureau of Standards, Center for Bldg Technol; NBS BSS-76, 83 pages, 23 figs, 20 refs, July 1976.

Availability: GPO

Methods for analytically predicting the behavior of simply supported reinforced concrete beams subjected to fire are presented. This is generally a two-step process involving a thermal analysis followed by a stress analysis. This study emphasizes the latter, wherein the determination of moment-curvature-time relationships for the beam cross section incorporates the temperature-dependent strength degradation in the steel and concrete as well as thermal and creep strains. The sensitivity of the predictions to various phases of analytical modeling is investigated to establish the parameters most important for the predictions of beam behavior and to indicate where additional data should be gathered. A comparison of predicted behavior with that observed in fire tests shows excellent agreement when realistic reinforcement temperature histories are used. (Author)

3. BEHAVIOR AND PROPERTIES OF MATERIALS

f. Stability of Materials at Elevated Temperatures—Continued

771. Anon

FIRE RESISTANCE OF PRESTRESSED CONCRETE BEAMS. Netherlands Committee for Concrete Res, Zoetermeer; CUR Rapport 68, 56 pages, 1975 (Dutch)

Research being carried out on prestressed concrete beams is continued in this report, in which a method is developed to calculate the endurance of a fire-exposed prestressed concrete beam before the prestressing steel fails after reaching critical temperature. Some beams did not conform to standard conditions, failing prematurely and suddenly (so-called "rogue" beams). The cases of premature failure in fire tests is considered in this paper. Failures are classified as "rogues", encountered mainly in I-beams, in which continuous horizontal cracks develop in the web, and cases where slip of the pretensioned 1-1/2-inch strand tendons initiates premature failure. The failure is related to shear problems, while the attainment of critical temperatures is related to bending moment.

The principal unsolved problem is that of bond strength of the steel and concrete in fire environments. Apparently, however, the use of 3/8-inch strands or a helix of reinforcing steel around 1/2-inch strands in a concentrated arrangement delays failure from deficient bond strength. (Author)

4. FIRE MODELING AND TEST BURNS

a. FIELD EVALUATION

772. Williams FW, Indritz D and Wells E

FULL-SCALE SHIPBOARD FIRE TEST: COMPARISON OF THREE PARAMETERS VIA PERSPECTIVE PLOTTING

J Fire Flammability; 7(1):59-70, 1976

Fires as they occur in nature are exceedingly complex. For one to gain insight into the intricate physical and chemical parameters which control fires, one builds varying-size fires and controls as many variables as possible. In an attempt to overcome the problem of the larger number of variables, large-scale tests are highly instrumented, resulting in a large number of discrete data points which ultimately have to be related to the overall test. Perspective plots of three parameters, fire test area and temperature, have been developed to gain better insight into the overall aspects of large-scale fire tests. 10 figs, 1 table, 7 refs. (Author)

773. Wilson WJ

LARGE SCALE FIRE TESTS

J Fire Flammability; 7(1):112-124, 1976

Laboratory fire tests are economical, but never fully satisfactory, because they can exhaust only limited possibilities. Large-scale tests are unavoidable and were carried out on a broad scale. Described are the fire test house used for the large-scale tests, its floor plan and interior finishing, various kinds of furnishings, and the practical tests with different kinds of fires, once with toxic gases as test basis, once with medium ventilation. The materials inside the house have the greatest influence on the fire intensity. 6 figs, 2 tables, 6 refs

774. Stuckey RN, Bricker RW, Kuminecz JF and Supkis DE

FULL-SCALE AIRCRAFT CABIN FLAMMABILITY TESTS OF IMPROVED FIRE-RESISTANT MATERIALS. TEST SERIES 2. Nat Aeronautics and Space Admin, LB Johnson Space Center; NASA TM-X-58172, JSC-10613, 62 pages, Apr 1976

Availability: NTIS N76-23181/OGA

Full-scale aircraft flammability tests in which the effectiveness of new fire-resistant materials was evaluated by comparing their burning characteristics with those of other fire-resistant aircraft materials were described. New fire-resistant materials that are more economical and better suited for aircraft use than the previously tested fire-resistant materials were tested. The fuel ignition source for one test was JP-4; a smokeless fuel was used for the other test. Test objectives, methods, materials, and results are presented and discussed. The results indicate that, similar to the fire-resistant materials tested previously, the new materials decompose rather than ignite and do not support fire propagation. Furthermore, the new materials did not produce a flash fire. (Author)

b. FIRE TESTING, STRUCTURES

775. Anon

FRS LARGE-SCALE FIRE TEST ON ALUMINUM ROOFING

Fire; 69(853):82, 1976

The Aluminum Federation (UK) showed a film of the large-scale test carried out by the Fire Research Station. The film demonstrated how an aluminum sheeting roof vented rapidly in the test fire and minimized damage to the test building's interior structure and cladding materials. The venting also had a significant effect on temperature distribution within the building. 1 photo.

c. MODELING AND SCALING

776. Smith EE

RELATION OF PERFORMANCE TESTS TO ACTUAL FIRES

Fire Technol; 12(1):49-54, 1976

"Hazard load" calculations have been proposed which use exposed surface area and release rate data for the control of, or to measure, loading. Release rate values can be used to rate and specify materials and products as a function of location in the fire system and the nature of the occupancy. In theory, predictive methods based on release rate data offer an approach by which the performance of materials and products can be determined under any fire exposure. The advantage of this approach is the ability to look at a number of combustion characteristics, rather than just one attribute, to describe the fire safety of a material. No one characteristic, nor one exposure, can adequately describe the performance of an item in a fire. Release rate data give a more complete evaluation of combustibility characteristics and a more relevant description of a material's or product's performance. 2 tables, 3 refs. (Author)

FIRE TECHNOLOGY ABSTRACTS

4. FIRE MODELING AND TEST BURNS

c. Modeling and Scaling—Continued

777. Dean RK
A FINAL REPORT ON FIRE TESTS INVOLVING STORED PLASTICS
Fire Technol; 12(1):55-65, 1976

This paper highlights the final report of a five-year fire test program to determine how plastic commodities compared to ordinary combustibles and to determine sprinkler protection requirements for stored plastic goods. Tests were conducted on three scales - laboratory, small, and large. Laboratory tests analyzed thermal characteristics of plastic materials used in the program. Small-scale tests were run to determine the burning characteristics of plastic commodities, and large-scale tests provided data used in the development of some fire protection standards. The program was a generalized one; therefore, the solutions to fire protection problems that came out of it are also generalized. 17 figs. (Author)

778. Svetashov I and Bunin E
STAIRWELL PRESSURIZATION IN HIGHRISE BUILDINGS
Pozhar delo; (6):26-27, 1976 (Russian)

In order to determine the degree of pressurization required in stairwells of highrise buildings for heat and smoke removal during fires, a model of a stairwell of a 16-story residential building was built and tested at the All-Union Fire-Engineering Academy of the USSR. On the basis of calculations it was found that the pressure and air flow must be determined successively for each floor taking into account not only gravitational and wind pressures, but also the hydraulic resistance of the steps and landings. The model is illustrated in a diagram, the calculations in graphs. 3 figs.

779. Alpert RL
PRESSURE MODELING OF TRANSIENT CRIB FIRES.
Factory Mutual Res Corp, Basic Res Dept; FMRC 22360-2, 38 pages, 11 figs, 4 tables, 7 refs, Dec 1975

It has previously been demonstrated that free-burning fires in solid fuels can be modeled by increasing the ambient air pressure while reducing all length scales with the two-thirds of pressure. The modeling concept has been tested, up till now, for steady or quasi-steady aspects of fires in simple, isolated fuel elements of wood or solid plastic. The current study is concerned with testing the pressure-modeling concept for the important transient processes of fire growth and delay in pine-wood cribs ignited at the center of the crib base. In addition, the validity of pressure-modeling compartment fires is tested by burning cribs within simplified, vented enclosures. Measurements of crib burning rates for a ten-to-one range of length scale show that pressure modeling of portions of the burning rate time history is indeed feasible. While modeling of ventilation-controlled crib fires is highly successful, it appears that a lack of modeling of the rate of radial fire spread within the crib allows only peak burning rates and the fire decay process to be modeled in the fuel-surface-controlled regime. For the specific crib geometries considered, the effect of an enclosure on fire intensity is measurable and can be pressure-modeled. (Author)

780. Furukawa K
MODEL EXPERIMENTS ON NA POOL FIRE. Japan Atomic Energy Res Inst, Tokai Res Establ, Tokai, Japan; JAERI M-6073, 176 pages, Mar 1975 (Japanese)
Availability: NTIS

In an Na-cooled Fast Breeder Hazard Analysis for an Na pool fire in the reactor containment vessel, Na fire model experiments have been carried out with a 3.2 m³ closed vessel of height 2 m and diameter 1.5 m. The burning areas used are 0.3, 0.15 and 0.075 m². For the different initial Na temperatures, initial oxygen contents and atmospheric humidities, the burning rate was estimated from change of the oxygen content in the atmosphere, gas density or generated heat. The Na surface burning rate of initial temperature 500°C in the closed air with 21 v/o oxygen depends strongly on the ratio of Na surface area and sectional (bottom) areas of the reaction vessel. The apparent burning rate is nearly constant. Below 5 v/o oxygen, at least, the mild oxidation without brightness proceeds in first-order reaction with the oxygen content. (Author)

781. Clark RK
ANALYTICAL MODEL FOR CABLE TRAY FIRES. Sandia Labs, Albuquerque, NM; SAND 75-0288, 23 pages, Sep 1975
Availability: NTIS

A model for cable tray fires based on buoyant plume theory is presented. Using the model in conjunction with empirical data on size of natural fires and burning rate of cellulosic materials, estimates are made of the heat flux as a function of vertical and horizontal distance from a tray fire. Both local fires and fires extending along a significant length of tray are considered. For the particular set of fire parameters assumed in the calculations the current tray separation criteria of five feet vertical and three feet horizontal are found to be marginal for local fires and too small to prevent fire spread for extended tray fires. 8 refs. (Author)

782. Boehm L and Jordan S
AEROSOL GENERATION AND FILTER BEHAVIOR IN SODIUM FIRES. Kernforschungszentrum Karlsruhe, FRG, Lab fuer Aerosolphys und Filtertech; KFK-2202, 43 pages, 23 figs, 9 refs, Nov 1975 (German)

Within the scope of a long-term program, the authors investigated a) aerosol formation rates during Na fires, b) behavior of Na aerosols in a closed system, and c) filtration of Na aerosols. These experiments in the ABRAUS facility were intended to simulate the behavior of Na aerosols after an accident in the inner and outer sheaths of the sodium-cooled SNR 300 fast breeder reactor. A sand-bed filter arrangement was developed which is better than the fiberglass filters. Sand-bed filters resist high pressure and temperature peaks. Liquid Na aerosols are filtered with an efficiency of better than 99.9%. A physical model was evaluated to explain pressure increase at the sand-bed filter under load conditions with filter penetration. Calculated values were in good agreement with experimental results.

4. FIRE MODELING AND TEST BURNS

d. SYSTEMS BEHAVIOR

5. FIRE PROTECTION PRINCIPLES

a. BUILDING DESIGN AND CONSTRUCTION PRINCIPLES

783. Pettersson O and Thor J
FIRE ENGINEERING DESIGN OF STEEL STRUCTURES
 Swedish Institute of Steel Construction; 232 pages, 1976

This handbook describes a national fire engineering design process for loadbearing structures and steel partitions based on performance requirements. The design methods presented here are based on the regulations, advisory notes, and recommendations given in the Swedish Building Regulations and on a separate publication on national fire engineering design compiled from instructions of the National Swedish Board of Physical Planning and Building. The handbook discusses the principles governing national fire engineering design and also gives a detailed method for practical application. The handbook can also be used for courses of instruction in technical schools.

784. Anon
UNPROTECTED STEEL CONSTRUCTION PROVES ITSELF IN A FIRE
Brandaus; 84(7):266-267, 1976 (German)

A fire in a one-story workshop in Wuppertal (FRG) which contained large quantities of highly combustible semifinished and finished products served as the stimulus for a discussion of the resistance of unprotected steel constructions. The shop was built as an unshathed rigid frame structure made of 5-mm hollow sections. The smoke and heat removal possibilities were good. Despite a fully developed fire and one-and-a-half hours of exposure, only 3 of 40 columns were destroyed. Then a description of structural application of water-filled hollow section columns is given, not only representing a preventive structural fire protection measure, but also permitting the erection of less massive facades. The article was taken from *Stahlbau-Nachrichten*, Nos. 1/2, 1976, of the German Steel Association. (Fachdok 12/1003)

785. Hopp H
THE INTERMEDIATE SCHOOL CENTERS IN BERLIN
Brandschutz; 30(6):158-161, 1976 (German)

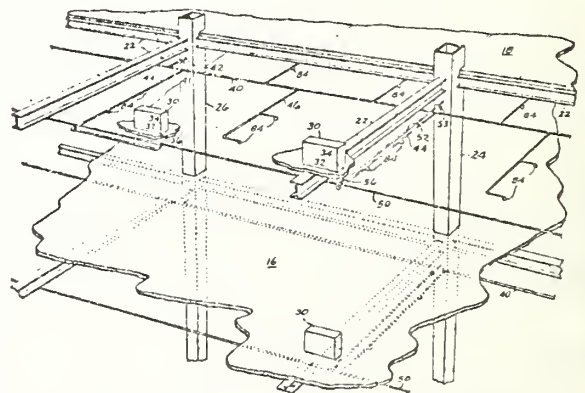
The program to integrate the traditional school system in Berlin led to the construction of intermediate school centers, which were intended to be used also for extracurricular activities. The arrangement of space in these buildings is loose and flexible. The general design of these buildings is described and illustrated. The main portion of the article deals with the cooperation of the Berlin Fire Department in the building permit process. The competent judgement of the Department was solicited with respect to the supply of water for firefighting, accessibility, freedom of action and safety for firefighting systems and rescue equipment, smoke removal systems, detection and alarm equipment, operational fire-protection regulations. 8 figs. (Fachdok 12/0775)

786. Anon
SCHOOLS - A REAPPRAISAL
Fire Prev; (115):21-22, 1976 (English; French and German summaries)

A further look is taken at fire protection for schools with particular references to construction, especially ceiling voids, and arson, in the light of recent publications from the Building Research Establishment (UK) and the Department of Health and Social Security. School fire statistics, including damage, causes, date of school construction, and time of call to the fire brigades, are summarized in four tables. 4 tables.

787. Carroll JL
COMBINATION AIR CONDITIONING AND FIRE PROTECTION SYSTEM FOR A BUILDING
US Patent No. 3,939,914; Cl 169/16, (A62C 35/00), Appl 26 Apr 1974, Discl 24 Feb 1976

A combination air-conditioning and fire protection system for a building including a heat exchanger through which fluid may pass under pressure, a fluid conditioning unit operable to bring fluid to a desired temperature for passing through the heat exchanger, and fluid supply and return conduits interconnecting the heat exchanger and fluid conditioning unit for circulating fluid therebetween. The supply and return conduits have discharge heads spaced therealong which are openable in case of fire to discharge fluid therefrom to extinguish a fire in the vicinity of the head. The conduits may include risers in the form of hollow, fluid-tight structural columns which also act to provide structural support for the building. Flow control devices and check valves in the system assure that pressure will be maintained in either the supply or return conduits to discharge fluid onto a fire if the other conduit is damaged and loses pressure. 6 claims, 6 drawing figs. (Author)



5. FIRE PROTECTION PRINCIPLES

b. DETECTION AND ALARM EQUIPMENT

788. Anon
WIDE-RANGE AIRBORNE INFRARED PHOTOGRAPHIC FIRE SENSING SYSTEM
Technocrat (Japan); 8(10):53, 1975

The Fire Research Institute, Fire Defense Agency, Ministry of Home Affairs (Japan) is developing a remote sensing technology for fire detection based on the fact that infrared rays from fires readily pass through smoke. An airborne infrared camera rapidly and accurately shows where fires are and is expected to prove particularly useful in case of earthquake or simultaneous outbreak of fires in many places. A two-year study on development of this technique is to be initiated. 2 photos.

789. Bachmann F and Elias S
PROBLEMS IN THE USE OF AUTOMATIC FIRE PROTECTION EQUIPMENT
Unser Brandschutz; 26(5):29-31, 1976 (German)

The necessity of using automatic fire protection systems is governed primarily by economic viewpoints. The targets to be protected present complicated evacuation conditions, have a high fireload or contain fire-hazardous materials, or rapid fire buildup must be expected. The type of system to be used (fire alarm, detector, etc.) is determined on the basis of a fire-hazard analysis. The information systems (including automatic fire alarms) are classified on four levels and the appropriate system for each level is adopted. The construction and operating modes of level-I fire alarms are described. 2 figs, 1 table. (Fachdok 12/0691)

790. Lein H
FIRE PROTECTION AND SMOKE CONTROL. DETECTORS: FIRST LINE OF DEFENSE
ASHRAE J; 18(2):26-28, 1976

Four stages of a fire are described, from a nascent fire without visible smoke or apparent flame or heat to the heat stage of a fire with heat and toxic fume emission. Different types of detectors, adapted to different situations, suitable for one or other of the four stages, are presented, namely: fixed-temperature thermal detectors and thermal compensation detector, in which the rate of temperature rise is measured; flame detectors, which measure the light of the flame in the visible or UV range; photoelectric-cell smoke detectors; combustion detectors, which pick up the combustion products; and finally some new types, more sophisticated, such as laser beam. The type, number, and location of detectors relative to the ventilation system are discussed.

791. Anon
MINI FIRE ALARMS: MODELS CF 2, DCF 10, SF 200
Protivpozarna Zastita; 16(2):58-59, 1976 (Serbocroatian)

Three types of mini fire alarms which emit a buzzing signal when the temperatures reaches 57°C are described. The CF 2, DCF 10, and SF 200 fire alarms are operated either by batteries or by the electric power supply line. The dimensions of the alarms are 5.1 x 4.4 x 3.15 cm and 12.7 x 7 x 3.8 cm in the prismatic versions (CF 2, SF 200) and 11.4 x 3.8 cm in the bell-shaped version. (Fachdok 12/0926)

792. Moor W
ALARM FACILITIES OF THE FIRE DEPARTMENT, POLICE AND SECURITAS PROTECTION COMPANY IN BASEL
PTT Tech Mitt; 54(4):126-134, 1976 (German)

A new electronic alarm signal system and new alarm systems for the municipal fire department and medical services were introduced in 1970 in conjunction with an overhaul of the municipal fire service in Basel. At the same time, additional alarm systems for the fire departments of suburban communities of the Canton of Basel were integrated into the municipal alarm center. In view of the similarity of interests and the possibility of economizing costs of central control points, the police and the Securitas Protection Company were also included in the alarm system. The author outlines the structure, arrangement and operation of the system. 14 figs. (Author)

793. Lundstrom I, Shivaraman MS, Stibler L and Svensson C
HYDROGEN IN SMOKE DETECTED BY THE Pd-GATE FIELD-EFFECT TRANSISTOR
Rev Sci Instrum; 47(6):738-740, 1976

A recently developed hydrogen-sensitive Pd-gate MOS-transistor was used to detect small amounts of hydrogen in smoke. It is shown that the device can be used to detect a fire before it has really started and therefore has a potential application as a fire alarm. 2 figs, 1 table, 3 refs. (Author)

794. Stoib W
SRS 150, A NEW CENTRAL STATION FOR COMPLEX FIRE PROTECTION SYSTEMS
Siemens Rev; 43(8):351-353, 1976

Complex fire protection systems, i.e., systems with automatic and manual alarm signaling, different types of alarms, control of fire protection facilities and plants, including automatic fire-extinguishing systems, required central stations with capabilities greater than simply receiving and transmitting alarms. They should be suitable for signaling alarms and for controlling external devices without human manipulation, and full programming flexibility in the allotment of tripping to tripped components should be provided for. Those qualities are incorporated in the SRS 150. 2 figs. (Author)

795. Hakino A and Takeda M
FIRE WARNING SYSTEM
Ohm: denki zasshi; 62(13):46-51, 1975 (Japanese)

The design, block diagram and operating principle of a modern electronic fire warning system for highrise plant administration buildings are described. The system is semiautomatic, because it provides for a human operator at the control panel. The panel is provided with communication, control and indicating equipment, including a cathode-ray tube which makes it possible to switch in to and supervise at will different sections of the area being protected via a closed TV system. The operation of the system under various conditions is examined. A particular feature of the system is that it is all-purpose, as compared with the peripheral devices, in that it can operate normally with any type of fire detector. The characteristics, tactical features and specifications are

5. FIRE PROTECTION PRINCIPLES

b. Detection and Alarm Equipment—Continued

given, and the electrical circuitry, design and operating principle of the four types of most up-to-date fire detectors used in such systems in Japan are described. The advantages and deficiencies of each detector are noted; recommendations for their most efficient use are given. It is reported that one of the modifications of this system provides for an improved closed-circuit TV system which combines color and black and white channels. This feature will improve the man-machine characteristic of the control panel to an appreciable degree. 18 figs, 1 table. (RZh)

796. Kato S and Ohashi Y

FIRE EXTINGUISHING SYSTEM

Ohm: denki zasshi; 62(13):52-56, 1975 (Japanese)

A description is given of the design, operating principle, block diagram, and results of testing an automatic fire detection and extinguishing system for use in relatively small municipal installations. All the control and signal components of the system have leads to the control panel, which is a comparatively small vertical console-type stand. The combination of assemblies and subassemblies within the stand is analyzed. A large reserve of blank boards in the printed and volumetric mounting of the electric components as well as free space in the forward panel of the console permit free planning of further system improvements in the sense of a more complicated structure. The extinguishing agent is Halon 1301, which is contained under high positive pressure in a hermetically sealed cylinder and is distributed via a grid of sprinkler heads. Experimentally obtained graphic relations illustrate the efficiency of system operation. 11 figs, 3 tables. (RZh)

797. Simon FN and Rork GD

IONIZATION-TYPE SMOKE DETECTORS

Rev Sci Instrum; 47(1):74-80, 1976

A simple model is developed to determine quantitative relations among operating parameters applicable to the design of ionization-type smoke detectors. The model permits the adjustable parameters of operating current, radioisotope source intensity, and cell geometry to be specified for ambient pressure response and optimum sensitivity to smoke particulates. Specific ionization has been measured for two sources (^3H and ^6Ni) as a function of pressure as required by the model. Experimental agreement with the model presented shows its validity for design evaluation of ionization cells for smoke detection and possibly other special applications with particulates. 12 figs, 8 refs. (Author)

798. Nash P and Theobald CR

THE USE OF AUTOMATIC SPRINKLERS AS FIRE SENSORS IN CHEMICAL PLANTS

Fire Prev Sci Technol; (15):11-18, 1976 (English; German and French summaries)

Automatic sprinklers in chemical plants may be used in two main ways. First, they may be used as closed sprinklers in sprinkler systems in buildings, e.g., in control rooms, offices, etc. In the event of fire they will respond to the convected hot gas layer beneath the ceiling of the room in which the fire occurs. Second, they may be used in the open air as "detectors" or "detectors" for triggering a supply of water to a series of open water

spray nozzles designed to control flammable liquid fires or to provide a degree of cooling of vulnerable areas of the plant which might be subjected to intense heat radiation from a nearby fire. Where the sensor is likely to be immersed in rapidly-developing flames, e.g., when sited above an oil-cooled transformer, it will operate quickly by conduction of heat from the flames. Where it has to depend upon the incidence of thermal radiation alone, however, it has been found that its operation may be long delayed unless the size and temperature of the radiator is such that radiant intensities of not less than 1.5 W/cm² are available. These points must be considered when siting sensors in chemical plants. 7 figs, 8 refs. (Author)

799. Sharovar F and Metelkin G

NEW ELECTRIC FIRE ALARM SYSTEM

Pozhar delo; (5):26-27, 1976 (Russian)

A new type of electric fire alarm receiving system has been developed by the All-Union Fire Protection Research Institute of USSR. The system permits discrimination of signals from fire detectors and sensors combined in one beam. A distinctive feature of the system is monitoring of the operational status of all wire communication lines with automatic determination of line damages. The system is described on the basis of two circuit diagrams. 2 figs.

800. Matoba K

FIRE ALARM

Swiss Patent No. 566,602; Cl G08B 17/10, Appl 14 Jun 1974, Discl 15 Sep 1975, Assignee: Cerberus AG

The fire alarm consists of a pickup sensitive to signs of fire and an integral electric circuit for signal transmission when a limit monitoring level is exceeded. The proposed detector is different in that the circuit contains at least one voltage-sensitive member with resistance varying as a function of the voltage of the communications line and controlling the resistance of the element which determines the threshold value of the variable being measured. 4 drawing figs.

801. Jacoby S

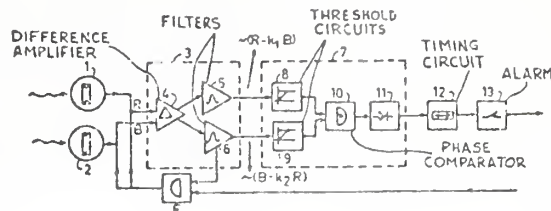
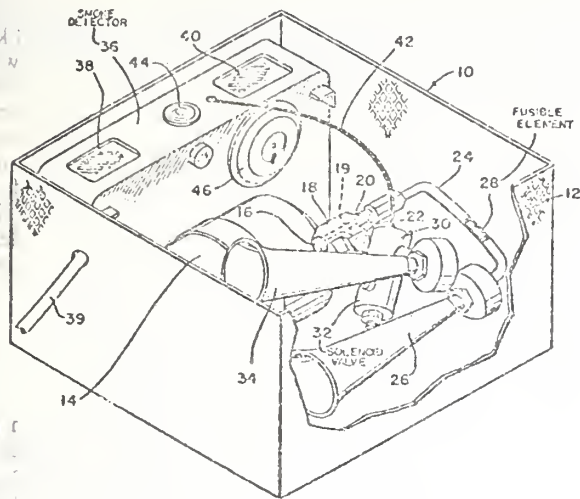
COMBINATION SMOKE AND HEAT DETECTOR ALARM

US Patent No. 3,938,115; Cl 340/237S, (G08B 17/04), Appl 13 June 1974, Discl. 11 Feb 1976, Assignee: Evergard Fire Alarm Co, Inc, Philadelphia, PA

A combination smoke and heat detector alarm including a self-contained stored energy source in the form of a cylinder of compressed gas. A T-fitting connects to the cylinder and feeds separate conduit systems leading to individual sounding devices. A fusible element is interposed in one of the conduit systems to automatically permit transfer of the compressed gas to a first sounding device upon the presence of elevated temperatures. A solenoid operated switch is interposed in the other conduit system to normally prevent the flow of gas. The solenoid is responsive to a smoke detector and is wired to open the solenoid valve upon sensing the presence of a predetermined concentration of smoke. 12 claims, 1 drawing figure. (Author)

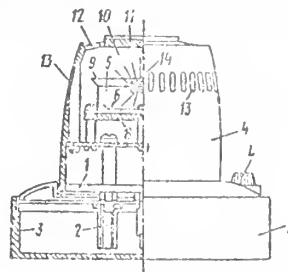
5. FIRE PROTECTION PRINCIPLES

b. Detection and Alarm Equipment—Continued



804. Anon
FIRE DETECTION DEVICE CONSISTING OF AN IONIZATION DETECTOR
Swiss Patent No. 563,044; Cl G08b 17/10, Appl 1 Dec 1972, Discl 13 Jun 1975, Assignee: Universal Det

This ionization fire detector design permits elimination of the major deficiency of existing ionization detectors, which is actuation by an air stream without a fire hazard. The detector (see the drawing) is mounted on an insulation base 1, which is equipped with pins for insertion into holes in the pedestal 3. All the parts are enclosed in a cowl 4. Above the base is a sheet with a printed circuit 8 containing all the components of the alarm circuit. A closed calibration ionization chamber 5 is found above the sheet. Its positive electrode 6 is connected to the positive pole of the alarm circuit. The radioactive source 7 can contain Pu^{239} which emits alpha particles with an activity of 4-8 microcuries. The space between the negative electrode 9 of the calibration chamber and the cowl forms an open ionization measurement chamber 10 connected to the negative pole of the alarm circuit. The radioactive source 14 of the measurement chamber has an activity of 10-18 microcuries. The chamber is open to the atmosphere through holes 12 and slots 13 in the cowl. The detector is supplied from a d-c source (24V). The common electrode 9 of the ionization chamber is connected to the gate of a field transistor whose outlet is connected via a potentiometer and zener diode with a thyristor which cuts in current in the circuit of a signal lamp 5 (or some other signal device). Under normal conditions the diode is blocked and the signal circuit open. When smoke reaches the measuring chamber, the potential at the outlet of the field transistor rises, the diode opens, the thyristor is actuated and transmits an alarm signal. To eliminate signals from strong air currents the openings and slots in the cowl are dimensioned for minimum perturbation in the measuring chamber. In addition, by regulating the distance between electrodes 9 and 11 as a function of the radioactive source, the field transistor outlet potential can be reduced when exposed to an air current. For



802. Rims L
ALARM DEVICE, PREFERABLY FOR FIRE ALARMS
FRG Patent No. 2,408,129; Cl G08B 23/00, G08B 17/06, Appl 20 Feb 1974, Discl. 21 Aug 1975, Assignee: Preussag AG Feuerschutz

The patent device is designed for single-wire connection of sets of signal devices, regardless of what kind, preferably fire detectors, to a central control panel or some other kind of commutator. 5 drawing figs.

803. Mueller P
DETECTION OF PRESENCE OR ABSENCE OF FLAMES
US Patent No. 3,940,753; Cl 340/227 R, (G08B 21/00), Appl 13 Sep 1974, Discl 24 Feb 1976, Priority: Switzerland, Appl No 13722/73, 25 Sep 1973, Assignee: Cerberus AG, Mannedorf, Switzerland

At least two photoelectric sensors, sensitive to different spectral ranges of incident light, provide two sensed output signals; the relationship of the a-c components of the sensed output signals is evaluated, and it is determined if these a-c components fall within predetermined low-frequency ranges, for example, 2 to 50 Hz, preferably 5 to 25 Hz; if so, a "flame present" signal is provided, for example to give a fire alarm, or to indicate that a burner is operating. Preferably, the relationship of the signals is such that a different signal is provided between one of the sensed signals and a fraction of the other, and conversely, and the sensitivity of the sensors is adjusted to have the same output signals at a predetermined color temperature, for example about 1400°K. Illumination signals incident on the sensors due to other sources than flames then are reliably eliminated while still providing the "flame present" signal upon coincidence of the appropriate difference signals, which coincidence preferably is determined by analyzing the phase relationships of the resulting difference signals in a phase comparator. 20 claims, 1 drawing fig. (Author)

5. FIRE PROTECTION PRINCIPLES

b. Detection and Alarm Equipment—Continued

example, a decrease of about 2V is obtained with an electrode spacing of 10-20 mm. This measure excludes the possibility of triggering the diode and issuing a false alarm. In the presence of smoke the potential increases by 8-9V, which is sufficient for reliable alarm signaling even with the above-mentioned drop in potential. Also provided for are signal lamp triggering circuits in case of failure of the detector or supply system. 3 drawing figs. (RZh)

805. Nagakura M
FLAME SENSING UNIT

Japanese Patent No. 50-16179; CI 111F19, G01J 5/36, Appl 3 Sep 1969, Discl 11 Jun 1975, Assignee: Nippon Pajrotekuta kk

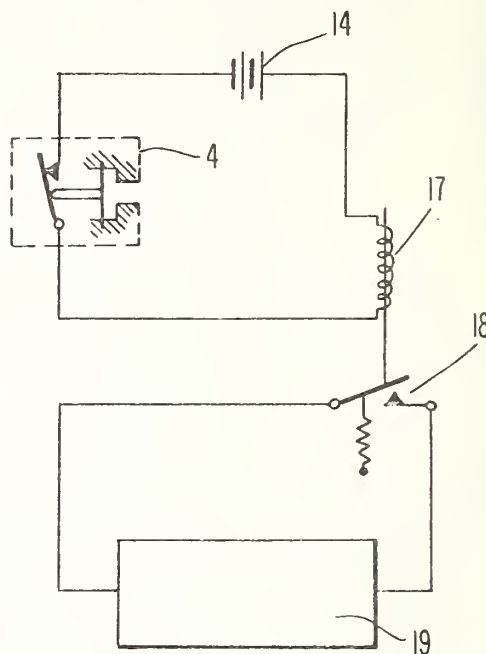
A patent is disclosed for a block diagram and operating principle of a complex fixed installation based on the capacity of heated objects and flame to radiate electromagnetic oscillations in the IR range for the detection and timely warning of the outbreak of fire in a protected area. The device consists of a sensitive IR element responding to radiation in the 1700-2900 A wavelength range; a standard pulse-count generator operating from an external potential input and having a monostable multivibrator, a coincidence circuit operating on a logic "and" element, a multiple-discharge flip-flop pulse counter, a video pulse amplifier, and a warning circuit with acoustic and visible signal system. In case of fire, if radiation in the given range appears in the field of vision of the IR element, the element is actuated and a control voltage is applied to the external triggering input of the pulse generator, resulting in a sequence of counting pulses, highly stable in length and frequency, at the generator output, with external characteristics variable by means of generator control levers, depending on the nature and value of the desired threshold. The generator pulse sequence is applied to the counting input of the multiple-discharge flip-flop pulse counter which makes a binary count. The coincidence circuit is connected in parallel to the output of the pulse counter in such a way that each discharge of the counter is commutated with the corresponding discharge of the coincidence circuit. The pulse counter and coincidence circuit must be in the system to implement the threshold detection, principle in which a decision as to the presence of fire is made by the device only when the control voltage at the output of the IR unit persists longer than a certain predetermined threshold period. This prevents an alarm from random effects. The control circuit permits arbitrary selection of threshold length within a broad range by appropriate adjustment of the coincidence circuit. 2 drawing figs, 2 refs. (RZh)

806. Sullivan JT
GAS-POWERED ALARM WITH PRESSURE RESPONSIVE REMOTE INDICATOR CIRCUIT

US Patent No. 3,938,114; CI 340/227.1, (G08B 17/02), Appl 5 Apr 1974, Discl 10 Feb 1976, Assignee: Standard-Farrington Alarm and Signal Corp, Trevese, PA

The passageway between a freon cylinder and a freon-powered horn is plugged by a eutectic metal plug. When

sufficient heat loosens the plug, the horn is activated. A switch in the passageway senses the back pressure from the freon gas flow and activates a remote electrical indicator which can be used to determine which of a plurality of horns has been activated. 3 claims, 3 drawing figs. (Author)



807. Hunzeker CJ
ALARM DEVICE

Swiss Patent No. 564,809; CI G08h 19/00, Appl 21 Feb 1974, Discl 31 Jul 1975, Assignee: Raymond Lee Org

The device consists of a radio transmitter with a heat detector, a photocell and a tilt sensor, and a portable radio receiver. When the temperature increases near the point where the transmitter has been located, when the light beam incident on its photocell is intercepted, or when the object to which the transmitter-detector is fixed tends to move or tilt, the detector begins to transmit radiowaves and an acoustic signal is emitted in the portable receiver. The heat sensor is set at a specific temperature. A mercury circuit breaker is used as the tilt sensor. 3 drawing figs.

808. Dunphy MJ
PORTABLE FIRE DETECTOR

US Patent No. 3,943,499; CI 340/227R, (G08B 21/00), Appl 16 Apr 1974, Discl 9 Mar 1976, Assignee: Pyrotector, Inc, MA

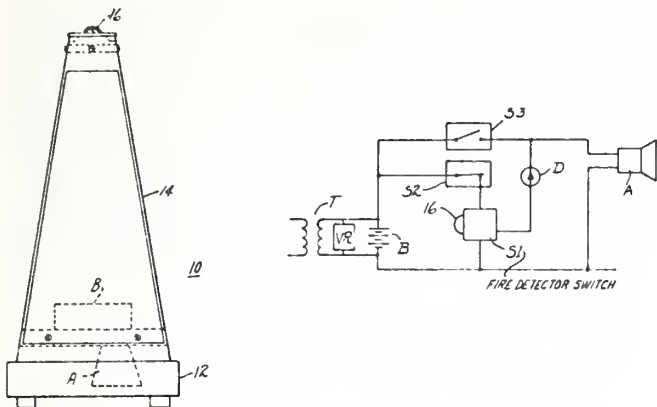
A portable fire alarm device comprising fire detecting means and alarm means powered from a self-contained power supply. The power to the detector and alarm is through a normally closed switch of the type such as a mercury switch which may be opened by tilting the device to a predetermined angle from the vertical so that the alarm may be shut off. A second normally open switch of the mercury type connects the power supply directly to the alarm device and is so oriented that tilting the

FIRE TECHNOLOGY ABSTRACTS

5. FIRE PROTECTION PRINCIPLES

b. Detection and Alarm Equipment—Continued

device to a predetermined angle from the vertical closes said switch and energizes the alarm to test the condition of the battery. 3 claims, 2 drawing figs. (Author)



809. Duggan J FIRE DETECTOR

UK Patent No. 1,402,783; Cl G4N, (G08B 17/04, H01H 37/40), Appl 11 Apr 1973, Discl 13 Aug 1975, Assignee: Fire Devices Mfg, Ltd

A patent is disclosed for a device to be used in various fire alarm systems to determine when the permissible rate of heating of an object being monitored is exceeded. The system must contain means for sensing the heat on the object and transmitting data to the detector. The sensor consists of a housing and pickup connected in such a way as to form an air chamber with an outlet, so that when a flame appears or fire breaks out the air can escape from the chamber. The chamber contains a thin flexible membrane (about 0.06 mm thick) over an electric contact. When the pressure increases, the membrane closes the contact. The membrane has a stiffening rib along its edge and a special plastic coating of a certain distinctive strength, elasticity and electrical resistance. Membrane properties are maintained up to +750°C. The rate of escape of air from the chamber can be regulated to adjust the detector to various rates of temperature increase of the ambient air. 4 drawing figs.

810. Matoba K and Iwami F IONIZATION FIRE DETECTOR

Swiss Patent No. 569,335; Cl G08B 17/10, Appl 23 Sept 1974, Discl 14 Nov 1975, Assignee: Cerberus AG

The distinguishing feature of this ionization fire detector is that the common point of the fire detector's series connected ionization chambers is connected to the control electrode (gate) of the field transistor with a voltage divider or, in another version, a stabilizer in the output circuit. The output circuit of the field transistor contains a resistor and the control electrode of the thyristor which, when actuated, short circuits the supply and signal circuit. 2 drawing figs.

811. Broadbent A and Frost P IMPROVEMENTS IN FIRE DETECTION APPARATUS

UK Patent No. 1,410,482; Cl G1A, (G08B 17/12), Appl 20 Jan 1972, Discl 15 Oct 1975, Assignee: Talentum Development Ltd

A patent is granted for an improved fire detector consisting of a photo-receiver sensitive to IR-radiation having a spectral characteristic of 1.5-3 microns and a selective frequency amplifier with a maximum frequency characteristic of about 10 Hz and a cutoff frequency of 20 Hz. The actuator relay is a thyristor which responds when a signal of the appropriate strength impinges on the control electrode and shorts the signal circuit. The alarm signal receiver can be located at some distance from the detector. This detector is designed to work in combination with a smoke detector.

812. Peberdy WT FIRE ALARMS

UK Patent No. 1,455,615; Cl G4N, (G08B 17/10), Appl 11 Aug 1972, Discl 10 Sep 1975

A patent is disclosed for an alarm system which uses the change in transmission and scatter of a gaseous light medium when strongly heated or when smoke appears to detect fire. The system consists of a pulse source which generates a broad light beam and a detector, so arranged that the light beam between them passes through a controllable gas medium, means for transforming light signals into electric signals, devices for the extraction of signals with frequency corresponding to the source frequency, and the alarm itself, which is triggered when the light signal is modulated in amplitude by heating the gas medium. An infrared gallium-arsenide semiconductor radiator is used as the light source. The light-radiation detector is a phototransistor to which a constant positive bias is applied by bias lighting. A pulse radiator is used to reduce the influence of the ambient light, a broad light beam to reduce the influence of wall oscillation, etc. 6 drawing figs.

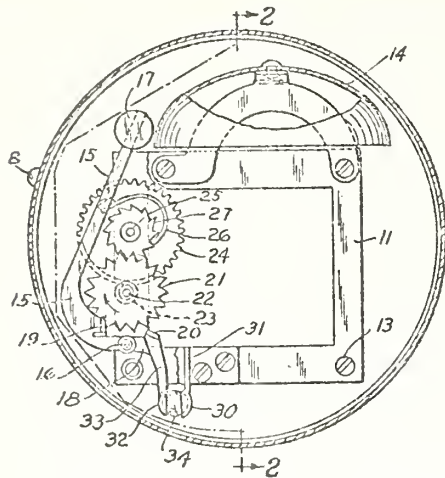
813. Keeley JR and Everson R AUTOMATIC FIRE ALARM

US Patent No. 3,931,785; Cl 116/106, (G08B 17/00), Appl 18 Nov 1974, Discl 13 Jan 1976

This device comprises an audible alarm member arranged to be sounded by spring operated clapper means which is normally held inoperative by temperature-responsive devices, all in a perforated housing suitable for installation in a room. The temperature-responsive devices include a body of wax-like material disposed between two cup-shaped members of good heat-conductive material and holding said members apart at all ordinary room temperatures. If the temperature surrounding the device is raised to a predetermined limit, as by a fire in the room, the wax body will soften or melt and this will permit the cup-shaped members to be moved and cause the alarm to be sounded. 4 claims, 4 drawing figs. (Author)

5. FIRE PROTECTION PRINCIPLES

b. Detection and Alarm Equipment—Continued



814. Charles SJ
A LIGHT OBSCURATION METER. Telecom Australia Res Lab, Melbourne, Australia; REPT 6953, 9 pages, Jun 1975
 Availability: NTIS N76-22513/5GA

The light obscuration meter described is an instrument in which smoke is produced and its light obscuration measured. It is primarily designed for the testing and calibration of smoke-operated fire detectors. (Author)

815. Pistor M
ON A SCATTERED-LIGHT MEASURING DEVICE FOR USE IN TESTING TYPES OF SMOKE DETECTORS. Rheinisch-Westfalian Tech Coll, Inst Electron Commun Technol, Aachen, FRG; NBSIR 76-1087, 35 pages, 9 figs, 16 refs, Jul 1976
 Availability: NTIS

Generally, the response threshold value of fire detectors is tested with measuring instruments which operate on the same physical principle as the detectors to be tested. For example, this means that the response threshold value of an ionization measuring chamber and the response threshold value of an optical-type smoke detector operating on a light extinction principle is checked using an extinction measuring instrument. However, optical-type smoke detectors operating on a light-scatter principle (photoelectric in U.S. parlance) have also been checked using an extinction measuring instrument.

Since the light-scatter type of smoke detector is by far the most commonly used of the optical type of smoke detector it seems appropriate to use a light-scatter measuring instrument to check the response threshold value of these detectors. In addition, the need for such a measuring instrument is emphasized by the fact that both the parameters of the smoke aerosol and the design features of the measuring instrument are affected in different ways by light scatter and light extinction.

The author describes the technical features and design details of a newly developed, light-scatter measuring instrument along with some experiments to determine its response to artificially-generated aerosols. (Author)

816. Aarts HF, Evans WB and Utley LW
RADIO-FREQUENCY INDUCTION FOR CHECKING FIRE DETECTORS. Atomics Internat Div, Golden, CO; TID-26978, 10 pages, Jan 1976
 Availability: NTIS

A new method of testing fire detectors in the glove-box lines has been developed. The method includes heating the fire detector by a strong electromagnetic field which induces eddy currents in the metal case of the fire detector. Developed as a radiofrequency induction heating system, a prototype was designed and built for use with fire detectors installed at the Rocky Flats Plant. The system has been tested and operates satisfactorily. It is concluded that the system could be installed in glove boxes and could easily be automated from a central point. Applications exist for glove-box lines on site or for facilities off site. (Author)

c. FIRE AND EXPLOSION RISKS

817. Laufke H
A METHOD FOR THE EVALUATION OF RISKS CAUSED BY ELECTROSTATIC CHARGING AND FLAMMABLE ATMOSPHERE IN INDUSTRY
Acta Univ Upsaliensis; (356):1-49, 1976

This thesis aims at shedding light on injuries and damage caused by electrostatic discharges in connection with flammable mixtures and at developing a method for quantitative calculation of the risk for simultaneous fire damage. It consists of an introduction and four papers by the author, in collaboration with others, as follows: static electricity in industry-introductory investigations; static electricity in industry-risk for personal injuries and property damage in conjunction with the simultaneous presence of electrostatic charging and a flammable atmosphere; equipment for measuring flammable atmospheres and static electricity in industry; and measurements of flammable atmospheres and static electricity in industry. 21 figs.

818. Anon
A LOOK AT AVIATION HAZARDS
Fire Internat; 5(52):57-66, 1976 (English, French, German; Spanish summary)

This is an edited extract from the new 14th edition of the National Fire Protection Association Handbook. Methods to reduce the post-crash fire hazard are enumerated. Considerable attention is devoted to the codes for aircraft power plants of the U.S. Federal Aviation Administration and to their basic fire prevention fundamentals for the design of reciprocating engine power plants. The types of failures and hazards considered basic to gas turbine engines are listed and described, along with the fire prevention design features, which apply to both turbine and reciprocating engines. Summary data on the fire hazard properties of aviation fuels are presented in table form. Other hazards identified and discussed are cabin materials. The problems of fire detection and extinguishing and the provision of emergency exit facilities are emphasized. 3 figs.

FIRE TECHNOLOGY ABSTRACTS

5. FIRE PROTECTION PRINCIPLES

c. Fire and Explosion Risks—Continued

819. Anon

SPECIAL HAZARDS OF MILITARY AIRCRAFT

Fire Internat; 5(52):69-72, 1976 (English, French, German; Spanish summary)

The special military aircraft hazards facing rescue and firefighting crews are discussed, including ejection seats and canopy ejectors, armament, bombs, rockets, pyrotechnics, missile propellants, rockets and space vehicles, and missile launch sites. The article is an edited abstract from the new 14th edition of the National Fire Protection Association Handbook.

820. Petrov I and Belozherov N

FIRE SAFETY OF A CLUSTER OF OIL AND GAS WELLS

Pozhar delo; (4):18-19, 1976 (Russian)

A detailed description is given of tests made in 1975 at the Nizhnevartovsk (USSR) testing grounds to extinguish fires in a cluster of ten wells. The results of the tests showed that a cluster of eight oil wells exceeds fire safety requirements and that the number of clustered well drillings cannot be increased before fire suppression techniques and equipment or drilling and oil well operation techniques are improved. 1 photo.

821. Jorgensen M

FIRE HAZARD OF BUCKET ELEVATORS

Brandvaern; 2(2):20-22, 1976 (Danish, English summary)

The slowdown or stopping of a bucket elevator because of overloading or jamming is the usual reason for fires in mills, grain elevators, drying plants, and the like. Therefore, fire engineering regulations require that such elevators be equipped with devices which cut off the supply of power to their motors when the rate of motion decreases or when they stop. The design principles of such devices are briefly examined. 8 figs.

822. Gregersen fnu

THE FIRE HAZARD OF TEXTILE FLOOR COVERINGS

Feuerwehr; 26(3):67-68, 1976 (German)

Differing opinions as to the fire hazard of textile floor coverings and as to suitable test methods typify the situation with regard to evaluation of carpeted floors. Two fire accidents with serious consequences, resulting in human fatalities (carpeted floors contributing principally to the spread of the fire), have led the author to believe that laying carpeted floors in halls and stairwells in densely occupied buildings is hazardous. Opinions also differ as to the correct hazard evaluation by standard DIN 54332. In contrast, the corresponding standards in the USA consider two different risk situations, (pill test for a small ignition source and radiant panel test for a major primary fire), which take better account of the actual situation. (Fachdok 12/0651)

823. Anon

SPECIAL FIRE HAZARD IN MAJOR INDUSTRIAL PLANTS

Brandverhuetung; (118):59-61, 1976 (German)

A major fire in a chipboard factory with property damage of 60,811,000 Austrian shillings illustrates once

again that inadequate fire protection measures, especially in plants with a high fire risk, have serious consequences. Following a description of the work processes and the outbreak of the fire, the cause of the fire is discussed, namely, abnormal operation of the chip drier, whereby glowing chips reached the bunker, triggering an explosion and fire. 2 figs. (Fachdok 12/1001)

824. Anon

TAR VAPOR HAZARDS TO ELECTRICAL WIRING

Brandverhuetung; (118):61-62, 1976 (German)

A usually ignored possibility of fire occurring in tar-paper factories can sometimes lead to damages of major proportions. It was possible to pinpoint the source of the fire incident discussed in this paper. The fire broke out solely because of a short circuit in the lighting installation. Hot bitumen generates fumes; the condensate of the fumes affects the synthetic insulation of the electric wiring. The insulation of the electric wiring consists of soft PVC, which is not particularly resistant to naphthenes such as benzene, naphthalene, etc. In the course of time, therefore, the insulation is destroyed. 2 figs. (Fachdok 12/1025)

825. Vinter FW

FIRE HAZARDS IN THE PAPER AND BOARD INDUSTRY

Paper Technol; 16(6):361-367, 1975

Causes of fires, such as faulty building construction, and fires resulting from dust, pulpwood storage areas, waste paper storage areas, and storage of rolled stock in inadequately ventilated areas are discussed. Properly planned maintenance can be a strong preventive measure in fire control; sprinkler systems for extinguishing fires are also evaluated. 5 figs, 2 tables, 2 refs. (Author)

826. Anon

WASHING MACHINE EXPLOSIONS

Protivpozarna Zastita; 16(2):59, 1976 (Serbocroatian)

This brief note reports on explosions and fires that may occur when washing clothing soiled with oil. The gases and vapors that form when clothing is cleansed with gasoline and other solvents can sometimes cause explosions. The cause of the explosion is electric sparks that are generated when the washing machine is turned on. Incidents from Switzerland and Yugoslavia are cited. 1 fig. (Fachdok 12/0950)

827. Koprivica B

CAN FIRES AND EXPLOSIONS OCCUR IN HEATING OIL CONTAINERS?

Protivpozarna Zastita; 16(5):47-48, 1976 (Serbocroatian)

An explosion which took place in a heating oil tank is reported. The cause of the explosion was an excessively low oil level in the tank, which was not provided with an oil level gauge, resulting in empty heating elements. It was discovered that oil-level gauges are not prescribed in the safety regulations. The author demands that the regulations be modified. 2 figs. (Fachdok 12/0973)

5. FIRE PROTECTION PRINCIPLES

d. FIRE LOADS

e. HEAT AND PRESSURE LOAD EFFECTS ON STRUCTURES

828. Anon

FIRE ENDURANCE OF BUILDING STRUCTURES (OGNESTOYKOST STROITEL'NYKH KONSTRUKTSIY)
 VNII Protivopozhar oborony, Moscow USSR; 115 pages, 1975 (Russian)

This digest, No. 3 in the series *Sbornik trudov VNII protivopozharnoy oborony*, contains articles on the results of theoretical and experimental investigations of building and ship structures. The thermal engineering problem of calculating the fire endurance of structures is solved using a computer. Recent data on the change in strength and in the deformation of concrete and steel at high temperatures as well as on the causes of explosive spalling of concrete during fires are cited. Information is given on the fire endurance of laminated protective structures, fiberglass cladding, and suspended fireproof ceilings. The fire endurance of a ship bulkhead with an air layer in the insulation is calculated for the first time. (RZh)

829. Barthelemy B

HEATING CALCULATION OF STEEL MEMBERS
ASCE Proc. J Struct Div; 102(ST8):1549-1558, 1976

A method of calculation of fire resistance of steel structures has been developed in France by the Technical Center for Steel Construction. The main parts of this method are the determination of critical temperature and heating-up behavior of steel structures. This second part is developed in detail. It takes into account the steel protection by dry, wet, form-fitting, or sprayed protecting materials, but not by intumescent paints. Flow charts make the use of theoretical calculations easier. Thermal properties of some well-known materials are listed. 7 figs, 2 tables, 14 refs. (Author)

830. Lee BT

FIRE PERFORMANCE TESTING OF BULKHEAD INSULATION SYSTEMS FOR HIGH STRENGTH TO WEIGHT SHIP STRUCTURES. Nat Bureau of Standards, Center for Fire Res; NBSIR 76-1012, 63 pages, 8 figs, 28 tables, 12 refs, Aug 1976
 Availability: NTIS

Sixteen insulated aluminum bulkhead specimens were subjected to a material screening process as well as evaluated for their comparative fire performance with a 2-foot horizontal slab furnace. Two insulated and two unprotected glass-reinforced plastic specimens were also tested to obtain fire performance data on these structural materials. In addition, painted aluminum and steel panel specimens were included to determine the fire protective merits of two types of intumescent paints. Potential heat release, smoke, and combustion gas generation were also determined for the insulation and coating materials. Specimens insulated with organic base foams released high levels of combustion gases and could contribute considerable heat to an on-going fire. Specimens insulated with either refractory fibrous material or with mineral wool gave the best overall performance. The same thickness of insulation needed to protect an aluminum panel for

over an hour can provide up to 20 minutes of protection for a glass-reinforced plastic panel of the same thickness. The intumescent paints did little to protect the specimens during the fire exposure. Parameters of insulation thickness, heat capacity, density, and thermal conductivity as well as fire duration on specimen temperature were analytically investigated. (Author)

831. Butlin RN and Finch CP

GAS EXPLOSIONS IN BUILDINGS. PART V. THE MEASUREMENT OF SOUND LEVELS AND PRESSURES OUTSIDE A VENTED GAS EXPLOSION CHAMBER. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 988, 9 pages, 7 figs, 7 refs, May 1976

The methods of measuring the external pressure and sound levels resulting from vented gas explosions in experiments by the Fire Research Station at Cardington are described, together with the methods of calibration. Examples of the oscilloscope traces for sound and pressure are given. See also Fire Res Note 1052. (Author)

f. PREVENTION AND HAZARD REDUCTION

832. Smith FJ

DEVELOPMENT OF FIRE RESISTANT ELECTRONIC CONFIGURATIONS FOR USE IN OXYGEN ENRICHED ENVIRONMENTS
Space Simulation Conf, 8th, Proc; 1975, Nov 3-5, Silver Spring, MD

The flammability requirements of the various manned space programs required development of electronic configurations that would eliminate any flammability hazard to crews or missions. Initial test and development efforts were directed at the development of nonflammable or self-extinguishing materials. Design concepts for electronic black boxes and modules were tested in oxygen-enriched atmospheres, and it was found that various types of sealed configurations would generally eliminate any flammability hazard. The type of configuration and its construction was found to be of more importance in the elimination of flammability hazards in electronic configurations than the types of materials utilized in them. The design concepts developed for fire-hazard-free electronic configurations for use in manned space programs are applicable for the design of electronic hardware for any use or environment. (Author)

833. Stefancic S

FIRE HAZARDS AND FIRE-PROTECTION MEASURES IN THEATERS
Sigurnost; 18(1):27-54, 1976 (Serbocroatian)

Fires in theaters are characterized by several particular features, viz., numerous rooms, special equipment, etc. The author reports on fire protection in the Zagreb (Yugoslavia) theater and music hall. The indispensable guidelines for the organization of fire protection in theaters are also discussed. The author presents the results of his dissertation on fire protection in theaters. 2 figs. (Fachdok 12/0877)

5. FIRE PROTECTION PRINCIPLES

f. Prevention and Hazard Reduction—Continued

834. Kawashima K
INCREASING THE FIRE SAFETY OF HYDRAULIC LIFTS*Yuatsuka sekkei*; 13(10):65-69, 1975 (Japanese)

A fire-safety study is made of the four basic designs of hydraulic lifts used in Japan and other countries as tools to mechanize laborious loading and unloading tasks: lift with a one-section telescopic cylinder; lift with a three-section telescopic cylinder; lift with one cable assembly (cable reduction gear); and lift with a system of cable assemblies. The first two lifts represent an increased fire hazard, because the working pressure developed in the cylinder is approximately four times greater than that developed in lift cylinders with cable reduction gears. The temperature conditions in the two types of lift cylinders also differ by about the same factor. It is concluded that it is necessary to develop mineral oils with a higher ignition temperature, considerably greater than 270°C (this is the temperature reached in such types). In addition, it is recommended that monitoring and measuring devices (manometers) and the automatic safety devices (valves) on the lift compressors and motors be improved. Given in tabular form are the reasons and various combinations of circumstances that lead to oil overheating in the lifts. 2 figs, 1 table. (RZh)

835. Jowett CE
CONTROL OF STATIC ELECTRICITY*Fire Prev Sci Technol*; (15):4-10, 1976 (English; German and French summaries)

Electrostatic charges are a threat to safety, and to the reliability of plants, and they can exist without their presence being realized, due to the ease with which they are generated and their inconspicuous nature. As they are always present in the manufacturing environment, and often act as the "match" which causes the blaze or explosion, they must be controlled. In this article some ways in which static electricity is generated are described and the appropriate safe working practices which should be adopted in order to minimize this generation are outlined. Methods of increasing the rate of dissipation of charge such as the use of conductive clothing, flooring and other materials, bonding and grounding, and the formation of surface films, for example of moisture, carbon or metals, are described. 10 figs, 2 tables. (Author)

836. Kul'pin SE, Panazdyr VV, Red'kin VV, Zhilenko IM and Borisov AN
METHOD OF STORING NATURAL GAS
USSR Patent No. 455,224; Cl F17c 5/02, C07c 9/04, Appl 3 Feb 1971, Discl 4 May 1975

A method of storing natural gas in the liquified state using absorbents is described. The novelty of the method consists in the use of carbon dioxide, sulfur dioxide, or formaldehyde as absorbents to reduce the fire hazard and cost of storage. 1 drawing fig. (RZh)

837. Kirby WE and Ruggles BF
CONCEPT STUDY: FEASIBILITY OF CHARACTERIZING AIRFIELD FIRE HAZARDS AND OF DEVELOPING ASSIGNMENT CRITERIA FOR FIRE SUPPRESSION RESOURCES (FINAL REPORT). Wright-Patterson AFB,DoD Aircraft Ground Fire Suppression and Reserve Office, OH; DoD AGFSRS-76-4, 49 pages, Feb 1976
Availability: NTIS AD-A024 449/1GA

This report presents the results of a project that was undertaken to correlate aircraft fire hazards aground with some quantified airfield parameters involving aircraft operations. The feasibility of: (1) correlating aircraft accident/incident history data with airfield operations data in order to characterize aircraft fire hazards which exist in aircraft operations on airfields and (2) developing the criteria needed to assign crash fire suppression equipment to airfields in a manner that reflects the level of an aircraft fire hazard which exists at a given airfield and the capability of specific equipment to deal with the hazards that actually exist was studied.

838. Woods JF
SMOKE HAZARD IN BUILDING FIRES; Paper No. 25
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 343-351
Sponsor: Fire Res Sta, Bldg Res Estab (UK)

It is important when formulating building regulations to recognize that smoke is also a primary life hazard. This review of methods for reducing the smoke hazard in building fires has indicated areas where research and cost benefit studies are necessary in order to evaluate future code requirements. These include smoke detection and the coupling of detector systems to doors and dampers, the effectiveness of roof venting, lobby ventilation requirements, and the determination of which test methods are best suited for New Zealand, to limit the use of materials according to their smoke emissions. 22 refs. (Author)

g. PROTECTIVE DEVICES AND EQUIPMENT

839. Terai T
THE DESIGN OF FIRE PROTECTION SYSTEMS
Ohm: denki zasshi; 62(13):21-27, 1976 (Japanese)

Aspects of the design and use of complex modern fire detection and suppression systems embodying both electronic equipment for control and measurement and mechanical equipment for suppression are analyzed. One of the most important developmental tendencies in such systems is the standardization of parts, assemblies and subassemblies comprising the system. The use of completed standardized parts and assemblies will make it possible, in the design and development stage, to perfect such systems and to increase the number of functions they perform without excessive complication of the design of the equipment. In this way the reliability of the systems will be improved, since standardized apparatus is characterized by a high level of operational reliability, repairability and interchangeability. Some new reliability factors used to evaluate such complex fire protection systems from a technical and economic standpoint are examined on the basis of the MIL STD-882 fire detection, ventilation and suppression system, which is mass-produced. In particular, the concept of systems reliability is introduced, which is defined as the product of three factors: operational readiness, reliability, and degree of compliance with requirements. The first and third factors are measured

5. FIRE PROTECTION PRINCIPLES

g. Protective Devices and Equipment—Continued

in conventional units. The various influences which affect the value of these factors are analyzed. An analytical comparison is made by tables which relate the efficiency of the system as a whole and the efficiency of the constituent parts. 5 figs, 2 tables. (RZh)

840. Hashegawa K, Akaogi I and Kumazawa M
INFLATABLE SMOKE-CUT SHUTTER, PART 2
Rep Fire Sci Lab (Japan); (12):68-70, 1975 (Japanese)

A description is given of the design and operating principle of several versions of balloons of varying configuration to be automatically inflated in the case of fire for the purpose of effective localization of smoke sources during fires. In particular, the use of inflatable smoke barriers is expedient in buildings with forced fresh air ventilation systems, especially in the underground floors of multistory buildings. The basic version of such barriers provides for storage of the deflated balloons in special recesses between floors with ceiling panels normally closed. When a fire breaks out and smoke appears, the smoke detectors are actuated (these detectors may either form an integral part of the inflatable smoke barriers or may be part of the building net or self-contained fire detectors). The ceiling panels of the recesses open automatically; the smoke barrier balloons drop out, the upper edge remaining fixed in the recess; the valves of the compressed air cylinders in the recesses, which are connected to the balloons via flexible hoses, open, filling the shells with air and thus making them operable. The balloons take on the form of inflated barriers of a size commensurate with the size of the corridor in which the smoke barrier is located. The barriers partition the building corridors and other enclosures into isolated sections, thus barring the propagation of smoke. The barriers have special apertures, hatches, permitting people to crawl through them unhindered in case of necessity. To prevent the passage of smoke through the hatches, an elastic sleeve is attached along the perimeter; the outlet of the sleeve can be easily closed off by applying a little tensile force. (RZh)

841. Powell ADWT
FIRE-RESISTING FIRE-CHECK SELF-CLOSING DOORS
Fire; 68(851):600, 1976

Defective installation and maintenance and neglect in the daily use of fire doors cancel their effectiveness. The author suggests methods of correcting these defects, particularly the self-closing aspect, by improving the mechanics and efficiency of the method.

842. Voellinger H
FIRE-PROTECTION CLOSURES: STANDARDIZATION AND LICENSING
Brandschutz; 30(7):186-191, 1976 (German)

A survey of the existing supply of "genuine" fire-protection seals as stipulated in German standard DIN 4102, page 3, and as licensed for use by the building inspectorate is given in this article. A distinction is made between three kinds of "genuine" fire-protection doors: standard doors, licensed doors, and doors licensed for use in certain cases. The most flagrant infringements and defects that appear time and again in the installation of

fire protection seals are shown. A list of fire-protection seals presently licensed by the building inspectorate is given in the appendix. 7 figs, 3 refs. (Fachdok 12/0907)

843. Hijirikawa I
DESIGN OF FIRE AND DISASTER PREVENTION SYSTEM AND ITS CONSTRUCTION
Densetsu kogyo; 21(11):82-98, 1975 (Japanese)

A survey is made of the automatic fire detection and suppression systems used in Japan. The organizational and technical problems facing the designers of such systems are discussed. The tactical characteristics and specifications, the organizational principle, the construction and operation of several systems are considered. The technical parameters and the special system design features are given in the form of comparative tables. Deficiencies are noted and recommendations are made as to the arrangement of system components during installation and their location relative to standard building assemblies. A method of calculating the emplacement of fire detectors, sprinkler extinguishing devices, ventilation and smoke-removal systems, and public warning devices is given. A method for selecting the parameters and dimensions of emergency elevators as well as of emergency elevator shafts is examined in detail. The specifics of using different kinds of fire detectors are analyzed separately. It is noted that the demands imposed on the reliability and capacity of emergency power-supply systems are particularly high: gas-driven generators, batteries, etc. The organization of specialized governmental agencies empowered to check, repair and perform other technical servicing tasks of a regulatory nature for large fixed systems is outlined. Up to the present time such work has been performed, as a rule, by the personnel of the organizations that are using the equipment. 26 figs, 8 tables, 1 ref. (RZh)

844. Saito H
FIRE PROTECTION OF VENTILATION SYSTEMS
Kuki tyowa to reito; 15(11):61-66, 1975 (Japanese)

A survey is made of the existing methods of preventing fire break-out and spread through ventilation and smoke-removal ducts in large buildings. The types of fire-and heat-resistant varnishes and coatings used in combination with various materials from which the ducts and other system components are made are classified. Recommendations are given for optimum selection of such combinations. It is emphasized that the hazard of fire ignition and spread through the ventilation ducts depends in large measure on the configuration and cross-sectional area of the duct. The results of experimental investigations of this relationship are presented using as an example three circular ducts made of fiberboard, cotton felt, and particleboard. It is noted that the temperature at which favorable conditions for fire break-out and spread are created decrease from 330 to 130°C when the cross-sectional duct area increases from 0.25 to 250 cm (which is the average for all types of ducts). A formula is given which establishes an optimal relationship between the geometrical dimensions of a rectangular duct, smoke temperature, and the rate of smoke removal. The formula also takes into account the properties of the duct material. The formula is recommended for use in calculating the capacity of ventilation systems. 2 figs, 6 refs. (RZh)

5. FIRE PROTECTION PRINCIPLES

g. Protective Devices and Equipment—Continued

845. Medlock LE
AUTOMATIC FIRE PROTECTION SYSTEM FOR DIESEL-ENGINED VEHICLES*Fire Internat*; 5(52):89-93, 1976 (English, French, German; Spanish summary)

This article is a reprint of an article appearing in *Fire*, 68(848):449-50, 1976. For the abstract consult the entry for the journal in the Source Index. 5 figs.

846. Nakanishi H
EMERGENCY LIGHTING*Ohm: denki zasshi*; 62(13):67-72, 1975 (Japanese)

A survey is made of the types of emergency lighting systems used in Japan and of the different kinds of signs used to aid in evacuating people via emergency exits, stairwells, elevators, etc., in case of fire. These aids are classified in several categories, depending on the specific purpose. They are principally verbal or symbolic signs, either suspended from the ceiling or attached to the walls; they are made in the form of semi-transparent materials with internal fluorescent lighting. Some of the more successful designs are illustrated. The technical requirements relating to size, configuration and other parameters of the statements and symbols used in these signs are discussed. Recommendations for the optimal location of all types of signs at different places in buildings are made. Of considerable interest is the method used to install flat illuminated signs flush with the floor in corridors. For this purpose, the framework of the signs is of optimum mechanical strength. An example of the use of such signs in combination with fire warning devices (visual and acoustic) in complex fire safety systems is given and examined. 10 figs, 1 table, 6 refs. (RZh)

847. Kletz TA
THE PROTECTION OF PRESSURE VESSELS AGAINST FIRE*Fire Internat*; 5(53):18-30, 1976 (English, French, German; Spanish summary)

This article explains how pressure vessels can be protected against the effects of fire by sloping the ground so that spillages of flammable materials do not accumulate under the vessel, thermal insulation, water cooling, and reducing pressure in a vessel. Particular attention is paid to the rate at which the pressure should be reduced and the methods of reducing it. (Author)

848. Anon
FLAME AND SMOKE INTERCEPTING WALL IN FLEXIBLE CONSTRUCTION*Technocrat (Japan)*; 8(9):52, 1975

The automatic flame and smoke intercepting wall is designed as a two-layer net with gap which is dropped from the ceiling when a fire breaks out. Foam fills the gap between net layers, the net intercepts the heat and smoke emitted by the fire and, by preventing oxygen supply, stifles the fire. The system consists of a smoke detector, an actuator panel, solenoid valve, pump, undiluted solution (surfactant), tank, mixer, synchronized valve, foam maker, piston damper, foam container and net.

849. Levoy RP
FIRE INSURANCE IS NOT ENOUGH*Vet Med Small Anim Clin*; 71(4):520-521, 1976

The author recommends that hospital records, important papers, and accounts receivable be stored in fire-insulated cabinets to ensure coverage of losses not included in fire insurance. 2 figs.

850. Sterling WK
PREVENTIVE FIRE PROTECTION BY MEANS OF A SELF-CLOSING SAFETY CABINET*Zentralbl Arbeitsmed Arbeitsschutz*; 25(12):373-374, 1975 (German)

A fire-resistant, automatically closing steel-plate cabinet for the storage of readily combustible or very sensitive materials, such as critical liquids, chemicals, antibiotics, or documents, magnetic tapes and the like, is described. 1 fig.

851. Schmidt WA
FIRE PROTECTION AND SMOKE CONTROL HVAC SYSTEMS CAN SAVE LIVES*ASHRAE J*; 18(2):17-19, 1976

The problems of firefighting in highrises are briefly reviewed along with the fire regulations, which were aimed at blocking the ventilation system responsible for the spread of fire and asphyxiating those in a hospital, for the development of a controlled ventilation system which could produce negative pressures in the fire zone and positive pressures elsewhere, thus permitting smoke evacuation from zones not yet touched by the fire. This system is not compatible with the stipulations of the NFPA code, and therefore a new code draft is presented. 7 refs.

852. Rozotte R
SMOKE-VENTING FIREBREAK HATCHES*French Patent No. 2,242,845*; C1 A62C 2/02, Appl 28 Aug 1973, Discl 28 Mar 1975, Assignee: Caprec

A smoke hatch with a fire endurance of two hours for installation in partitions between compartments is patented. The opening is spanned by two small doors whose connecting portions are canted in such a way that one door restrains the other. The spring-loaded doors strive to rotate through 180°, but the restraining door is fixed in position and is remotely controlled by means of an electromagnet. The doors are hollow and have an inorganic filling to increase the fire resistance. 7 drawing figs.

853. Marois J
FIRE RESISTANT WALL AND ENCLOSURE WITH SUCH A WALL*French Patent No. 2,248,722*; C1 E05G 1/02, Appl 17 Oct 1973, Discl 16 May 1975

Ordinary safes frequently do not provide adequate security for valuable papers and documents in case of fire. The proposal relates to reliable safe-keeping by fitting out a room partitioned off from the rest of the building with hollow walls, ceiling and floor within which water pipes with sprinklers are laid. In case of fire, the readily fusible plates blocking the sprinkler valves melt and the

5. FIRE PROTECTION PRINCIPLES

g. Protective Devices and Equipment—Continued

heated portion of the structure is cooled with water, providing a high degree of fire resistance to the structure and, consequently, security to the valuables stored in the room. 8 drawing figs.

854. Meshman LM, Kuznetsov NP, Rode AA, Grunenkov VS and Veselov AI
DEVICE FOR DETECTING DEFECTIVE STATES IN FIRE AND EXPLOSION PROTECTION SYSTEMS
USSR Patent No. 451,111; CI G08b 17/10, Appl 25 Jul 1973, Discl. 29 Apr 1975, Assignee: VNII protivopozhar oborony

The patented device relates to an automatic alarm and is suitable for detection of UV flame radiation of mixtures of gas, vapor, and airborne dust against background and industrial noise. 1 drawing fig. (RZh)

855. Mikovich P
FIRE PROTECTION AND SMOKE DAMPER
Austrian Patent No. 324,631; C1 36 E 009, (F24F 013/08), Appl 4 Oct 1972, Discl 10 Sep 1975, Assignee: Peter Mikovich oHG

The damper is intended for automatic closing of air-conditioning ducts when the hot gases generated by a fire enter the ducts. A toothed segment and a pulley for a rope and weight extend outward from the axis of the housing. An open pipe with a piston is fixed inside the housing perpendicular to the wall. The piston rod also projects outside, where a small gear-wheel is press-fitted on it. In the normal open damper position the pulley cannot turn, since the toothed segment on its axis is locked to the gear wheel on the piston rod. The other (inner) end of the hollow pipe is filled with a low-melting metal, to which the piston is held by a spring. When the metal melts because of rising temperature, the piston ejects it from the pipe and withdraws inside, pulling in the gear wheel, which unlocks from the toothed segment. The weighted rope pulley turns the axle with the damper, closing the duct. 3 drawing figs.

856. Barbarin J
FIRE DAMPER
French Patent No. 2,233,549; CI F16K 17/38, A62C 3/14, Appl 14 Jun 1973, Discl 10 Jan 1975

The damper is designed to prevent fire from spreading from the area in which it breaks out into a ventilation duct. The damper is made in the form of a shutter which, under the pressure of two springs, is restrained from sliding over the plane of the wall by a fusible lock. When the temperature rises, the lock melts and the shutter is released by the springs, closing the opening of the ventilation shaft. The advantage of this configuration is that the shutter panel is made of an incombustible material of low thermal conductivity. The thickness of the material can be increased, if necessary, to provide greater fire resistance. 6 drawing figs.

857. Novikov VN
DEVICE FOR AUTOMATIC CONTROL OF A SMOKE-REMOVAL SYSTEM
USSR Patent No. 475,646; CI G08b 17/10, Appl 3 May 1973, Discl 13 Oct 1975, Assignee: Upr po Proektir Obschestv Zdaniy i Sooruzh Mosproekt-2

A description is given of an automatic device to control a smoke-venting system. The device contains parallel beam sets with series-connected sensors, shunted by diodes, a supervisory relay and actuator relays. The definitive feature of the device is that it is simplified by being equipped with make-or-break pushbuttons. The make pushbuttons are series connected with the supervisory relay, the break buttons with the sensors; the supervisory relay and the actuator relays are connected to a single feed line. 2 drawing figs. (RZh)

858. Patterson G
FIELD TRIALS OF A FIRE DOOR CLOSER SYSTEM; Paper No. 7
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 69-77
 Sponsor: Fire Res Sta, Bldg Res Estab (UK)

The purpose of the trials was to monitor how people behave under normal conditions. The main interest of the results lies in the contribution to a better understanding of why people wedge fire doors and how a closer system might diminish this form of abuse. The system allowed the doors to be held open and, if they had latches, to be free-swinging under normal conditions. Under fire conditions, the system ensured the doors automatically became self-closing only. The trials demonstrated that the additional facilities significantly reduced abuse and indicated how they might be selected to meet different behavior patterns. (Author)

859. Holt JE
FIRE VENTILATION POLICY; Paper No. 12
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 149-169
 Sponsor: Fire Res Sta, Bldg Res Estab (UK)

The two documents given here are Colt International's Fire Ventilation Policy Document and a quarterly test record book. The policy document was produced for internal use and gives, what is in the Company's view, the obligations of a company designing and supplying heat and smoke exhaust schemes. The quarterly test record is an endeavor to obtain cooperation from the user to ensure that the equipment is in good working order between the annual visits by the Colt representative. 9 figs. (Author)

860. Morgan J and Marchant EW
SOME EFFECTS OF NATURAL WIND ON VENT OPERATION IN SHOPPING MALLS; Paper No. 13
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 171-183
 Sponsor: Fire Res Sta, Bldg Res Estab (UK)

In town center redevelopments the wind pressures developed on the upper surface of the mall roofs, due to the presence of taller buildings close to the mall, may have an adverse effect on the operation of smoke vents. An experimental investigation was carried out in a wind tunnel using nineteen building geometries in an attempt to quantify the problem. The results from four geometries are discussed. Criteria for vent failure are defined and

5. FIRE PROTECTION PRINCIPLES

g. Protective Devices and Equipment—Continued

calculated probabilities of failure are presented. 5 figs, 6 tables, 7 refs. (Author)

861. Heselden AJM
STUDIES OF SMOKE MOVEMENT AND CONTROL AT THE FIRE RESEARCH STATION; Paper No. 14
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 185-195
 Sponsor: Fire Res Sta, Bldg Res Estab (UK)

Recent studies of smoke movement and control at the Fire Research Station (UK) are described. These have included: (a) the movement of a buoyant smoke layer in a channel and its implications for smoke control in certain types of buildings, notably shopping complexes, (b) the entrainment of air into a smoke plume rising within a shopping complex, (c) the production of smoke by a sprinklered fire, (d) the efficient extraction of smoke from a thin ceiling layer, (e) smoke extraction by a ducted water spray, and (f) the effect of sprinklers on smoke layering. These have involved both model and large-scale experiments, and the development of instrumentation and experimental methods. 4 figs, 18 refs. (Author)

862. Butcher EG
THE DESIGN OF PRESSURIZATION SYSTEMS - A SURVEY OF CURRENT CODES AND DISCUSSION OF DIFFICULTIES; Paper No. 15
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 199-208
 Sponsor: Fire Res Sta, Bldg Res Estab (UK)

In this paper the requirements of the Codes or Regulations relating to the use of pressurization in various countries are compared and their main differences discussed. The desirable features of a pressurization system are stated and a brief discussion of how these can be incorporated in a building design is given. The difficulties arising and the criticisms commonly made are indicated. (Author)

863. Leworthy LR
CONTROL AND PREVENTION OF SMOKE MOVEMENT AND ENTRY INTO BUILDINGS BY MECHANICAL VENTILATION; Paper No. 16
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 209-218
 Sponsor: Fire Res Sta, Bldg Res Estab (UK)

An essential part of a scheme to control smoke movement by mechanical ventilation is a release vent or evacuation valve to vent or release air pressure from the protected cube. The earliest schemes known to its author were the wartime report and control centers (circa 1940) which were designed to keep war gases, as well as smoke from adjacent fires, from the protected accommodation. The paper briefly describes the plant, the air distribution, the return air path and the final evacuation valve venting to atmosphere. 6 figs, 1 ref. (Author)

864. Fung FCW
SMOKE CONTROL BY SYSTEMATIC PRESSURIZATION; Paper No. 17
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 219-235
 Sponsor: Fire Res Sta, Bldg Res Estab (UK)

An experimental investigation of smoke control in highrise buildings by the "Systematic Pressurization" concept is presented here. This concept of smoke control involves the utilization of a modified building air-handling system. The building is generally divided vertically into several horizontal smoke control zones, each containing a predetermined number of floors. Upon smoke alarm the airhandling system is programmed to switch to smoke control mode by providing 100% exhaust to the smoke zone and 100% supply to the other zones. The idea is to simultaneously exhaust smoke from its zone of origin and prevent smoke propagation to the other zones by pressurization. 9 figs, 2 tables, 10 refs. (Author)

865. Moulen AW
FIRE PRECAUTIONS IN BUILDINGS WITH AIRHANDLING SYSTEMS; Paper No. 18
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 237-243
 Sponsor: Fire Res Sta, Bldg Res Estab (UK)

The purpose of a mechanical smoke control system in the event of fire in a building is to prevent the recycling of combustion products through the building, to prevent smoke and hot gases from entering fire escape routes, and to avert the spread of fire by way of the air-handling ducts to other stories or other parts of the building. Results of field surveys of pressures measured in multistory buildings are reported. These pressure measurements were made to forecast the likely smoke movement, the effectiveness of air-handling systems in exhausting decomposition products from possible fire areas, and whether escape routes would be kept smoke-free when air-handling plants are operated as specified by Australian Standard 1668, Part 1 - 1974, Mechanical Ventilation and Air-conditioning Code Part 1, Fire Precautions in Buildings with Air-handling Systems. 1 fig, 1 table, 4 refs. (Author)

866. Minne IR
SMOKE INFILTRATION IN THE FIRE ESCAPE ROUTES OF TALL BUILDINGS; Paper No. 19
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK
 Sponsor: Fire Res Sta, Bldg Res Estab (UK), pages 245-265

During the time required for evacuation, fire escapes must remain free of smoke. Tests were done in the Government Administrative Center in Brussels, a highrise building, in which lock chambers are present between each compartment and the staircase. In each lock chamber, an overpressure is realised by means of a blower system. It is shown that this procedure can insure that no smoke comes into the staircase even through a lock chamber with open doors, when the air supply is a 500m³h unit and the blower duct is provided with an efficient diffuser.

5. FIRE PROTECTION PRINCIPLES

g. Protective Devices and Equipment—Continued

The solution "staircase in overpressure" seems to be less advantageous. 6 figs, 1 table, 4 refs. (Author)

867. Ferrie M

SMOKE REMOVAL IN HIGHRISE BUILDINGS; Paper No. 20

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 267-279 (French, English Summary)
Sponsor: Fire Res Sta, Bldg Res Estab (UK)

As a sequel to his previous report in April 1969 at Watford (UK), the author begins by explaining experiments made in actual buildings. After a brief summary of the possible solutions for making stairways smoke-proof, the author compares the three systems currently adopted in France: systems with 0, 1, 2 ducts per lobby (security and reliability, ease of adjustment of ventilating systems). This is followed by an explanation of the problems raised by the adjustment, service control and maintenance of these installations. The financial aspect is also considered both at the stage of construction and in use. The writer then outlines the energy savings which can be made by the use of automatic systems in high buildings, for which a mechanical smoke proofing system is not imposed by French regulations (buildings less than 28 m high or less than 50 m). The report closes with a presentation of the current level of technology of the automatic materials which ensure the smooth running of these installations. In particular, two innovations are presented, the first concerning doors, trapdoors, dampers and gates which open and/or close automatically; the second concerning the working reliability: the "Positive Safety" floor by floor. 2 figs, 4 tables, 7 refs. (Author)

868. Kohno M and Kasahara I

SMOKE MOVEMENT CALCULATION FOR SEVERAL CONTROL SYSTEMS IN A HIGH-RISE BUILDING; Paper No. 21

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 281-295
Sponsor: Fire Res Sta, Bldg Res Estab (UK)

The behavior of smoke during a fire is determined by such meteorological conditions as temperature and wind direction as well as by the height and floor plan of the building, by window status (open or closed), etc., factors which are particular for each building. In order to decide on a smoke control system that is optimum for a certain building, therefore, it is necessary that a simulated circulation of air flow be made by varying these factors; that is, determine whether the building is capable of withstanding these conditions. Air flow calculations in full-scale buildings require much time, even when a computer is used, so that it is almost impossible in practice to calculate all the conditions involved. For this reason, the authors prepared a rough calculation program to take into account these conditions and carried out a calculation for about 100 cases. The present paper gives the results of these calculations. 2 figs, 11 tables, 2 refs. (Author)

h. SUPPRESSION DEVICES AND EQUIPMENT

869. Stevens RE

THE NEED FOR SPRINKLERS IN HIGH-RISE BUILDINGS

Constr Specifier; 29(1):36-40, 1976

The author points out the advantages of sprinkler systems in terms of influencing the cost of insurance rates and life safety in conjunction with an active fire safety program. Some NFPA standards and codes having a direct bearing on certain phases of sprinkler protection are cited in the bibliography. 7 tables.

870. Jiromaru M

CONSOLIDATION OF THE FIRE EQUIPMENT OF HIGHRISES IN CENTRALIZED SYSTEMS

Ohm: denki zasshi; 62(13):17-20, 1975 (Japanese)

In multistory residential and plant administrative buildings, a natural way of increasing the effectiveness of fixed fire equipment is to consolidate it into systems and to centralize control of the systems. An ideal tool for controlling and coordinating such systems is a multipurpose computer. The comparative simplicity of the tasks involved in automatic detection of a fire source and in controlling the suppression process make it possible to use obsolescent and unused third- and even fourth-generation computers, regardless of whether they are analog or digital. Considered is a block diagram and operating principles of a computer used for this purpose, combining both analog and digital information processing methods. The computer tasks include the following: collection, conversion and processing of information arriving in the form of d-c signals from peripheral sensors, fire detectors; making a decision as to whether a fire has broken out; determination of the location and boundary lines of the fire sources; generation of a visual and acoustic emergency alarm signal; transmission of control signals to magnetic starters or directly to the actuators of the foam extinguishing system through a branching network of sprinkler heads; transmitting an alarm signal to the control panel of the municipal fire protection office; providing for emergency telephone and TV (local) communication, and other tasks. 2 figs. (RZh)

871. Kita M

AUTOMATIC SMOKE REMOVAL SYSTEM IN CASE OF FIRE

Ohm: denki zasshi; 62(13):62-66, 1975 (Japanese)

A technical description is given of an automatic smoke removal system designed for installation and operation in case of fire in buildings of complex design, such as multistory, factory buildings, etc. The system consists of powerful fans and a set of compact smoke removal sections of varying cross-section and configuration. The design of the sections is such that they can be joined to each other for easy construction of a smoke removal line to conform to the particular features of the building design. Several ways of joining smoke removal sections to form lines of a given configuration are illustrated. The operation of the system is examined using interaction with a complex automatic fire detection and sprinkler suppression system as an example. The fire detection signals, which correspond to outbreak of a fire, automatically

5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

trigger the magnetic starters, actuating the fans and also opening the smoke intake holes of the smoke removal system. The holes, with shutters normally closed, are in the end panels of the system, either in the side walls of the smoke removal system, flush with the walls or ceiling of the enclosure. The system is self-supervisory owing to several control points along the line provided with draft sensors, which transmit telemetric information on the level of rarefaction at these points over wire communications lines to the control panel. 9 figs, 6 refs. (RZh)

872. Anon
AUTOMATIC EXTINGUISHMENT OF FIRES
(AVTOMATICHESKOE TUSHENIE POZHAROV)
VNII Protivopozhar oborony, Moscow, USSR; 112 pages, 1975 (Russian)

Various aspects of automatic detection and suppression of combustible liquid fires are presented in this digest of papers of the All-Union Fire Protection Research Institute in its series *Sbornik trudov VNII protivopozharnoy oborony*. This digest contains the results of research into determining the mass flow into a nitrogen-Freon mixture required to extinguish combustible liquid fires in an enclosure. A solution is given of one of the problems of heat exchange between a protective surface and a heated gas. Data are presented on the temperature conditions in enclosures, on determining tolerable distances, on methods of locating detectors and on their time of actuation as a function of the fire buildup conditions. (RZh)

873. Shimanuki T
SELECTION OF EQUIPMENT IN DESIGNING SMOKE-REMOVAL AND FIRE-EXTINGUISHING SYSTEMS
Kuki tyowa to reito; 15(11):110-112, 1975 (Japanese)

Problems connected with the optimum method of selecting the technical parameters and types of mass-produced equipment and accessories in the design and calculation of large-scale automatic fire-extinguishing and smoke-removal systems are discussed. All-purpose indexes governed by some Japanese and US standards, establishing a relationship between the characteristics of the protected installations and the parameters of the smoke-removal and fire-extinguishing systems, are presented. In addition, data from the results of experiments carried out by the Tokyo Laboratory of Microclimatic Devices are cited. These data establish a relationship between the capacity of ventilators of smoke-removal systems, on the one hand, and the volume as well as relative geometric dimensions of enclosures, on the other hand. Also established is an optimum relationship between the capacity of the ventilators and the cross-sectional area of the smoke-removal ducts. A block diagram is shown, and the operating principle of an all-purpose automatic fire-extinguishing system combined with smoke-removal equipment is analyzed. 1 fig, 1 table. (RZh)

874. Oda K
FIRE EXTINGUISHING SYSTEM
Yuatsu gijutsu; 14(13):57-62, 1975 (Japanese)

The structure and operation of some new automated fire-extinguishing systems for use in various branches of industry are described. A component part of one of these

systems is a subsystem, an emergency system for protection against the formation of explosion- and fire-hazard gas concentrations in air. The system consists of a photo-calorimetric analyzer, a relay, a magnetic starter, an electric motor, and a high-powered fan. The system operates as follows: from the analyzer vessel a reagent is piped continuously to a liquid pump, which serves to pump into the analyzer a gas mixture which blends with the reagent and goes into a glass cuvette. The latter is illuminated by a gas-discharge lamp with a special reflector to ensure uniform illumination over the entire volume. The beam of light passes through the solution and hits a photocell. When the color of the solution or its optical properties change, so does the current intensity of the photocell, which is recorded instantaneously by electrical-contact galvanometers. If the gas concentration in the medium under study exceeds the maximum permissible concentration, the photocell current causes the galvanometer needle to close the terminals of the relay circuit, which in turn closes the terminals of the magnetic starter, transmitting voltage of industrial frequency to the electric motor of the high-power fan. After the fan has run for some time, the gas concentration in the medium drops, the galvanometer needle changes position and opens the terminals of the relay. The fan motor is disconnected from the power supply. The industrial production-line processes that are recommended to be carried out in conjunction with automatic gas analyzers are listed. It is pointed out that secondary devices, such as visual and acoustic signalling devices, various indicators, communications devices, power packs, etc., should be located in adjacent premises, or in premises where explosion- and fire-hazard concentrations of vapors and gases cannot form with air. The operational and technical parameters of this and the other systems are given. 11 figs, 3 tables, 2 refs. (RZh)

875. Korzhov VT
UVS AUTOMATIC FIREFIGHTING SYSTEM
Bezop tr prom-sti; (4):20-21, 1976 (Russian)

A report is made of fire suppression tests with the UVS automatic extinguishing system constructed by the Donetsk mine rescue equipment factory. The extinguisher nozzles operate at a pressure of 6-35 atm and form a water curtain which wets down the entire cross section of the mine area. The nozzles can be actuated automatically or manually. The system has proved to be effective in coal mines of the Donetsk basin. 1 fig. (Fachdok 12/0971)

876. Jiromaru S
DESIGN OF FIRE-FIGHTING DEVICES AND METHODS OF EXTINGUISHING FIRES
Kuki tyowa to reito; 15(11):74-80, 1975 (Japanese)

Aspects of the optimal location and use of mass-produced fire-fighting equipment, including large systems and individual assemblies, to ensure the fire safety of multi-story buildings are discussed. It is pointed out that the effectiveness of large complex automatic fire-extinguishing systems depends largely not only on the correct distribution of fire detectors and sprinkler heads, but also on the correct choice of types and the correct combination of detectors and heads in the design and assembly of systems. Ideas relating to the choice of detector and sprin-

5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

kler head types as a function of the nature and parameters of the installations and premises being protected are developed. Optimal variants of selection, as well as of the combination and distribution of various types of detectors and sprinkler heads, are illustrated in tabular and graphic form as a function of the geometric parameters and purpose of the premises, the number and types of fire-hazard equipment found in the building, the area of the building occupied by people, and how many, the type and capacity of the intake and exhaust ventilators, etc. Also considered are the design and operating principles of some centralized sprinkler extinguishing systems of high (nominal) efficiency in various stages of design and development. 3 figs, 3 tables. (RZh)

877. Gulyaev G and Kochnev A
OPERATION OF FIXED FOAM INSTALLATIONS
Pozhar delo; (5):24-25, 1976 (Russian)

One of the most important components of fixed foam fire-extinguishing systems is the foam generator. If the generator operation is unstable, the expansion ratio and stability of the foam are low. The reason may be the poor quality of the foam compound, a low foam-compound concentration in the solution, abnormal operation of the spray tip, painting over or clogging the screens with rust, trash, etc. Each of these reasons is discussed in detail.

878. Itskov AI
TECHNICAL MAINTENANCE AND RELIABILITY OF AUTOMATIC FIRE EXTINGUISHING SYSTEMS
Pozhar delo; (4):23-25, 1976

The reliability of automatic fire-extinguishing systems depends on correct use and timely and careful technical maintenance. Data on statistical analysis, checking and reliability of these systems are given with the aim of establishing servicing techniques and schedules. The reliability data were obtained by mathematical formulas. A chart is included which lists the methods of improving reliability in the design, manufacturing, construction, installation and operating stages. 6 tables

879. Anon
FIRE EXTINGUISHER WITH PROPELLANT-GAS CARTRIDGE
Maschinenmarkt; 82(2):29, 1976 (German)

A description is given of a fire extinguisher containing a powder and a compressed gas cylinder. The cylinder is placed in a special duct inside the extinguisher. The powder fills the space between the walls of the extinguisher and the cylinder ducts. The advantage of this extinguisher consists in the fact that the inside of the extinguisher is pressurized only when it is used. When actuated, the compressed gas cylinder opens, forcing powder into the seat of the fire. The extinguisher is recharged by replacing the used cylinder and refilling with powder. 1 fig.

880. Kramer HJ
DISCHARGE DEVICES FOR WET WATER, HIGH- AND MEDIUM-EXPANSION FOAMS AND THEIR OUTPUT CAPACITY
Unser Brandschutz; 26(4):29-31, 1976 (German)

The effective application of wet water, high- and medium-expansion foams depends on the discharge devices used for them. Precise information on their construction, operating method and, above all, on the technical and tactical conditions for their use is a prerequisite if effective extinguishment is to be achieved. Data are presented on the important details of some discharge devices produced and used in the GDR. 8 figs, 1 table. (Fachdok 12/0575)

881. Kislung HM
FOAM EXTINGUISHING SYSTEMS FOR DIP-PAINTING PLANTS
Brandvaern; 2(1):17-19, 1976 (Danish)

Automatic extinguishing systems for special production sites where combustible liquids are used normally contain carbon dioxide as the extinguishant. In this article a description is given of a novel foam extinguishing system that uses light water to make the foam and is capable of guaranteeing the safety of large dipping tanks in which large components and body parts are painted. 1 fig. (Fachdok 12/0756)

882. Tsurumi T
AUTOMATIC FIRE EXTINGUISHER
Japanese Patent No. 50-10478; Cl 95B3, (A62C 13/50), Appl 18 May 1970, Discl. 22 Apr 1975, Assignee: Tyuo Kiki Sejsakusyo kk

A patent is disclosed for a manual fire extinguisher equipped with an automatic on-off valve which is triggered by a cable with a heat-sensitive head attached to the hose of the extinguisher. The head is located near the discharge nozzle. The cable consists of a tube housing with a flexible movable rod. The head is a plug in the housing, one side spring-loaded, the other with a heat-sensitive plate. The flexible rod of the cable is fixed to the drive mechanism of the valve and the heat-sensitive head. When the hose is aimed at the seat of the fire, the heat-sensitive plate heats up, deforms and releases the plug; the spring forces the plug out of the housing, pulling out the rod; the rod actuates the driving mechanism, opens the on-off valve, and extinguishant is delivered from the extinguisher tank through the hose. 4 drawing figs. (RZh)

883. Balagin PG
DEVICE FOR SPRAYING LIQUIDS
USSR Patent No. 461,743; Cl B05b 1/30, A62C 35/54, Appl 14 Aug 1972, Discl 23 Jun 1975, Assignee: VNII protivopozhar oborony

The invention relates to a device for spraying liquids, consisting of a container with lateral inlet perforations and an outlet. The device also has a stopper with a duct and is suitable for spraying atomized liquids onto fast-burning materials. The novelty of the device consists in the stopper, which can be moved vertically. 2 drawings. (RZh)

884. Sukharenko VI, Mikhedov VG, Zemskiy GT, Kupriyanova LI, Tsvetkov MN, Nazarov NI, Sukhov IYa and Krutov VA
EXTINGUISHER FOR ALKALI METAL FIRES
USSR Patent No. 326,799; Cl A62d 1/00, Appl 29 Oct 1970, Discl 29 Oct 1975, Assignee: VNII protivopozhar oborony

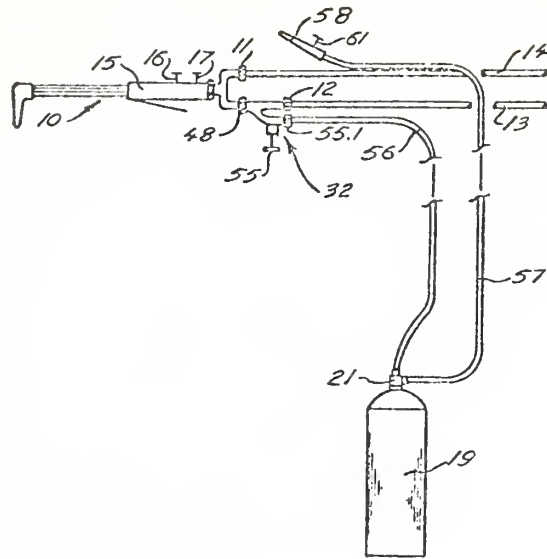
5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

A method of extinguishing alkali metals is described. The innovation of the method is the addition of 1 to 15 vol % of CO₂ to the inert gas (nitrogen, argon, helium) to increase the extinguishing efficiency. 1 table. (RZh)

885. Anon
AUTOMATIC VALVE FOR FIRE EXTINGUISHANTS
French Patent No. 2,242,847; Cl A62C 37/08, Appl 31 Aug 1973, Discl 28 Mar 1975, Assignee: Soc de Fabrication et d'Entretien de Materiel Electrique

If the fire extinguishant is discharged from the extinguisher as a single conical jet, the desired area of coverage is not assured. The valve patented here has a nozzle with six openings angled in such a way as to produce a spray covering an area considerably greater than with one opening. The valve can be actuated automatically, when a fixed glass flask is ruptured by the increasing temperature, electrically, by special sensors, or manually. 2 drawing figs.



886. Anon
EXTINGUISHER WITH A MANOMETER
French Patent No. 2,245,163; Cl A62C 23/00, GOIL 19/00, Appl 27 Jul 1973, Discl. 18 Apr 1975, Assignee: A Werner & Co, Spezialfabrik fuer Feuerloeschtechnik

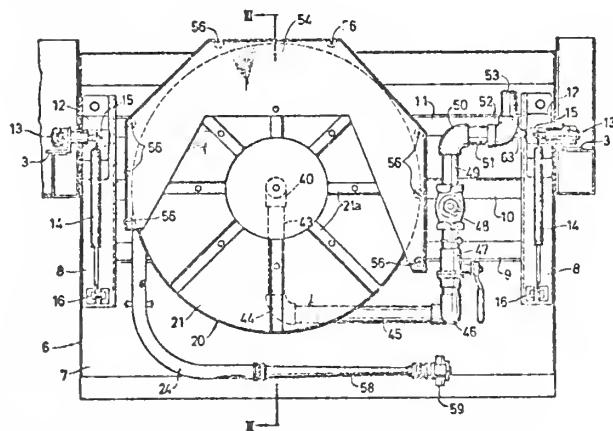
Manometers are used to check the operational readiness of fire extinguishers containing a pressurized extinguishant. The special feature of this version is a manometer connected to the cylinder via a shut-off valve, permitting a periodic check to be made of the charging status of the extinguisher and replacement of a defective manometer without losing pressure in the cylinder. 2 drawing figs.

887. Bohme AE
FIRE EXTINGUISHING APPARATUS FOR OXYACETYLENE WELDING ASSEMBLIES
US Patent No. 3,945,440; Cl 169/54, (F23D 13/46), Appl 23 Jun 1975, Discl. 23 Mar 1976

The fire-extinguishing apparatus for oxyacetylene welding assemblies with a cylinder having a free-floating piston, over the actuator of a release valve, mountable at one end of a pressurized bottle containing a fire-extinguishing fluid and connectable at its opposite end to an oxygen return line and a valve assembly connectable between the oxygen line and the torch, the valve assembly has a through-passage for enabling passage of oxygen from the oxygen line to the torch and an intersecting passage having a manually operated shutoff valve intersecting the through-passage at one end and having means at its opposite end for connection to the oxygen return line to the bottle of extinguishing fluid for enabling pressurized oxygen to flow to the cylinder and move the piston into operating engagement with the actuator of the release valve so as to release the fire-extinguishing fluid therefrom. A discharge hose is extended from the fire-extinguishing fluid bottle to the operator of the welding torch. 4 claims, 3 drawing figures. (Author)

888. Miyazaki T
HOSE REEL DEVICE FOR FIRE EXTINGUISHING APPLIANCE
US Patent No. 3,935,879; Cl 137/355.16, (B65H 75/34), Appl 11 Mar 1975, Discl 3 Feb 1976, Assignee: Nomi Bosaikogyo Kabushiki Kaisha, Japan

A hose reel device for a fire-extinguishing appliance of the type having a cabinet and a swingable door to be horizontally opened so as to provide a vertical rotational axis for the hose reel mounted on the inside of the door in opened position. The device is accordingly adapted to use in a highway tunnel so as to be recessed into a wall portion immediately over an inspection walkway and is intended to provide, in case of emergency, a better mode of opening the door and convenient reach of the device by an operator even though remaining under



5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

the walkway, while permitting the hose to be run out in any direction without any deliberate effort of the operator. 6 claims, 4 drawing figs. (Author)

889. Kinoshita E

DEVICE FOR THE EXTINGUISHMENT OF FIRES IN BUSES

Japanese Patent No. 50-13598; Cl 95B263, (A62C 35/12), Appl 12 Feb 1969, Discl 21 May 1975, Assignee: Nissin Kogyo kk

The design and operating principle of a fire-extinguishing system for passenger buses are disclosed. The device includes the following units: a set of fire detectors located at various points in the chassis of the bus and the motor; a water tank, a cylinder filled with a powder extinguishing agent to form a high-expansion foam when mixed with water; sprinkler heads distributed over the chassis of the bus, around the motor, and within the passenger compartment; a pipe system; an inert-gas cylinder under high pressure, connected to the pipe system, to extinguish the fire when opened by forcing the components of the fire-extinguishing solution into the mixing chamber and then into the network of sprinkler heads; a system-triggering mechanical lever located next to the driver's seat; and a visual and acoustic alarm device connected to the fire detectors by means of electrical commutators in the instrument panel of the driver's compartment. The fire in the passenger compartment is located visually by the driver. Depending on the location of the fire, the driver can actuate only some of the sprinkler heads to extinguish the fire. 4 drawing figs. (RZh)

890. Ogino A

DEVICE FOR EXTINGUISHING A FIRE IN A TUNNEL

Japanese Patent No. 50-10476; Cl 95AO, (B62C 2/00), Appl 1 Oct 1969, Discl 22 Apr 1975, Assignee: Nomi Bosai Kogyo kk

A method is patented for suppressing fires in vehicle, railroad and other tunnels by means of a complex automatic system. The system consists of a large number of fire detectors uniformly distributed along the inside of the tunnel. The system also contains several openings of comparatively large diameter in the tunnel roof which are usually closed by automatic shutters; a pipe system with sprinkler heads distributed along the inner surface of the tunnel to extinguish fires with fire-extinguishing foam; a system of electromagnetic drive mechanisms which are triggered by the fire detectors in case of fire and which in turn actuate levers to open the shutters over the openings as well as the sprinkler system. In addition, the system also provides for ventilators next to the openings for rapid removal of smoke. The ventilators are also turned on automatically. The system operates by sections, that is, when a fire breaks out, a certain number of detectors located in the involved tunnel section are actuated. The detectors turn on only part of the system, each section of which has its own vent, ventilator and set of sprinkler heads with individual foam containers. See also Japanese patent 50-2960. 2 drawing figs, 2 refs. (RZh)

891. Biro G

IMPROVED PROCEDURE FOR PRESSURIZING FIRE-FIGHTING EQUIPMENT TANKS

French Patent No. 2,245,162; Cl A62C 13/00, Appl 25 Sept 1973, Discl 18 Apr 1975, Assignee: Biro et Fils, Dion

The patent is for a method of maintaining operating pressure in tanks for fire-extinguishing powders. The systems usually used to regulate the gas pressure are subject to frosting because of the intense cooling caused by rapid gas expansion. Considerable deviations from the prescribed pressure occur because of the delays involved in closing and opening valves. These delays in establishing operating pressure are due in part to gas entering the tank through the regulation system. Since the delivery rate depends on the pressure, such delays in the fire-extinguishing system can lead to disastrous results. To eliminate these deficiencies, it is proposed that a quantity of gas sufficient to maintain the required pressure in the entire system, except for the control system, be supplied directly to the tank. This method ensures almost instantaneous pressurization and preparation of the control system for operation before the gas has passed through it. The gas required to maintain pressure during operation of the fire-extinguishing system passes from a second source directly into the control system and through it into the tank. The control process begins directly with operating, not atmospheric, pressure, and the operating pressure differences are minimized. The system consists of the tank, a pressurized gas source connected to the tank via a valve and designed to first fill the tank with gas, a second source connected to the tank via a valve and control system to maintain operating pressure during operation of the system as a whole. The control system consists of a gas tank supply conduit with a spring-actuated valve, a membrane connected to the moving member of the valve, a gas conduit connecting the membrane cavity and the tank to apply pressure on the membrane from the tank and to provide for feedback. 1 drawing fig.

892. Anon

HERMETIC CONNECTION BETWEEN A FIRE EXTINGUISHANT CONTAINER AND A SHUT-OFF DEVICE

FRG Patent No. 2,336,502; Cl A62C 23/00, F16L 41/00, Appl 18 Jul 1973, Discl 19 Jun 1975, Assignee: R and G Schmoelle Metallwerk

The main component of the hermetic connection between a fire-extinguishant container and a shut-off device is a seal ring of complex configuration. The inner surface of the ring consists of a cylindrical portion 1/5 to 1/6 the total height of the ring, diameter approximately that of the shut-off device, and a conical portion. The cone half angle is 10 - 20°. The outer surface of the ring also consists of two portions, one adjoining the base with a slope of 10 - 20°, the other some distance from the base with a slope of 40 - 50°, corresponding to the slope of the conical surface of the container shaft. In the lower portion of the shaft below an adjacent horizontal or inclined wall segment is a ring, threaded on the shaft side, which is connected to a flange by means of an intermediate component. The flange is attached to the wall, e.g., by point welding. This coupling provides a reliable seal and holds the shut-off device screwed into it in a certain position. 8 drawing figs. (RZh)

5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

893. Schmidt VG

FIRE EXTINGUISHER*French Patent No. 2,249,525*; Cl A62C 7/00, Appl 29 Oct 1973, Discl 23 May 1975

The patent relates to a pad for the suppression of small fires in vehicles, living quarters, etc. The pad is made of a layer of flexible flameproof material (e.g., fiberglass) and a layer of readily fusible material (e.g., a polyethylene film) attached to the first layer along the edges. The space between the fabric and the film is filled with a layer of powder (e.g., bicarbonate of sodium) capable of releasing incombustible gases during thermal decomposition. To prevent leakage of the powder, the fiberglass layer is coated with a polysilicone. The fire is covered with the readily fusible film side facing the fire. The film disintegrates and the powder drops into the fire. The dense layer of fireproof fabric prevents escape of the incombustible gases generated when the powder decomposes and supply of oxygen to the combustion zone, effectively extinguishing the fire. Also provided is another version of the pad in which covers for the powder are placed on both sides of the fireproof fabric. So that the pads harmonize with the interior of the vehicle or living quarters, they are made in a decorative form, such as rugs, coasters, pillows, etc. The results of a number of tests demonstrating the efficiency of the invention are described.

894. Anon

FOAM-WATER SPRINKLER DEVICE*UK Patent No. 1,412,348*; Cl BIC, (B01F 3/04, B05B 7/04), Appl 7 Mar 1973, Discl 5 Nov 1975, Assignee: Mather and Platt, Ltd

A drencher type device is patented for use in fire-extinguishing systems to apply foam (or water) to the seat of a fire with the following characteristics. The housing of the drencher, open on both sides, consists of a number of sections of variable and constant diameter, arranged in series, to ensure optimum foam (or water) delivery characteristics and better foam-making ratios (from the viewpoint of expansion factors). The foam is formed by deflecting the flow (foam solution) to the inner walls of the drencher by means of a spherical divider fixed by two pins at the point of the expanding section of the drencher along the axis of symmetry. The diameter of the sphere is equal to the minimum diameter of the inlet to the drencher housing. Final foam formation occurs when the flow hits the deflector located in the lower portion of the drencher. In tests of this device foam with an expansion factor of 8.5 - 5.7 was obtained at a pressure of 2.1 kp/cm². Analogous tests of other drenchers of the same type yielded foam with a factor of 7.8-3.9. 8 drawing figs.

895. Grenier WJ

AUTOMATIC ON-OFF SPRINKLER HEAD*UK Patent No. 1,408,278*; Cl A5A, (A62C 37/16), Appl 6 Nov 1972, Discl 1 Oct 1975, Assignee: General Ind, Inc

The sprinkler head includes two inter-connecting chambers separated by a spring-triggered movable diaphragm. The upper chamber is equipped with a control valve actu-

ated by means of a bimetallic plate. The lower chamber contains an outlet with valve connected to the diaphragm. At normal ambient temperature, equal pressure is maintained in the chamber and the head is closed. When the ambient temperature rises above a set level, the bimetallic plate opens the control valve of the upper chamber and part of the fire-extinguishing compound in it escapes into the atmosphere. The pressure in the upper chamber drops, the movable diaphragm is displaced by the spring, uncovering the outlet in the lower chamber. The fire-extinguishing compound is applied to the seat of the fire. When the ambient temperature drops, the bimetallic plate resumes its original position and the control valve closes. Closure of the control valve reestablishes normal pressure in the chamber, the movable diaphragm returns to its original position, and the outlet of the head closes. 2 drawing figs.

896. Govarrubias GS

STOPPER FOR A HOLLOW BODY CONTAINING A FLUID UNDER PRESSURE*Swiss Patent No. 565,567*; Cl A62C 37/06, Appl 25 Aug 1973, Discl 29 Aug 1975, Assignee: CBF Systems, Inc

The design and operating principles of a shut-off valve for a container filled with a pressurized liquid are patented. The device can be used in fire extinguishers with liquid carbon dioxide, etc. The device answers the following needs: quick and easy opening by hand or automatic mechanism; a straight-line flow of liquid when opened; absence of leaks during many years of storage; and easy, unambiguous distinction between opened and closed position. 5 drawing figs.

897. Sailor G

FIRE EXTINGUISHER WITH CONTAINER FOR EXPPELLING AGENT, PENETRATOR AND VALVE*FRG Patent No. 1,559,691*; Cl A62C 13/42, A62C 23/00, Appl 20 Sept 1966, Discl 17 Jul 1975, Assignee: A Werner and Co, Spezialfabrik fuer Feuerloeschtechnik

The extinguisher contains a flask with expelling agent inside the container with fire-extinguishing agent. The flask is opened by a plunger with a pin to penetrate the membrane. The fire extinguishant is discharged through a valve with housing rigidly connected to the membrane plunger, both in the same axis. 1 drawing fig.

898. Fletcher F

TUBULAR BODIES*UK Patent No. 1,394,680*; Cl B2F, (B05b 1/00), Appl 20 Dec 1971, Discl 21 May 1975

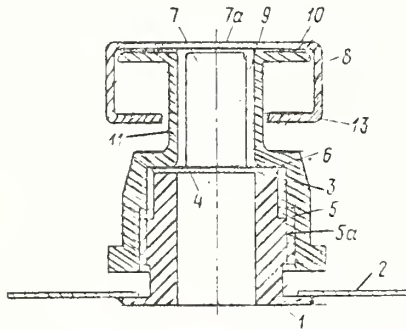
A method is proposed for production of tubular bodies working under pressure, e.g., branchpipes, hydrants, shut-off caps for fire extinguishers. The method makes it possible to reduce the metal content and the cost while preserving adequate strength. According to the method, the body is cast from a solid plastic reinforced with a metal lattice incorporated in the plastic. The reinforcing lattice is affixed to a metal ring which permits uniform distribution of shocks and facilitates manufacture. An example of production of a branchpipe by this method is given. 1 drawing fig.

5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

899. Donner H, Iben S and Beyersdorf H
TEMPERATURE-CONTROLLED TRIGGER FOR AUTOMATIC FIRE-EXTINGUISHING SYSTEMS OR DEVICES
FRG Patent No. 2,229,620; Cl A62C 37/10, Appl 19 Jun 1972, Discl 3 Jul 1975, Assignee: Minimax GmbH

A device is patented for actuating automatic fire-extinguishing systems, especially those with liquified gas as the extinguishing agent (see the drawing). The device is installed in the wall of the extinguishant container, which is provided with a metal lock 8 held in place by the fusible joint 10 and membrane 4, which is prevented from sagging by the loose heat-insulating material 7. Area 7a corresponds to a change in volume when the membrane sags, area 9 is the heat-insulating section between the fire extinguishant and the fusible joint. When the device is triggered, the membrane breaks, the fusible joint disintegrates, the material moves upward, raising the lock with overhang 13 beneath the upper edge of the housing 5. The extinguishant flows through the duct to the material, which in this case acts as a deflector. The device forms a good seal over a long period of time under high temperature conditions and prevents false triggering. (RZh)

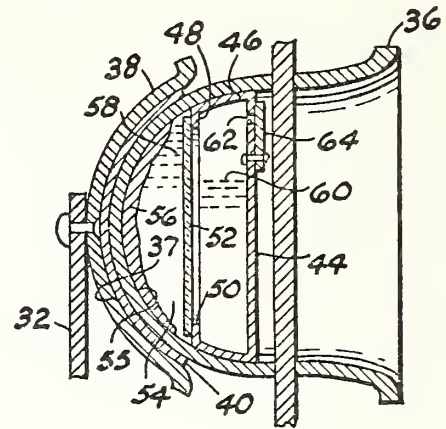


900. Rothman AJ and Semple JB
A SPRINKLER HEAD ACTUATOR
UK Patent No. 1,406,677; Cl A5A, (A62C 37/12), Appl 10 Aug 1972, Discl 17 Sept 1975, Assignee: S R Products, Inc

The patent is for the design of a mechanism to permit actuation of a sprinkler head in the early stages of fire buildup and in the case of smoldering fires. The mechanism includes an actuator and a fire detector (smoke, heat, etc.). The actuator is a steel cylinder containing a chemical capsule to ignite the heat-generating compound in the cylinder. The actuator is fixed to an ordinary sprinkler head provided with a readily fusible lock near the actuator. When a fire breaks out, the detector is triggered, transmitting a signal to the chemical capsule, which ignites the heat-generating compound. The heat from the actuator melts the lock of the sprinkler head and puts it in operation. 9 drawing figs.

901. Young RJ
EXOTHERMIC CHEMICAL REACTIVE SPRINKLER RELEASE
US Patent No. 3,937,284; Cl 169/37, (A62C 37/18), Appl 30 Sept 1974, Discl 10 Feb 1976

A thermally sensitive stored chemical energy capsule is formed in the heat collector or attached to the fusible link of existing thermally sensitive sprinkler heads for activating individual sprinkler heads by heat generated by the intermingling of the capsule-contained chemicals. 6 claims, 5 drawing figs. (Author)



902. Isavnin NV, Kurbatskiy OM and Shkvirskiy IS
POWDER FIRE EXTINGUISHER
USSR Patent No. 450,431; Cl A62C 13/50, Appl 26 Nov 1970, Discl 20 Nov 1975, Assignee: VNII protivopozhar oboronu

This powder fire extinguisher has a wide chamber base with an opening and is provided with a porous diaphragm. 1 drawing fig. (RZh)

903. Boud C G
IMPROVEMENTS IN OR RELATING TO FLUID CONTAINERS
UK Patent No. 1,399,863; Cl A5A, (C62c 13/40), Appl 20 Jul 1971, Discl 2 Jul 1975, Assignee: Graviner, Ltd

A patent is disclosed for a device for opening a vessel containing a pressurized fire-extinguishing liquid or powder by the directed explosion method. The device includes a hermetically sealed vessel containing a pressurized charge material, external means holding the explosive charge opposite the point for the discharge opening, a detonator placed near the charge, and means to hold the material for preventing spread of the explosion away from the vessel. 3 drawing figs.

904. Anon
REMOTE CONTROL DEVICE FOR A FIRE EXTINGUISHER
French Patent No. 2,240,605; Cl A62C 23/02, Appl 10 Aug 1973, Discl 7 Mar 1975, Assignee: Cie Centrale Sicli

The invention relates to a device for wall-compartment fire extinguishers. The spring-actuated valve which shuts off the discharge orifice of the extinguisher tends to force its way upward into the open position, but is restrained by a lever which presses the valve cap upward. The free end of the lever is release-coupled to a plunger. When the plunger moves downward the lever is released and

5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

the valve opens the outlet for the fire-extinguishing liquid. The plunger can be displaced by various known methods. 1 drawing fig.

905. Mohler H
SPRAY SPRINKLER HEAD

Swiss Patent No. 566,791; Cl A62C 35/34, Appl 22 Jun 1973, Discl 30 Sep 1975, Assignee: Jomos Sprinkler-Material AG

A fixed sprinkler head consisting of a nozzle and a serrated deflecting plate is patented. The water stream issuing from the nozzle impacts on the deflector plate and separates into individual vortical sprays. The teeth lining the edge of the plate convert the individual sprays into a fog which covers the protected area. 5 drawing figs.

906. Grishin VV and Kukharuk VA
DEVICE FOR MAKING MECHANICAL FOAM

USSR Patent No. 470,298; Cl A62C 5/04, Appl 15 May 1973, Discl 27 Aug 1975, Assignee: VNII protivopozhar oborony

Described is a device for making mechanical foam to be used as a fire extinguishant. The device consists of a housing containing a set of screens and a spray tip. This new device is different in that to improve mixing of the foam agent and water, a mixing chamber has an annulus with peripheral perforations tangential to the inner diameter of the annulus and opposite in direction to the perforations of the spray tip. 2 drawing figs. (RZh)

907. Ogino A
AUTOMATIC FIRE EXTINGUISHING SYSTEM FOR TUNNELS

Japanese Patent No. 50-2960; Cl 95B260.3, (A62C 37/04), Appl 27 Nov 1969, Discl 30 Jan 1975, Assignee: Nomi Bosai Kogyo kk

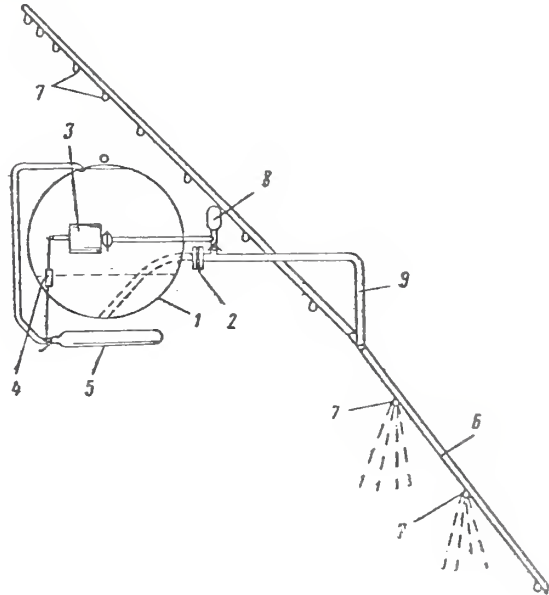
A patent is disclosed for an electrical circuit and operating principle for an automatic system of extinguishing vehicle fires in tunnels. The system consists of a set of fire detectors and foam sprinkler heads uniformly distributed along the walls and ceiling of a tunnel, and also an emergency lighting and TV monitoring system. The circuit transforms the d-c signals of the detectors into pulse sequences which control the magnetic starters of the sprinkler system. A balanced multivibrator is used to form the square-wave video control pulses. See also Japanese patent 50-10476. 2 drawing figs. (RZh)

908. Anon
AUTOMATIC FIRE PROTECTION INSTALLATION

French Patent No. 2,243,586; Cl A62C 37/30, Appl 7 Sep 1973, Discl 4 Apr 1975, Assignee: Cie Centrale Sicli

A patent is disclosed for a device which will permit the use of more effective fire-extinguishing solutions in sprinkler systems instead of water. The system (see the figure) consists of a tank 1 filled with a fire-extinguishing fluid connected via a rupturable diaphragm 2 to the pipe working section 6 equipped with sprinkler heads 7. In the monitoring state the pipe sections 6, 9 are filled with water; complete filling is ensured by a reserve in a special tank 8. When one or several heads 7 are actuated, water

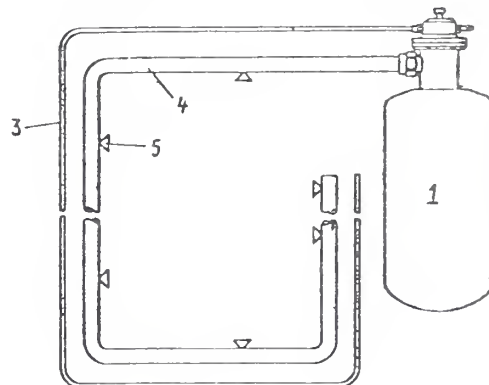
flows out from sections 6, 9; as a result, mechanism 3 becomes unbalanced and compressed-air cylinder 5 opens up. The pressurized fire-extinguishing fluid in the tank ruptures the diaphragm and is supplied to the open sprinkler heads. 2 drawing figs. (RZh)



909. Lockwood CR and Fitch DC
FIRE EXTINGUISHING APPARATUS

UK Patent No. 1,406,359; Cl A5A, (A62C 37/34), Appl 7 Feb 1973, Discl 17 Sep 1975, Assignee: Chubb Fire Security, Ltd

A patent is disclosed for a liquid fire-extinguishing system (see the drawing) consisting of a pressurized chamber 1 with fire-extinguishing liquid, a supply line 4 with spray heads 5 around the premise being protected. Mounted on the upper part of the chamber is a head (2 versions) containing a shut-off valve (membrane or piston type); a tube 3 (other end plugged) is connected to the space above the valve; the tube is filled with an inert gas under sufficient pressure to keep the shut-off valve of the chamber closed. The tube also serves as a detector; it is made of a fusible material (e.g. nylon) and is laid at points of possible fire. When a fire breaks



5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

out, the tube melts, disintegrates, the pressure in it drops to atmospheric, and the extinguishing liquid begins to flow from the chamber through the pipeline to the heads. 3 drawing figs. (RZh)

910. Anon
FIRE EXTINGUISHER CONSISTING OF AN EXTINGUISHANT TANK FILLED WITH A PRESSURIZED FIRE EXTINGUISHANT

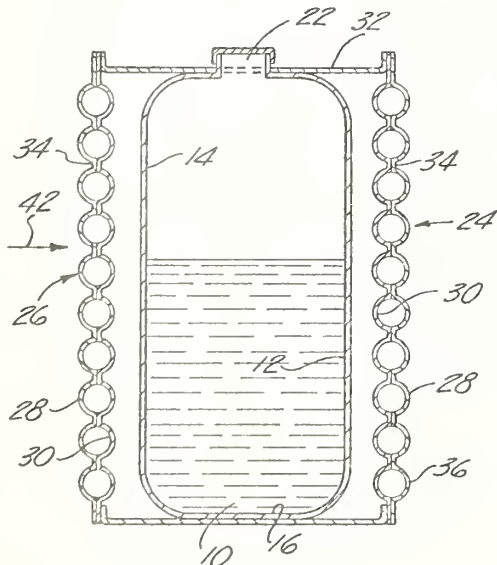
Belgian Patent No. 754,896; CI A62C 23/00, Appl 14 Aug 1970, Discl 5 Nov 1975, Assignee: A Werner and Co

This improved fire extinguisher has a pressurized extinguishant in the housing and an actuator in the head attached to the housing. In existing appliances of this type the head may detach from the housing at the moment the extinguisher is used. It is proposed that the head be made of an elastic material attached to the housing by a special collar, which increases the reliability of the coupling. 3 drawing figs.

911. Bowman DW, Doetsch RC, Lemmer FS and Zobel EC
FLAME PREVENTION SYSTEM FOR FUEL TANK FIRES

US Patent No. 3,930,541; CI 169/62, (A62C 13/40), Appl 22 Oct 1974, Discl 6 Jan 1976, Assignee: USA, Secretary of the Army

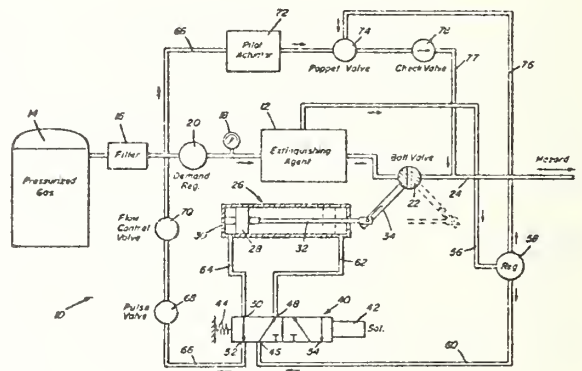
A device is needed to rapidly suppress gasoline fuel fires which are started as a result of the rupture of military vehicle fuel tanks by armor-piercing projectiles. The present invention contemplates a fuel fire suppressing device in the form of two hollow panels pressurized with a fire-suppressant substance, such as Halon 1301; the panels are located in the path that an enemy projectile would take during passage through the fuel tank. The opening formed in each panel by the projectile permits automatic discharge of the pressurized suppressant onto the fuel escaping from the tank. 2 claims, 5 drawing figs. (Author)



912. Hay GP
FIRE EXTINGUISHING SYSTEMS

US Patent No. 3,949,812; CI 169/61, (A62C 37/06), Appl 12 Nov 1974, Discl 13 Apr 1976

A fire extinguishing system includes a container of extinguishing agent and a valve for controlling the discharge of the extinguishing agent. The discharge control valve is opened and closed by a pneumatic cylinder operated by pressurized gas through a solenoid-actuated directional control valve. The solenoid of the directional control valve is coupled with a pneumatic timing relay actuated by a temperature sensor. With this arrangement, a pre-determined amount of extinguishing agent is discharged from the container and delivered to the hazard area and then the discharge shut-off. The discharge cycle is repeated, if necessary, until the fire is extinguished. The system is then automatically reset and ready to deliver further extinguishing agent on demand. The system also includes manual or automatic means for purging the delivery line downstream of the discharge control valve. 14 claims, 3 drawing figs. (Author)



913. Labes WG
EVALUATION OF FIRE PROTECTION SPRAY DEVICES: THE STATE OF THE ART. IIT Res Inst, Fire Prot and Inf Eng Dept, Chicago, IL; NBS GCR-76-72, 102 pages, 23 figs, 7 tables, 100 refs, Jun 1976
 Availability: NTIS

This report represents a descriptive review of the state-of-the-art on spray nozzle characteristics, drop-size measurement, and drop-size distribution and spray pattern analysis. A discussion of significant information gaps is also included. A list of references supporting these findings has been prepared and appears as an appendix to this report.

It is concluded that the evaluation of fire protection spray devices must be updated to include considerably more than the volume distribution of water at some standardized distance below the deflector of a sprinkler. Since both the fire environment and the spray structure are three-dimensional by nature, and, as these opposing forces

5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

occur simultaneously in real fire situations, it is desirable to understand in greater detail the application of water to fire by fire protection spray devices. (Author)

914. Nash P and Young RA
SPRINKLER SYSTEMS FOR SPECIAL RISKS. Building Res Estab (UK), Fire Res Station; BRE CP-52-76, 7 pages, 5 figs, 11 refs, Jul 1976

This article describes and discusses those risks not covered by existing rules and codes for sprinkler systems and the methods being used to protect them. The special risks are aircraft maintenance hangars, computer suites, cold storage plants, paper storage facilities, carpet warehouses, and offshore drilling platforms and terminals. The article is reprinted from *Fire Surveyor*, 1975, 4(6):23-31. (Author)

915. Young RA and Nash P
THE TESTING OF SPRINKLER INSTALLATIONS. Building Res Estab (UK), Fire Res Station; BRE CP-77-75, 9 pages, 7 figs, 3 tables, 4 refs Aug 1975

Sprinkler systems are designed to provide automatic detection and control of fire in a wide range of occupancies. They are required to operate satisfactorily at any time in their life, which for some systems already exceeds 75 years. If they are to meet this requirement, the system components must be manufactured to the highest standards. Approval tests are devised to ensure that any faults in design, materials, or workmanship are detected and rectified before the components are installed. Subsequent installation tests indicate that systems are operational and regular maintenance ensures that initial high standards were kept throughout the life of the system. This article deals with the testing of some sprinkler system components to the requirements of the Fire Offices' Committee (UK) installation tests and maintenance procedures. (Author)

916. Young RA and Corrie JG
THE PERFORMANCE OF A FOAM-SPRINKLER INSTALLATION ON SIMULATED OIL RIG FIRES. Building Res Estab (UK), Fire Res Station; BRE CP-98-75, 14 pages, 17 figs, 6 tables, Nov 1975

The experiments described in this paper were made with the object of finding the effectiveness of a foam sprinkler installation against typical oil-spillage fires which might occur in a module of a North Sea oil platform. The module for which the fire protection was being considered was one through which crude oil would flow through an array of pipes. The actual module is 45 m in length, 12 m in width, and 9 m in height, with open ends and steel-clad walls and roof. The fire extinction system within the module would be actuated by fire detectors, and the flow of crude oil through the pipes would be shut down automatically. In addition to the foam installation, fire extinguishers containing BCF and dry powder would be available.

The experiments were designed to simulate, in a reproducible way and within the facilities of the Joint Fire Research Organisation, the type of fire which would occur in an oil rig due to a leaking flange joint. This would be most likely to result in a spill fire together

with a running fuel fire from the residual oil in the pipework.

The two main objectives were:

(1) To assess the effectiveness of the foam sprinkler installation against unobstructed and running fuel fires, and

(2) to compare the performance of two different foam liquids on this type of fire. (Author)

917. Benson SP and Corrie JG
A 50 LITRE PER MINUTE STANDARD FOAM BRANCHPIPE. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1045, 29 pages, 19 figs, 2 tables, 6 refs, Jan 1976

Construction details of a 50 liter per minute foam branchpipe are given. The foam properties using protein foam liquid at various concentrations and pressures, together with properties using a range of foam liquids in common use, have been determined. A method for defining the performance of a branchpipe which could be used in specifications is also illustrated. (Author)

918. Haney JT
HILL AFB PROTOTYPE SMOKE ABATEMENT SYSTEM FOR CRASH/RESCUE TRAINING FIRES. Air Force Weapons Lab, Kirtland AF, NM; AFWL TR-74-126, 27 pages, Apr 1976
Availability: NTIS AD-A024 763/5GA

The first large-scale water spray injection smoke abatement system for open burning JP-4 fires, which was developed by the Air Force Weapons Laboratory, is described. The system was tested in the 75-foot diameter crash/rescue training fire pits at Hill AFB, Utah. Significant reduction in visible smoke emissions was achieved without major adverse impact on the realism of training. Details of design are given. The effects of various system design and operating parameters are discussed.

919. Laustsen R and Bristow R
EVALUATION OF FUEL FOG INERTING CONCEPTS (FINAL REPORT). Boeing Commercial Airplane Co, Seattle, WA; USAAMRDL TR-74-13, 48 pages, Apr 1974
Availability: NTIS AD-919 346/7GA

This report describes the theory and results of testing conducted to determine the feasibility of using condensate-formed fuel fog for inerting fuel tanks. The tests were performed in such a manner that the temperatures of the ullage space and one or two spray nozzles could be varied independently. A combination of spray temperatures and nozzle types was found that provided inerting over the complete range of ullage-space temperatures tested (+50°F to 155°F). Further findings for the 6-cubic-foot ullage space (over liquid JP-4 fuel) were that 1.0-gph nozzles were sufficient but 0.4-gph nozzles were not, neither single hot nor single cold nozzles were sufficient, and inerting would not occur for all ullage conditions except when both hot and cold nozzles were used. It was found that the hot and cold spray temperature differentials could each be at least as low as 5°F. In addition, a fuel fogging preliminary design for the AH-1G Cobra helicopter is included. (Author)

FIRE TECHNOLOGY ABSTRACTS

5. FIRE PROTECTION PRINCIPLES

h. Suppression Devices and Equipment—Continued

920. Alger RS, Laughridge FI, Wiltshire LL, McKee RG and Johnson WH
AIRCRAFT GROUND FIRE SUPPRESSION AND RESCUE SYSTEMS: CHARACTERISTICS OF KINEMATIC JET FUEL FIRES CASCADING AND ROD FUEL GEOMETRIES (FINAL REPORT). Wright-Patterson AFB, DoD Aircraft Ground Fire Suppression and Rescue Office, OH; DoD AGFSRS-76-3, 81 pages, Mar 1976
Availability: NTIS AD-A024 447/5GA

Based on a survey of kinematic fuel fires in aircraft accidents, two types, i.e., cascade and rod fuel flows, were selected for theoretical and experimental examination. The twofold objective was: (1) relate fire characteristics such as burning rate, radiation field, and flame size to the fuel parameters, the flowing conditions, and the environment, and (2) determine the parameters and their degree of control required to achieve reproducible fires suitable for testing extinguishing agents, equipment, and techniques. Theoretical models based on steady, laminar, one-dimensional flow were developed.

6. FIRE SAFETY

a. AGRICULTURE AND WILDLANDS

[For more complete coverage of the forest fire literature see *Forest Fire Control Abstracts (Canada)*.]

921. Vereskunov V
NEW FIRE SAFETY REGULATIONS FOR AGRICULTURAL ENTERPRISES
Pozhar delo; (6):18-19, 1976 (Russian)

The Ministry of Internal Affairs of the USSR has issued new standard fire safety regulations for agricultural enterprises, such as collective and state farms, demonstration, secondary and experimental farms, and others. Many of the regulations are similar to those for the same facilities in an urban environment; others are tailored to the specific agricultural needs. The new regulations are discussed in detail.

922. Butler CP
THE URBAN/WILDLAND FIRE INTERFACE, PART I
Fireline; 5-8, June 1976

The author defines the urban/wildland fire problem primarily as it applies to the canyon and hill dwellers of California suburban areas. 1 photo, 12 refs.

b. COMMERCIAL OCCUPANCIES

923. Borghini-Baldovinetti G
FIRE PROTECTION IN HIGH RACK WAREHOUSES
Antincendio protez civ; 27(10):764-765, 1975 (Italian)

The problems of sprinkler protection of high-rack warehouses are examined. Attention is drawn to the specific features of mechanized storage of materials with racks higher than 8m, which governs the special requirements on the layout of pipe networks and on the selection of technical properties of the sprinklers (melting point, sprinkler discharge rate, etc). In view of the high specific

load of combustible materials and the difficulty of suppressing fires inside the racks, the planned fire suppression time must be set higher than 2 hours. Pre-action sprinkler systems are recommended for warehouse areas where positive temperatures cannot be guaranteed in cold weather. (RZh)

924. Gripas S
INCREASING THE FIRE SAFETY OF COMMERCIAL ENTERPRISES
Pozhar delo; (3):27, 1976 (Russian)

The increase in area, height as well as display density of modern department stores and the complexity of floor space arrangement have created special fire hazards, particularly with regard to evacuation problems. The deficiencies of the existing fire safety code in this regard are pointed out, with particular attention to escape routes and evacuation.

c. ELECTRICAL

925. Vasil'ev A
FIXED SYSTEMS FOR PROTECTING CABLE ENCLOSURES USING WATER MISTS
Pozhar delo; (1):24-25, 1976 (Russian)

Fires in cable enclosures are usually extinguished with mechanical foam, chemical compounds and water sprays, but the last method is not widespread or well studied. Tests carried out by the Lvov Power Commission (USSR) and other power agencies of the USSR in accordance with a program approved by the All-Union Fire Protection Research Institute indicate that water mist extinguishment of fires in cable enclosures using fixed drencher systems is highly effective and promising. A diagram of a fixed system and the results of hydraulic and fire tests are presented. 5 figs, 1 table.

926. Bismukhametov KKh
THE QUALITY OF DESIGN OF ELECTRICAL SYSTEMS IN INDUSTRIES WITH EXPLOSION AND FIRE HAZARDS
Prom energ; (3):19-20, 1976 (Russian)

Some deficiencies in the design of electrical systems for industries with explosion and fire hazards are examined. It is concluded that a radical improvement in the quality of design must be made. 4 refs. (RZh)

927. Belau G, Thieme H and Feldt B
FIRE PROTECTION IN CABLE SYSTEMS
Unser Brandschutz; 26(3):30-31, 1976 (German)

As a result of analysis of cable fires in industrial establishments and power plants a number of effective fire protection measures have been developed and introduced recently. The subject of this article is modern fire protection and firefighting steps to be taken in the extensive cable systems of a power plant in the GDR, such as effective fire compartmentation, fire alarm systems, and fixed extinguishing systems (water spray devices) in the walk-in cable passages, and laying cables in sand beds as an economically preferable measure compared to laying cables on trays. 7 figs. (Fachdok 12/0871)

6. FIRE SAFETY

c. Electrical—Continued

928. Kaufman S and Landreth CA
DEVELOPMENT OF IMPROVED FLAME RESISTANT INTERIOR WIRING CABLES

International Wire and Cable Symp, 24th, Proc; 1975, Nov 18-20, Cherry Hill, NJ, pages 9-14

Sponsor: US Army Electron Command, Ft Monmouth, NJ

Availability: NTIS AD-A017 787/3GA

A PVC flexible jacket compound with an oxygen index of 32% has been developed without sacrificing good low temperature brittleness properties. The high oxygen index was achieved by minimizing the plasticizer level and substituting fine particle size hydrated alumina as a filter/flame-retardant for the inert filler, calcium carbonate. 1 ref. (Author)

929. Matsubara H, Matsunaga C, Inoue A and Yasuda N

DEVELOPMENT OF NEW FIREPROOF WIRE AND CABLE

International Wire and Cable Symp, 24th, Proc; 1975, Nov 18-20, Cherry Hill, NJ, pages 15-25

Availability: NTIS AD-A017 787/3GA

Sponsor: U. S. Army Electron Command, Fort Monmouth, NJ

Design data for low-voltage fireproof cables as well as high-voltage cables are given. The heat resistance layer is made of asbestos fibers. Test data with various temperatures and exposure times are also given. 9 refs. (Author)

d. INDUSTRIAL OCCUPANCIES

930. Anon

PLANT MANAGEMENT AND FIRE SAFETY

Face au Risque; (119):25-36, 1976 (French)

A round-table discussion was held on the topic "management, its tasks with respect to fire risks, inspection, investigation, checking" and another discussion on the topic "maintaining fire safety when structural changes are made." Discussed in particular were: new places of employment, maintenance of infrastructure and production means, transportation, construction problems, personnel problems, fire-protection foresight, fire prevention and insurance problems. The topics under discussion are summarized. (Fachdok 12/0706)

931. Anderson J

NORTH SEA OIL PROJECT BRINGS ON-SHORE NEED FOR FIRE PROTECTION

Fire Internat; 5(53):87-92, 1976 (English, French, German; Spanish summary)

This article is the same as that published by the same author in *Fire*, Vol 69, No. 855, pp. 189-190, 1976. (Consult the source index for the appropriate abstract). 1 photo.

932. Anon

FIRE TRAINING CENTRE PROJECT FOR THE OFFSHORE OIL INDUSTRY

Fire Internat; 5(53):53-56, 1976 (English, French, German; Spanish summary)

In view of the expansion of underwater oil exploration and exploitation, proposals are being formulated to build a fire training center, primarily for the offshore oil industry, on a 16-acre site in Montrose, Scotland. It is anticipated that about 1000 trainees a year will take a basic four-day elementary fire training course, with a lesser number of supervisory personnel attending for additional, more advanced training. The facilities, training methods, and aids are described. The scheme is sponsored by the major oil companies operating in United Kingdom centers. 1 fig.

933. Anderson J

THE FORTIES OIL FIELD AND ITS ASSOCIATED PROJECTS

Fire; 69(855):189-190, 1976

The provision of fire protection facilities for the offshore and onshore oil extraction and production installations of the BP Forties Field (UK), which lies 105 miles off the Scottish coast in the North Sea, is described. The entire complex consists of four platforms, a 170-km submarine pipeline, a 210-km buried landpipe, a refinery, and a loading terminal on the Firth of Forth. 1 photo.

934. Anon

HOW THE BBC ORGANIZES FIRE PREVENTION

Fire Prev; (115):13-16, 1976 (English; French and German summaries)

Live broadcasting in the presence of studio audiences and the use of highly technical equipment are two of the complications faced by the BBC fire prevention team, including more than 90 full-time firemen. A combination of thorough planning, well-trained staff and clearly-defined procedures helps overcome such problems in the radio and TV studios. 7 photos. (Author)

935. Anon

FIGHTING FIRE WITH FOAM

Ind Eng; 8(6):44-45, 1976

To protect its huge truck assembly plant from fire, the Ford Motor Company employs a three-pronged system of automatic detection and extinguishing systems, portable extinguishing equipment, and a well-organized round-the-clock fire brigade. The basic design of the plant included fire walls, fire doors, sprinkler systems with fusible plugs, water tanks, special foaming paints for shelving, and other installations. 2 photos. (Author)

936. Mosbacher CJ

FIRE - CAN YOU PUT IT OUT?

R/D; 27(10):18-21, 1976

This article presents some basic information on fire-extinguishing apparatus and standards it must meet, tells where to get more information, and describes one extinguishing agent (Halon 1301) to illustrate how detailed analysis is needed in choosing a fire protection system. 13 photos.

937. Zuber K

LNG FACILITIES - ENGINEERED FIRE PROTECTION SYSTEMS

Fire Technol; 12(1):41-48, 1976

6. FIRE SAFETY

d. Industrial Occupancies—Continued

In various types of LNG processing, storage, and transfer facilities, consideration must be given to vapor dispersion control, fire control, exposure control, and extinguishment. Tests conducted with LNG spill fires indicate that high-expansion foam facilitates vapor dispersal by warming the vapors, making them more buoyant. High-expansion foam was shown to be more efficient than water curtains and water spray in reducing radiant heat flux reaching exposures. Dry chemicals were most effective in extinguishing test fires following the application of a controlling layer of high expansion foam. A foam expansion ratio of 500:1 seemed to be the most satisfactory. In designing automatic fixed dry chemical systems, care must be taken to prevent disturbing the surface of the LNG, which can result in increased burning rate. Manual application requires well-trained personnel and the proper deployment of equipment of suitable capacity to cope with the hazard. 4 figs. (Author)

938. Huber E

IN-PLANT FIRE PROTECTION*Sichere Arb*; 29(2):12-13, 1976 (German)

The steps required for fire prevention (with emphasis on organizational steps) and for fire protection (fire detection points, alarm system, internal traffic control service, supply of water and extinguishants, training exercises) are discussed in accordance with the aims of in-plant fire protection. The final section reports on how fire protection is organized in plants with and without fire brigades. The article is an abbreviated version of a paper presented at the 63rd Conference of the Safety-Engineering Working Committee in Salzburg (Austria). (Fachdok 12/0836)

e. INSTITUTIONAL OCCUPANCIES

f. MINING

[For more complete coverage of the mining literature see **SMRE Safety in Mines Abstracts (UK)**.]

939. Kocherga NG

THE POSSIBILITY OF USING MECHANICAL FOAM TO PREVENT FRICTION-SPARK IGNITION OF METHANE WHILE OPERATING MINING MACHINES*Bezop ekspluat elektromekh oborud v shakhtakh*; (7):35-38, 1975 (Russian)

Methods and the results of research into the possibility of using foam to prevent the ignition of methane by friction sparks generated by the teeth of mining machines as they rub against solid ores are presented. It is shown that foam based on a 6% methane-air mixture can explode and ignite owing to friction sparking. Because of the low fluidity and lightness of foam, it is difficult to provide for continuous delivery to the zone of contact between the teeth and the mass of ore. Consequently, it is difficult to rule out or appreciably reduce the possibility of methane ignition by friction sparks in a contact zone. (RZh)

940. Kolosyuk VP

THE ROLE OF PROTECTION AGAINST GROUND CURRENT LEAKAGE IN REDUCING THE HAZARD OF ELECTRICAL SHOCK AND FIRE IN MINES*Bezop ekspluat elektromekh oborud v shakhtakh*; (7):67-72, 1975 (Russian)

Formulas are given for determining the reduction in probability of injury by electrical current and fire while using a system for protection against ground current leakage. It is shown that introduction of the existing apparatus for leakage protection has made it possible to reduce this hazard by a factor of 4.5. The probability of injury and fire can be further reduced by increasing the reliability, using self-supervisory circuits and providing for standby protective ground current leakage equipment. (RZh) 1 fig, 2 refs.

941. Anon

FIGHTING GAS, SUDDEN BLOWOUTS AND FIRES IN COAL MINES*Tr Vost Nil po bezop rabot v gorn prom-sti*; (24):239, 1975 (Russian)

Problems involved in predicting sudden blowouts of coal and gas from the nature of the gas emitted from drillholes, in evaluating the effectiveness of methods of fighting blowouts and the mechanism of unleashing gasdynamic phenomena in thick seams during preliminary mining work are examined. The results of studies aimed at evaluating methods of measuring gas pressure and the degree of degassing of seams with blowout hazards, and the development of a new method of preventing blowouts when opening seams based on the mechanical-hydraulic effect are presented. Also discussed are the results of improving ways and means of predicting endogenic fires and of monitoring the temperature and gas composition in the worked-out space of prevention and fire sections. (RZh)

942. Reid GR, Stockwell DL and Plog RJ

DEVELOPMENT OF AN AUTOMATIC FIRE PROTECTION SYSTEM FOR MOBILE UNDERGROUND METAL MINING EQUIPMENT.

Ansul Co, Marinette, WI; BuMines OFR-81-76, 153 pages, Dec 1975

Availability: NTIS PB-254 851/9GA

The contract objective is the development of an Automatic Fire Control System for Mobile Underground Metal Mining Equipment. The Phase I Report, which described the project data handling plan, was published on July 24, 1975. The Phase II effort covered the period from July 24 through December 2 and accomplished the following objectives: Acquisition of data in accordance with the project data handling plan; Analysis of accumulated data; and, Development of the AFCS design concept. By using the data analysis results and considering the state-of-the-art of fire control system components, a recommended design concept was developed with particular emphasis placed on the need for a low cost and reliable system. Design trade-off studies are provided for the recommended system and for four alternate system concepts.

6. FIRE SAFETY

g. POWER PLANTS

943. Belous A and Zabelin N
PROTECTION OF POWER PLANTS
Pozhar delo; (2):26, 1976 (Russian)

To ensure the safety of power plants, a number of measures have been taken by the Power Ministry of the USSR. Automatic fire protection systems have been installed in installations and machine assemblies with the greatest fire hazard. Studies have been made on the use of mobile units to extinguish fires in charged electrical assemblies. On the basis of these studies, a set of fire-fighting instructions for electrical installations in power plants has been issued. The provisions of this set of instructions are described.

944. Anon
NUCLEAR SAFETY CHARACTERIZATION OF SODIUM FIRES AND FAST REACTION FISSION PRODUCTS. QUARTERLY TECHNICAL PROGRESS REPORT, JULY-SEPTEMBER 1975. Atomic Internat Div, Canoga Park, CA; AI ERDA-13161, 24 pages, Nov 1975
 Availability: NTIS

Progress is reported in the areas of sodium jet dispersal tests, SOMIX code development, aerosol leakage, fuel and fission product release from burning sodium, and properties of high-temperature fuel mixtures.

h. PUBLIC BUILDINGS

945. Yamada Y
FIRE SAFETY SYSTEM
Ohm: denki zasshi; 62(13):57-61, 1975 (Japanese)

The technical description is given of a fire safety system implemented in an individual project in a public building in Tokyo. The system is automatic and consists of foam extinguishing devices, fire detectors and a sprinkler network. A special feature of the system is the incorporation of special induction microphone sensors located in enclosures, corridors and stairwells for the purpose of controlling flows of people in the building. This is necessary to prevent panic and associated negative phenomena in case of fire, alarms, etc. Statistical data illustrating the high number of injuries and fatalities during fires as a result of panic and the absence of proper coordination in the evacuation of people are cited as backup for the development and introduction of such systems. The operation and design principles of the control panel of such systems are given. 6 figs, 1 table. (RZh)

i. RESIDENTIAL OCCUPANCIES

946. Harper K
A THREE-POINT PLAN FOR HOME FIRE SAFETY
Fire; 69(854):119-122, 1976

The author, recipient of a Winston Churchill Traveling Fellowship, traveled around America and Canada for two-and-a-half months to study ways to reduce deaths and accidents caused by fires in homes. On the basis of his experience, the author discusses the three points he proposes as a program of public fire safety: (1) child education in schools; (2) dwelling inspections; and (3) use

of the media for direct education of the public, especially television. 3 figs.

j. TRANSPORTATION (Air, Rail, Road, Water)

947. Seray J
FIRE PREVENTION AND PROTECTION ON BOARD SHIPS UNDER CONSTRUCTION AND REPAIR
Nav, ports, chant; (302):489-494, 1975 (French)

A member of the Marine Fire Battalion of Marseille points out the special features of ship fire hazards, which are different from the fire hazard factors of land installations. A brief description is given of the structural characteristics of ships and of the cargoes they carry; potential fire sources are discussed. Fire prevention measures and fire-fighting means are examined. The regulations which must be adhered to in oil tankers and ships transporting liquified gas are listed. The text of a regulation dated July 18, 1958, on the precautionary measures to be observed on ships containing these cargoes is given as an appendix. 6 figs. (RZh)

948. Watters P
FIRE PREVENTION IN SHIPS UNDER CONSTRUCTION AND REPAIR
Fire Internat; 5(52):23-27, 1976 (English, French, German; Spanish summary)

Steps to be taken to prevent fires in ships under repair and construction are enumerated and discussed. Of particular importance is liaison with local fire brigades to ensure that vital services and access to all compartments are maintained. 2 photos.

949. Watanabe H
STEPS TO PREVENT TRAIN FIRES AND TRAINING OF SERVICE PERSONNEL
Diteru; (274):36-43, 1975 (Japanese)

An analysis is made of the organizational and technical measures developed and implemented after a major train fire in the Hokushiku railway tunnel, which occurred in 1972, resulting in 30 fatalities and varying degrees of injury to 714 passengers. The technical aspects of these measures were aimed at eliminating defects in the design of sleeping cars (from the fire-safety viewpoint), as well as at improving and increasing the effectiveness of automatic and manual suppression devices. The organizational aspects relate to fire training of train personnel. The regulations and the content of theoretical and practical training exercises, instruction methods, examinations and different kinds of tests are described. Potential variants and situations connected with the outbreak of fire in trains are illustrated and discussed, as are appropriate optimal methods of extinguishing such fires, evacuating and rescuing passengers (including rendering various kinds of assistance). 2 figs. (RZh)

950. Kourtides DA, Parker JA, Hilado CJ, Anderson RA, Tustin E, Arnold DB, Gaame JG, Binding AT and Mikeska JL
FIRE SAFETY EVALUATION OF AIRCRAFT LAVATORY AND CARGO COMPARTMENTS
J Fire Flammability; 7(1):125-159, 1976

6. FIRE SAFETY

j. Transportation (Air, Rail, Road, Water)—Continued

A program of experimental fires has been carried out to evaluate containment of fire in aircraft interior spaces such as lavatories and cargo compartments of wide-body jet aircraft. The objective of the program was to assess fire containment and other fire hazards by evaluation of ignition time, burn-through time, fire spread rate, smoke density, evolution of selected combustible and toxic gases, heat flux, and detector response. This information was intended to establish baseline data upon which improvements in fire safety for aircraft interiors could be designed. Two tests were conducted: one involving a standard Boeing 747 lavatory and one involving a simulated DC-10 cargo compartment. Results are examined. 30 figs, 6 tables, 10 refs. (Author)

951. Hiroshige I

THE RESULTS OF THE WORK OF THE TECHNICAL COMMISSION ON FIGHTING FIRES IN RAILROAD TRANSPORTATION*Sharyo to denki*; 26(7):30-32, 1975 (Japanese)

A further analysis is made of the causes, circumstances of break-out, nature and consequences of fires in trains on the basis of the results of an examination of fires occurring in Japan in 1973-1974 and of the results of fire tests of trains that have been carried out almost continuously in Japan in the last three years. Some features of the design of NAHA-20 sleeper cars that may influence the probability of fire ignition and the possibility of fire suppression in these cars are discussed. In the design of the cars, an essentially new method of rapid smoke removal during fires has been implemented, as has flame suppression by knocking it down with a powerful jet of air. For this purpose the upper end portion of the cars has been provided with air intakes of large inlet area (0.2m²) and air ducts of approximately the same cross-sectional area (0.15m²), giving the air supply system a high throughput. NAHA-20 sleepers are designed for high-speed express trains with a normal running speed of 120-190 km/hr. When the air intake is opened (in case of fire) at such speeds, therefore, an aerodynamic shock of comparatively high intensity arises in the corridor, sufficient to knock down the flame and remove the smoke almost instantaneously. In this case the air passes only through the corridor. When this system is used, rigid requirements are imposed on the closed radio-telephone emergency warning system, because it must be used to inform and prepare the passengers for the aerodynamic shock. An appreciable deficiency is that if the train speed is inadequate, the amplitude of the air wave will not be great enough to extinguish the flame. In fact, the reverse effect occurs and the fire will be intensified as a result of the powerful addition of air. Fire tests of NAHA-20 cars carried out in June-August 1974 and also in April-June 1975 showed that this system will be highly effective and reliable only at speeds greater than 160 km/hr, and not 120 km/hr, as assumed in the system design stage. Normally the air intake cone is closed with a streamlined plastic cowl. In case of fire the cowl is stripped off by means of a simple mechanical device with control lever in the car vestibule. Additional fire tests of these cars are planned for 1975-1976 for the purpose of determining some aspects of a strategic nature, in particular, must the train engineer increase the speed to criti-

cal (160 km/hr) when a fire breaks out, assuming it is less than that, or stop the train and resort to ordinary extinguishing methods. Also to be tested are various versions of system design, in particular with a greater air-intake area and greater throughput. If a positive solution to these and several other perplexing problems is obtained from the test results, recommendations will be made for widespread introduction of this method in various types of high-speed trains. 2 tables. (RZh)

952. Anderson RA, Price JO, McClure AH and Tustin EA

EVALUATION OF MATERIALS AND CONCEPTS FOR AIRCRAFT FIRE PROTECTION. Boeing Commercial Airplane Co, Seattle, WA; NASA CR-137838, D6-42614, 38 pages, Apr 1976

Availability: NTIS N76-22330/4GA

Woven fiberglass fluted-core aircraft interior panels were flame tested and structurally evaluated against the Boeing 747 present baseline interior panels. The NASA-defined panels, though inferior on a strength-to-weight basis, showed better structural integrity after flame testing due to the woven fiberglass structure. (Author)

953. Arnold DB, Burnside JV and Hajari JV

DEVELOPMENT OF LIGHTWEIGHT FIRE RETARDANT, LOW-SMOKE, HIGH-STRENGTH, THERMALLY STABLE AIRCRAFT FLOOR PANELING (FINAL REPORT). Boeing Commercial Airplane Co, Seattle, WA; NASA CR-147750, 74 pages, Apr 1976

Availability: NTIS N76-24365/8GA

Fire-resistance mechanical-property tests were conducted on sandwich configurations composed of resin-fiberglass laminates bonded with adhesives to Nomex honeycomb core. The test results were compared to proposed and current requirements for aircraft floor panel applications to demonstrate that the fire safety of the airplane could be improved without sacrificing mechanical performance of the aircraft floor panels. (Author)

7. FIRE SERVICE ORGANIZATION AND FACILITIES**a. ADMINISTRATION, ORGANIZATION AND MANAGEMENT**

954. Bahme CW

FIRE SERVICE AND THE LAW

Nat Fire Prot Assoc, Boston, MA; 270 pages, 1976

This recently published book is a practical, comprehensive, up-to-date legal guide for members of the fire service, city attorneys, and other legal advisers. It is a successor to the *Fireman's Law Book* (1967), with reference to recent court rulings on legal questions applicable to firefighters and fire departments, plus helpful guidance in applying these principles. Modern judicial and administrative thinking on legal matters affecting the fire service with new information on volunteer fire-fighting organizations and fire protection districts is reviewed. The chapters include "Liabilities of a Fire Fighter", "Salary and Compensation", "Duty Owed by Public to Members of

FIRE TECHNOLOGY ABSTRACTS

7. FIRE SERVICE ORGANIZATION AND FACILITIES

a. Administration, Organization, and Management—Continued

Fire Departments", plus introductory chapters on "The Judicial System" and "Organization of Fire Departments". The book can be used as a classroom text and as a personal reference.

955. Savkov E
TANKER PLUS PUMPER
Pozhar delo; (6):24-25, 1976 (Russian)

In many of the fire-fighting districts in the USSR a 1:20 imbalance in the ratio of pumpers to tankers has developed. Supporters of this proportion of firefighting equipment have advanced many arguments to defend this view, the principal one being deficient water supply systems. The author cites statistics to support his view that the ratio should be changed to one tanker and one pumper. 1 fig, 1 table.

956. Crawley HH
MASTER PLANNING PAYS OFF
Fire Chief; 20(7):29-30, 1976

A master plan begun five years ago in Tukwila, Washington, is producing results. Better relations with city fathers, a 90% sprinkler coverage in the city, and reduced fire losses are some of the advantages.

957. Adams GH
MUNICIPAL FIRE DEPARTMENTS (A BIBLIOGRAPHY WITH ABSTRACTS). Nat Tech Inf Service, Springfield, VA; NTIS PS-76/0575/1GA, 179 pages, Jul 1976
Availability: NTIS

Materials are presented on civil fire companies involving stations, equipment, planning, methods, and personnel. The discussions cover operations; the selection and testing and training of firemen; pumps, ladders, hydrants, hoses, extinguishers, techniques, and vehicles; mathematical models and computerized technology; fire research on buildings, materials, and combustion; and toxic combustion products. Also reported are integrated municipal information systems, community facilities, regional planning, emergency services, protective clothing, fire rescue, and projects in specific urban localities. Reference is made to civil defense, but in general fire-fighting operations relating to ships, mines, aviation, and forests are excluded. (Contains 174 abstracts.)

b. EDUCATION AND TRAINING

958. Granito AR
FIRE SERVICE INSTRUCTOR'S GUIDEBOOK
Nat Fire Prot Assoc, Boston, MA; 60 pages, 1976

This new tracking aid for fire service instructors and training officers gives, in question-answer format, general guidelines for an organized approach to course planning and teaching in the fire service. The chapters cover "Criteria of a Good Instructor", "Instructor Techniques", "The Trainee as a Member of the Fire Service...and as a Student", "Lesson Planning and Presentation", "Teaching and Training Aids", with tips on visual aids, and "Student Evaluation". The book represents a helpful time-saving aid for instructors.

959. Sima M, Saito M and Adati Y
DEVELOPMENT OF ELECTROSTATIC SMOKE REMOVAL SYSTEM (FOR BREATHING APPARATUS TRAINING TENT). PART 5
Rep Fire Sci Lab (Japan); (12):55-58, 1975 (Japanese)

A detailed description is given of several design versions of test smoke chambers to be used for testing gas masks, oxygen masks, and other protective devices used in fires in a smoke environment. The smoke chambers are comparatively small enclosures equipped with various smoke sources as well as control, measurement, and other devices required for testing. The test subject dons the test apparatus for breathing and then enters the smoke chambers where the required smoke charge is produced. During as well as after the tests, check measurements are made of the parameters of the smoke environment and of the medical and physiological parameters-of-state of the test subject. Various smoke chamber models were developed, including inflatable rubberized smoke chambers of different configurations. The principal difference between this series of smoke chambers and the preceding ones was the inclusion of an electrostatic generator set designed for rapid smoke removal at the end of the experiment. The electrostatic devices were powerful transformers of a-c voltage of 100V/50Hz industrial frequency into an electrostatic potential of negative polarity with a maximum amplitude of 11 kV. As is well known, smoke consists of soot and vapor particles which are, in turn, positively charged particles, cations, capable of being attracted to a cathode having a sufficiently high negative potential. Used as the electrode was the working element of a generator which, depending on the configuration of the smoke chambers, was of varying shape in the cases under consideration (in the form of a cylindrical rod, an integral mesh with rectangular cells, or a multitooth comb). At the end of the experiment, the smoke removal device is disconnected and the smoke environment in the chamber is suppressed by forced precipitation in the electrode, making it unnecessary to use ventilation systems and a cumbersome smoke removal duct. In addition, the sanitary conditions of experimentation are measurably improved. It is noted that these devices can also be used not only for the complete removal of smoke at the end of an experiment, but also to control (gradually decrease) the smoke level during the experiment by appropriately controlling the magnitude of the negative electrostatic potential on the electrode. Given are graphic data illustrating the results of testing these devices in the form of rate-of-smoke-removal as a function of magnitude of the potential on the electrode for various smoke chamber and electrode designs. Also examined, in addition to inflatable smoke chambers, are prefabricated rigid-shell chambers mounted on four-wheel rectangular chassis, making the chambers mobile. 10 figs. (RZh)

960. Lamb RTB
A SYSTEMS APPROACH TO EXAMINATIONS
Fire; 69(854):124-125, 1976

A systems analysis of the written examinations for promotions in the UK fire service indicates that greater emphasis has been placed on knowledge acquired by the association of symbols and objects and inadequate emphasis on knowledge associated with the ability to perform tasks. A model relating learning categories to some

FIRE TECHNOLOGY ABSTRACTS

7. FIRE SERVICE ORGANIZATION AND FACILITIES

b. Education and Training—Continued

methods of testing is constructed to match course contents, levels of attainment and categories of test methods to achieve the mix necessary to reach course objectives. 3 figs, 5 refs.

961. Gawiser SR
DEVELOPING A TRAINING CURRICULUM FOR THE FIRE SERVICE
Fire Chief; 20(9):39-40, 1976

The author discusses the problems of organizing the training program in large and small fire departments and suggests some possible solutions.

962. Ball TE
CONCRETE 'SHIP' USED FOR TRAINING
Fire Internat; 5(52):46-48, 1976 (English, French, German; Spanish summary)

A concrete "ship" is used by Britain's Fire Service Technical College at Moreton-in-Marsh for training in marine firefighting. Fires involving the aft peak, cabins, machinery, lower hold, tween decks and accommodations, as well as off-shore problems, can be introduced. The training facility and the fixed installations of the different ship sections, as well as the electronic equipment, are described and the facility is illustrated by a sketch. 1 fig, 1 photo.

963. Anon
TRAINING CENTER SPECIALIZES IN INDUSTRIAL BRIGADES
Fire Command; 43(7):27, 1976

The Celanese Fire Training Center, located at Rock Hill, SC, and administered by the York Technical College of Rock Hill, operates a year-round series of two-day advanced fire technology seminars with accommodations for 100 students per class. Since its inception in Oct, 1974, more than 1,000 emergency fire brigade and rescue members representing 20 industrial firms have used the training facilities. 1 photo.

964. Kraemer K
FIRE SERVICE REGULATION 2/1: TRAINING OF VOLUNTARY FIRE DEPARTMENTS - MINIMUM REGULATIONS. IMPLEMENTATION OF FIRE SERVICE REGULATION FwDV 2/1 IN THE FEDERAL STATE OF HESSEN
Brandschutz; 30(8):196-201, 1976 (German)

The new fire service regulation FwDV 2/1 regulates the peacetime training of voluntary fire departments and fire brigades and contains some innovations and modifications which are examined in this article. Information is given on training for positions in units, for leadership cadres and for special positions, where training is carried out, and how long the training lasts for the various positions. The problems faced by the fire service schools due to introduction of the FwDV 2/1 regulation and the possibilities for implementation in the State of Hessen are discussed. 5 tables. (Fachdok 12/0980)

965. Alger RS, Martin SB and Lipska AE
ENVIRONMENTALLY COMPATIBLE AIRCRAFT CRASH AND RESCUE TRAINING FACILITIES (FINAL

REPORT). Stanford Res Inst; NSWC WOL TR-75-205, 56 pages, Oct 1975

With the increasing sophistication of aircraft has come a corresponding increase in payload of weapons, fuel and cargo, which is reflected in a potential increase in accidents and fires. This report is concerned with development of training facilities and techniques to enhance the capability of firemen in coping with their fires, while still maintaining a reasonable level of environmental impact. Training objectives are reviewed and evaluation criteria are discussed. Location and operation of training facilities are analyzed from a cost-effectiveness viewpoint. Three levels of training facility are described that fulfill training requirements on a local, regional or national basis. It is concluded that the essential facilities can be realized within the environmental constraints, but additional cost-benefit analysis is recommended.

c. FACILITIES

966. Ewing DG
A PROFESSIONAL APPROACH TO FIRE STATION DESIGN
Fire Chief; 20(9):36-38, 1976

A professional architect offers suggestions on planning and construction of a fire station. He describes the architect's role, the client's role, and gives step-by-step procedures for effective planning. The subject of fees and additional services, e.g., site selection, is also given some attention. (Author)

967. Messer R
MODERN DRYING SYSTEM FOR FIRE HOSES
Schweiz Feuerwehr Z; 102(8):291,293,295,297-299, 1976 (German)

The first part of the report deals with a comparative analysis of the economy of horizontal hose maintenance systems and drying towers. The comparisons relate to civil defense hoses and fully synthetic hoses. The construction and installation costs are lower for horizontal systems, but the time expended in checking, washing, drying, dusting and winding in horizontal systems is greater than the corresponding costs for tower installations. In the second part a system which has been installed in the civil defense training center in Mythen/Schwyz is described. 8 figs. (Fachdok 12/0982)

968. Eremin V
NEW FIRE STATION DESIGNS
Pozhar delo; (3):29, 1976 (Russian)

Two new fire station designs are illustrated and described. The first is for light apparatus with living quarters and is designed for temperature zones with temperatures down to 140°C, except for permafrost, earthquake and mining zones. The second is for twelve apparatus with duty rooms for the same climatic conditions. All construction is with standard prefab parts. 2 figs

d. GENERAL EQUIPMENT

969. Loeb DL
LARGE DIAMETER HOSE
Fire Chief; 20(9):29-32, 1976

FIRE TECHNOLOGY ABSTRACTS

7. FIRE SERVICE ORGANIZATION AND FACILITIES

d. General Equipment—Continued

The author surveys the use of large-diameter hose in fire departments throughout the US. His five-part, in-depth report will cover the history, various size and material options, flows and friction loss, and procedures fire departments have developed for its use. In this first part the author covers the history and development of large-diameter hose. 5 photos. (Author)

970. Anon
FIRE BOAT

Fune no kagaku; 28(9):17, 1975

An information sheet containing the tactical and technical parameters of the fire boat *Kiyotaki*, which was constructed in 1974 by the Keykin Etto Co, is given. The dimensions of the boat are: 27.5m length, 10.4m width, height above waterline 2.1m, and displacement 235 tons. The boat is equipped with 8 fixed foam nozzles as well as 20 sets of hose with different connections and extensions and is designed for the extinguishment of shoreline fires. (RZh)

971. Ito Y
TESTS OF FIRE APPARATUS USING NEW FIRE-EXTINGUISHING EQUIPMENT
Kasai; 25(4):227-233, 1975 (Japanese)

The tactical characteristics and specifications of several new firefighting vehicles, each of which is especially designed to extinguish fires in specific installations, are given. The design and operation of these vehicles are described, as are the results of operational tests. Examined in particular are apparatus designed to extinguish fires in oil tanks, multi-story buildings, etc. Of greatest interest is a firefighting vehicle designed to extinguish fires in various live electrotechnical objects. It is pointed out that the suppression of fires in high-voltage objects represents a considerable obstacle to the use of conventional firefighting means, in that a stream of fire-extinguishing solution applied to such an object will become a conductor when it hits the current-carrying portions, resulting in possible electrical injury to the firefighting personnel. The problem is complicated by the fact that for various reasons the high-voltage energy cannot be cut off in some cases, or cutting it off may be undesirable. This apparatus is equipped with a foam-nozzle turret, in which the foam charge is in a cylindrical, hermetically sealed capsule under excess pressure. The length of the capsule is 1,000 mm, diameter is 150 mm. Discharge is accomplished by means of a simple electromechanical capsule device, which has sufficient power to impart an initial velocity of 46 m/sec to the capsule. The height reached by the capsule is 60 m. When the nose section of the capsule strikes a rigid surface, a directed charge of high-expansion foam is applied. For highly efficient suppression, even on vertical surfaces, the foam contains a binder so that the foam will adhere to the surface. The results of testing an apparatus equipped with this nozzle indicate that it is highly effective for extinguishing fires in high-voltage objects. 13 figs, 8 tables.

972. Freutel H
THE AERIAL LADDER: A SYMBOL FOR ASSISTANCE AND RESCUE
ZS Magazin; (4):30-35, 1976 (German)

A comprehensive article is devoted to the aerial ladder, which, in its modern form, is a universal tool for assistance and rescue. Since the initial development by C. D. Magirus, the founder of the company of the same name, this ladder has always been improved in cooperation with the fire service and in accordance with the basic requirements of fireground tactics. The present-day version of the ladder with its special fittings, which expand the range of application, is described and illustrated. 12 figs. (Fachdok 12/0619)

973. Anon
DECISION RELATED RESEARCH ON EQUIPMENT TECHNOLOGY UTILIZED BY LOCAL GOVERNMENT: FIRE SUPPRESSION. VOLUME I - EXECUTIVE SUMMARY. Mission Res Corp, Santa Barbara, CA; MRC R-7511-1-1175-Vol-1, NSF RA/S-75-076, 51 pages, Nov 1975
Availability: NTIS PB-252 389/2GA

This summary outlines the work accomplished during Phase I of a two-phase project intended to produce a procedural User's Manual to aid in the specification and procurement of mobile fire-suppression apparatus (pumpers) systems. Phase I was research-oriented and focused on an analysis of mobile fire-suppression systems and the definition of additional work required to develop the Manual. Phase II will address a series of experimental tasks and, finally, the development of the User's Manual. (Author)

974. Anon
DECISION RELATED RESEARCH ON EQUIPMENT TECHNOLOGY UTILIZED BY LOCAL GOVERNMENT: FIRE SUPPRESSION. VOLUME III. APPENDICES A THROUGH I. Mission Res Corp, Santa Barbara, CA; MRC R-7511-1-1175-Vol-3, NSF RA/S-75-076B, 320 pages, Nov 1975
Availability: NTIS PB-252 390/0GA

An analysis of mobile fire suppression systems is presented for the purposes of developing a User's Manual designed to aid in the specification and procurement of mobile fire suppression apparatus systems. Volume III compiles the supporting information contained in 9 Appendices of the research report. (Author)

e. INFORMATION SYSTEMS

975. Sims J
DATA RETRIEVAL MOBILIZING
Fire; 69(855):177-179, 1976

Amalgamation in April 1974 led to the centralized mobilizing of four brigade areas, with the consequential need to find an efficient filing system for the enormous number of attendance cards. This prompted the East Sussex Fire Brigade (UK) to carry out investigations into modern data retrieval systems to find a solution. Experiments with the microfiche system, marketed by Image Systems Inc, proved successful and the work on compiling some 10,500 entries was commenced. By 1975 the information index had developed to such an extent as to be the largest single index in a data retrieval machine manufactured by the company. It was considered that the system was sufficiently developed to justify a demonstration at last year's

FIRE TECHNOLOGY ABSTRACTS

7. FIRE SERVICE ORGANIZATION AND FACILITIES

e. Information Systems—Continued

"Interfire" Exhibition in London. The data base designed by East Sussex Fire Brigade has since been used at exhibitions in America, South Africa and Germany; subsequent exhibitions in this country have resulted in 16 brigades ordering similar machines. 2 figs, 1 photo.

976. Campbell V and Hamilton P
FIRE CONTROL SYSTEM - MUNICIPAL COBOL COMPUTER PROGRAMS MODULE MAGNETIC TAPE.
USAC Project, Wichita Falls, TX; USAC IMIS-WFT-013, HUD DF-76/012, magnetic tape, 1 reel, May 1976
Availability: NTIS PB-253 639/9GA

This tape contains the USAC Fire Control System Module for the Wichita Falls, Texas, Integrated Municipal Information System. The purpose of the module is to provide a computerized data collection and reporting system as well as to provide all pertinent operational data for subsequent analysis. There are 8 programs and one subroutine recorded on the tape. 256K bytes of core storage and 5M bytes of disk storage are needed to operate this module. Technical documentation describing this module include PB-251 482, PB-251 483, PB-251 484, Volumes 1, 2, and 3 respectively of the Application of System Management to Fire Protection Technique. Related documents necessary for implementation include: PB-227 709, Geographic Based Index Manual; and PB-234 988, Data Entry System Application Completion Report. Software Description: The programs are written in the IBM ANS 3.32 COBOL programming language while the subroutine is written in the IBM ALC programming language. These programs are written for implementation on an IBM 370/145 computer using the DOS VS 29 operating system. The Data Entry System Module and the proprietary IBM CICS Teleprocessing package are needed for the successful implementation of this module.

f. INVESTIGATION AND REPORTING

977. Deichman JT
EVALUATING A FIREFIGHTING OPERATION
Fire Chief; 20(8):79-82, 1976

Many fire departments hold critiques after fires, but these provide little specific information that can be compared to other firefighting operations. The author has developed some methods of post-fire analysis and performance evaluation that allow for comparison and provide information for improving firefighting operations. 1 fig. (Author)

g. PERSONAL EQUIPMENT

978. Anon
SHOULD FIRE PERSONNEL BE EQUIPPED WITH BREATHING FILTERS?
Brandforsvar; 13(1):10, 1976 (Swedish; English summary)

Experiments with light breathing filters in an atmosphere with a high concentration of sulfur dioxide were carried out in Helsingborg (Sweden). It was found that these filters provide good protection against the majority of chemical gases, except CO, for 35 minutes, which is enough for evacuation from a hazardous zone should a fireman unexpectedly enter such a zone. The filters can be carried

in a special case attached to the belt. For use it is pressed over the mouth, the nose being pinched by clamps. The service life is 4 years. Firemen fighting fires in factories should be equipped with these filters, in addition to the usual breathing apparatus issued in search and rescue work. (RZh)

979. Walther H-J
TESTING BREATHING MASKS FOR THEIR TEMPERATURE AND HEAT STABILITY
Draegerheft; (304):13-17, 1976 (German)

Investigations of the resistance of the Draeger full-cover masks Panorama Nova and Koreta to fire exposure have verified that these masks are highly fire-resistant, as reported in the publications mentioned in the introduction. Their resistance is due not least of all to the use of a metal frame for the window of the mask and the favorable arrangement of the speech diaphragm and exhaust valve in a well-protected position. The flame-test facility and the test method are described. 5 figs, 2 refs. (Fachdok 12/0909)

980. Vorob'ev P and Zavarukhin A
SYSTEM FOR CHARGING REBREATHING CANISTERS
Pozhar delo; (3):25, 1976 (Russian)

A system for charging and emptying rebreathing canisters of breathing apparatus is described. Canisters can be emptied in 14-17 sec and filled in 10-12 sec. A block diagram of the system is given, accompanied by a description of system operation. 1 fig.

981. Hashegawa K, Miyoshi M and Ogata Y
NEW TYPE OF OXYGEN BREATHING APPARATUS
Rep Fire Sci Lab (Japan); (12):75-78, 1975 (Japanese)

A detailed description is given of the design, operating principle, technical parameters, and the results of complex tests of a comparatively complex, portable, individual oxygen breathing apparatus, compact and light-weight, intended for use in a gassy, smoke-filled or other toxic environment. It is pointed out that in contrast to the individual oxygen apparatus of preceding models, which had a comparatively short effective operating time owing to the limited size of the portable oxygen flasks, this apparatus provides for considerably longer use and, consequently, greater effectiveness. These advantages are achieved by realizing partial organized recirculation of the exhaled air, rigorously proportioned, in the air circulation path of the apparatus. The latter consists of the following principal components: face mask, oxygen flask with a valve, respiratory system with flexible hoses, distributor valve, and mixing chamber, where the finished breathing mixture is prepared. Convenience of use of the apparatus is ensured by means of a control assembly connected to the distributor valve, which is graduated in percentages and is designed to change the ratio of oxygen and exhaled air in the breathing mixture as a function of the conditions of use of the apparatus. The apparatus test results, given in tabular and graphic form, clearly illustrate the optimum values of this ratio as a function of the magnitude and nature of the loads to which a person using the apparatus is exposed. 4 figs, 5 tables, 1 ref. (RZh)

FIRE TECHNOLOGY ABSTRACTS

7. FIRE SERVICE ORGANIZATION AND FACILITIES

g. Personal Equipment—Continued

982. Smirnov AD, Parshenkov MV and Solov'ev SN
DEVICE FOR THE SUPPLY OF AIR TO THE FACEPIECE OF A BREATHING APPARATUS
USSR Patent No. 450,577; Cl A62G 9/00, Appl 22 Jan 1973, Discl 8 Sep 1975

A description is given of a patent invention for a device supplying air to the facepiece of a breathing apparatus. The device contains filtering-sorbing elements, moving and fixed plates, air containers made of gasproof elastic materials, a valve distributor box and a corrugated tube connected to the facepiece. The distinguishing feature of the device is the arrangement of the filtering-sorbing elements which, to reduce the size and increase the operating convenience, are placed in pockets in the air bags and are closed off externally by covers with built-in inlet valves. 2 drawing figs. (RZh)

983. Anon
BREATHING APPARATUS WITH FILLER SENSITIVE TO WATER VAPOR
FRG Patent No. 2,163,125; Cl A62B 25/00, Appl 15 Feb 1971, Discl 17 Jul 1975, Assignee: Auergesellschaft GmbH

The breathing apparatus is equipped with a moisture-sensitive material; an inner shell protects the filler and an outer shell protects the entire apparatus. The outer shell incorporates the inner shell. The distinctive feature of the invention is that the space between the inner and outer shells contains a well-known moisture-absorbing material. This material, when it absorbs moisture, can change color, permitting visual check of the quality of storage of the breathing apparatus. 1 drawing fig.

984. Anon
SEAL FOR TOGGLE-JOINT STOPPERS OF CONTAINERS, ESPECIALLY FOR BREATHING APPARATUS
FRG Patent No. 1,586,580; Cl B65D 55/06, Appl 3 Jun 1967, Discl 10 Jul 1975, Assignee: Draegerwerk AG

A method is patented for sealing locks (shut-off devices) in which a company-developed plastic stopper shears off when the lock opens. The method is applicable for breathing apparatus. 4 drawing figs.

985. Ruhnke S
FIREFIGHTING EQUIPMENT
FRG Patent No. 1,708,849; Cl A62b 3/00, A62C 15/00, Appl 2 Aug 1957, Discl 26 Jan 1975

The invention relates to individual firefighting equipment for fire suppression consisting of a portable (shoulder-borne) extinguisher protected by a fire-resistant sheath. The distinctive feature of the equipment is that the fire-resistant sheath of the extinguisher is connected to a fireproof sleeve and a "mitten" containing the hose and pistol-grip branchpipe of the extinguisher. The equipment is intended for use in conjunction with a fireproof hood and apron, which protects the wearer from thermal radiation and the short-term effects of sparks and flame. 3 drawing figs. (RZh)

986. Giordano TA
DEVELOPMENT OF A SPEECH AMPLIFIER SYSTEM FOR USE WITH THE NAVY A4 OXYGEN BREATHING

APPARATUS AND A PROPOSED FIREFIGHTING INSTRUCTOR'S BREATHING DEVICE. Epsco Labs, Wilton, CT, 28 pages, Apr 1976
Availability: NTIS AD-A025 184/3GA

Navy damage control personnel (especially firefighters) are often required to work in areas of possible or actual oxygen deficiency and areas where the concentration of smoke or other toxic gases is high. In these situations, the investigator or firefighter normally wears an Oxygen Breathing Apparatus (OBA) or respiratory protection. Presently, the Naval Ship Engineering Center is considering the use of two new breathing devices. Neither breathing device was originally equipped with an amplified speech communication system. In order to make possible good face-to-face communication in the high noise environments anticipated, it was deemed desirable that some of these devices be provided with suitable voice amplifiers. (See also *FTA* 1(1/2), Abstract 484.) (Author)

987. Tyler MC and Deiser EE
AIRCRAFT FIRE FIGHTERS' PROTECTIVE PROXIMITY CLOTHING (FINAL REPORT). Wright-Patterson AFB, DoD Aircraft Ground Fire Suppression and Rescue Office, OH; DoD AGFSRS-76-6, 76 pages, Aug 1975
Availability: NTIS AD-A025 935/8GA

The DOD Aircraft Fire Suppression and Rescue Office has developed a new aircraft firefighters' protective suit to replace existing equipment used by DOD firefighters. The objective was to develop a lighter, less bulky, and more flexible suit with equivalent or improved durability and equivalent thermal protection as compared to existing suits. General functional requirements for such suits were determined and candidate materials for use in the suits were subjected to laboratory tests to determine relative strength, durability and thermal characteristics. Two outer shell materials and one lining material were selected for service testing. Service testing of these suits confirmed that the suits were easier to use and that they provided adequate protection.

988. Andruk FS
FACEPLATE-VISOR ASSEMBLY FOR THE ALUMINIZED FIRE-FIGHTERS' CRASH-RESCUE PROTECTIVE HOOD (PRELIMINARY REDESIGN STUDY). Navy Clothing and Textile Res Facility, Natick, MA; DoD AGFSRS-76-14, TR-118, 10 pages, Jun 1976
Availability: NTIS AD-A026 033/1GA

The Navy Clothing and Textile Research Facility conducted a study for the possible redesign of the facepiece-visor assembly of the current aluminized firefighters' crash-rescue protective hood to provide for verbal communication and the exchange of fresh air when the wearer is in a 'standby' situation with the visor open. Adjustable hood design concepts and techniques were investigated. Commercially available hoods, hood frames, materials and hardware were procured and performance tests conducted.

989. Audet NF
FACEPIECE-VISOR ASSEMBLY FOR ALUMINIZED FIRE-FIGHTERS' CRASH-RESCUE PROTECTIVE HOOD (INVESTIGATION OF ABRASION-RESISTANT OVERCOATING). Navy Clothing and Textile Res Facility,

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g. Personal Equipment—Continued

Natick, MA; DoD AGFSRS-76-15, TR-119, 41 pages, Jun 1976

Availability: NTIS AD-A026 024/4GA

The Navy Clothing and Textile Research Facility (NCTRF) investigated three protective overcoatings, identified as Abcite, 0-22, and Epoxy, as possible improvements to the present transparent protective overcoating on the infrared reflective gold-coated facepiece of the Aluminized Fire-Fighters' Crash-Rescue Protective Hood. All samples tested with the three overcoatings easily passed new radiant heat test requirements and showed a substantial improvement in abrasion resistance over the standard coatings. When applied to the standard facepiece materials, the coatings showed good adhesion to the gold. The coatings on these materials showed reasonable resistance to a number of environmental exposures.

990. Bailey M

IMPROVED FIREFIGHTERS' CRASH-RESCUE BOOTS (FEASIBILITY STUDY). Navy Clothing and Textile Res Facility, Natick, MA; DoD AGFSRS-76-16, TR-1200, 4-76, 17 pages, Jun 1976

Availability: NTIS AD-A026 094/3GA

The Navy Clothing and Textile Research Facility (NCTRF) has established the feasibility of using commercial insulated firefighters' boots and reflective spats to protect feet of crash-crew firefighters performing rescue operations in critical fire areas. Tests suggest that boot insulation and reflective covering on boots should enable feet to withstand high radiant heat for several minutes.

991. McGinnis NJ

EXHALATION VALVE LEAKAGE TEST. Nat Inst Occupat Safety and Health, Testing and Certification Lab, Morgantown, WV; NIOSH TC/R-005, 25 pages, Feb 1976

Availability: NTIS PB-252 692/9GA

A procedure is described to enable the reader to perform exhalation valve leakage tests on respirators as required by Title 30 CFR, Part 11. The steady-state leakage rate of the exhalation valve is measured in milliliters per unit time and on the positive pressure side of the exhalation valve.

992. Terry SL

DETERMINATION OF FACEPIECE CARBON-DIOXIDE CONCENTRATION LEVELS OF SELF-CONTAINED BREATHING APPARATUS. Nat Inst Occupat Safety and Health, Testing and Certification Lab, Morgantown, WV; NIOSH TC/R-003, 24 pages, Nov 1975

Availability: NTIS PB-252 695/2GA

While an individual is wearing a self-contained breathing apparatus, he is exposed to various concentration levels of expired carbon dioxide. These levels adversely affect the user's behavior and the respirator's performance. Because of the variability among test subjects, this procedure has been standardized to a machine-test method using a breathing machine with a sedentary cam which operates at 14.5 respirations per minute with a minute-volume of 10.5 liters. A 5% air-carbon dioxide mixture is fed into the facepiece during exhalation and the average exposure level during inhalation is calculated. Experimental design limits this method to breathing apparatus with

less than 1100 cc of effective dead-air space. The standard deviation of CO₂ concentrations obtained by this method is less than 0.1% CO₂ at a 95% confidence level.

993. Lenhart SW

PROCEDURE FOR TESTING STRENGTH OF HOSE AND COUPLINGS. Nat Inst Occupat Safety and Health, Testing and Certification Lab, Morgantown, WV; NIOSH TC/R-006, 18 pages, Feb 1976

Availability: NTIS PB-252 696/0GA

The test procedure has been prepared as a guide for testing the strength of hose and couplings of supplied-air respirators. Hose and couplings used with Types 'A', 'AE', 'B', and 'BE' respirators are tested with a pull of 113 kilograms for five minutes. Hose and couplings used with Types 'C' and 'CE' respirators are tested with a pull of 45 kilograms for five minutes and also subjected to an internal air pressure.

994. Lenhart SW

PROCEDURE FOR CONTINUOUS-FLOW RESPIRATOR FLOWRATE DETERMINATION. Nat Inst Occupat Safety and Health, Testing and Certification Lab, Morgantown, WV; NIOSH TC/R-004, 20 pages, Nov 1975

Availability: NTIS PB-252 694/5GA

The test procedure has been prepared as a guide to a method of determining the volume of air delivered by a continuous-flow supplied-air respirator. The method described has the advantage that the test results can be documented on recorder paper. The respiratory-inlet covering of a supplied-air system is placed in a container with an outlet; the outlet of the container is connected to a pneumotachometer and pressure transducer. Flowrates delivered by the respiratory-inlet covering at specified pressures and air-supply hose lengths are recorded and determined from a graph prepared during pneumotachometer calibration.

h. PERSONNEL AFFAIRS

995. Gaisbauer G

LIABILITY OF THE DRIVER OF A FIRE-SERVICE VEHICLE FOR A TRAFFIC ACCIDENT IN WHICH HE IS AT FAULT

Brandschutz; 30(7):174, 1976 (German)

The legal aspects of the liability of a firefighter who was at fault in an accident while performing his duties (driving a service vehicle to the inspection bureau for a checkup) are discussed. The State Supreme Court of Oldenburg (FRG) decided that "driving a fire-service vehicle for a scheduled technical inspection in accordance with paragraph 29 of the Traffic Regulations represents performance of sovereign duties" and that therefore the administration of the community is liable. (See also the related articles in the same issue of *Brandschutz*, pp 168-169, 170-171, 172-173 and 192.) (Fachdok 12/0906)

996. Rath K

LIABILITY FOR INJURIOUS CONDUCT IN THE FIRE SERVICE

Brandschutz; 30(7):172-173, 192, 1976 (German)

On the basis of an actual case, in which a firefighter was at fault in causing an accident on his way to have

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

h. Personnel Affairs—Continued

a firefighting vehicle checked at the Technical Inspection Association, an investigation was made of who has responsibility for any damage, bodily or property, caused a third person by a firefighter in performing his duties. To be specific, the question is whether the injurious conduct leads to government, duty, or personal liability. 17 refs. (Fachdok 12/0906)

997. Augustin P
SOCIAL INSURANCE OF THE FIRE FIGHTER
Hessische Feuerwehr Z; 85(15):267-272, 1976 (German)

The personnel benefits specialist of the German Firefighters Association informs the reader of the cases in which insurance protection is effective. Competence for honorary collaboration in firefighting units is discussed first within the framework of insurance law. The competence of the legal fire service accident insurance carrier extends only to active membership. Insurance is regulated for study and information trips. Accident insurance protection is extended to every citizen who enters the fire service. Also discussed are the cases when the legal accident insurance carriers grant compensation contributions for medical and professional rehabilitation and supplementary contributions for treatment and professional assistance. (Fachdok 12/0985)

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

a. COMMUNICATIONS AND SIGNALLING

998. Geisel H-O
COMMAND POST VEHICLES
Brandschutz; 30(4):96-99, 1976 (German)

In recent years many fire departments have been acquiring command-post vehicles (called command vehicles in standard DIN 14033). Depending on how views and key needs were formulated, broad variations in the design of vehicles, in equipment and personnel have occurred. This article attempts to classify the development and to present directions as to how a start at standardization might be made. The configuration of such a vehicle includes size and driving qualities (to suit the topography of the fire scene), floor plan, communications equipment, power supply, and external identification. 6 figs, 2 tables. (Fachdok 12/0571)

999. Araslanov Kh, Kazakov G, Pryanikov E, Naumov V
FIRE COMMUNICATIONS CENTER
Pozhar delo; (5):26-27, 1976 (Russian)

The new fire communications center in Ufa, the capital of the Bashkir Republic of the USSR, has been fully reconstructed to handle all problems of detection, alarm, dispatch, logistics, data transmission, information handling, unit readiness, availability of personnel, etc. The best response routes, the availability of firefighting equipment at the fire scene, the location of the fire and other firefighting data are all coded or plotted on situation maps. A description of the system is given.

1000. Bennett WG
EVALUATION OF RADIO COMMUNICATIONS FOR USE BY INDIVIDUAL FIRE FIGHTERS (FINAL REPORT). Wright-Patterson AFB, DoD Aircraft Ground Fire Suppression and Rescue Office, OH; DoD AGFSRS-76-5, 77 pages, Mar 1976
 Availability: NTIS AD-A025 936/6GA

This report presents the results of a project undertaken to fulfill an operational requirement for an individual, two-way communications system for firefighters. Contracts were initiated in June 1973 to obtain the basic radios and several accessories to be used in an operational test and evaluation program. The items purchased were selected because they were both commercially available, i.e., no development effort required, and because they appeared to offer the greatest potential for satisfying the stated needs of the operational commands.

b. EXTINGUISHING AGENTS AND ADDITIVES

1001. Burford RR
THE USE OF AFFF IN SPRINKLER SYSTEMS
Fire Technol; 12(1):5-17, 1976

The Factory Mutual Research Corporation contracted with 3M to conduct a test program aimed at determining the effectiveness of aqueous film-forming foam used in conjunction with a wet-pipe sprinkler system equipped with standard water sprinkler. The results indicate that closed, wet-pipe sprinkler systems using AFFF can control flammable liquid spill fires as effectively as, faster than, and using less water and AFFF concentrate than, deluge systems. Densities as low as 0.11 gpm/ft² (4.48 l/min.m²) provide effective control. Tests indicate that, at this discharge density, air temperature does not become high enough to damage structural members. 18 figs, 2 tables, 8 refs. (Author)

1002. Bumiller G
EXPERIENCES WITH CONVENTIONAL EXTINGUISHANTS AND EXTINGUISHING METHODS
Brandhilfe; 23(7):157-162, 1976 (German)

The discussion is aimed at presenting information and stimulating thought on whether equipment with some specific device or other is necessary and suitable and whether the firefighting unit is adequately equipped to handle every possible fire situation in its area. The prime subject discussed is the use of suitable powders and optimal equipment for them. The use of CO extinguishing methods must also be reserved for certain fire targets. The possibilities of using foam are, however, broader, since the discharge range and foam properties can be greatly varied by choosing suitable foam pipes and various foam compounds. 12 figs, 3 tables. (Fachdok 12/0984)

1003. Amore P
STUDY OF THE FIRE FIGHTING APPLICATIONS OF WETTING AGENTS
Antincendio protez civ; 27(10):755-760, 1975 (Italian)

The article contains the contents of a report of the directorate of the Hydraulics Laboratory of the Italian Fire Research Center devoted to problems connected with the application of wetting agents, which are widely used in the chemical industry, to the suppression of solid com-

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b. Extinguishing Agents and Additives—Continued

bustible material (wood, textiles, etc.) and combustible liquid fires. The appreciable increase in the wetting capacity of an aqueous solution of wetting agents compared to "pure" water permits effective use to extinguish solid materials in piles. Aqueous solutions of wetting agents are highly recommended for the suppression of forest fires. When extinguishing combustible liquids, a positive effect can also be obtained as a result of the formation of an emulsion in the surface layer of the liquid, promoting cooling. The adhesive properties of water and wetting agents on various surfaces are analyzed from the viewpoint of molecular theory. 5 figs, 13 refs.

1004. Elliott DE and Chiesa PJ, Jr
A NEW FOAM RHEOMETER FOR STUDYING FIRE FIGHTING FOAMS
Fire Technol; 12(1):66-69, 1976

The rheology of a foam defines its flow properties. Flow properties of a foam have been characterized by measuring its viscosity, continuous stress, and critical shear stress. The methods used, however, measure shear stress only at specific times during the lifetime of a foam, require extreme care in calibration, require the operator to read a moving pointer, are cumbersome to use, and produce no permanent record of the results. This paper describes a newly developed instrument that overcomes these problems. 1 fig, 1 table, 6 refs. (Author)

1005. Williamson HV
HALON 1301 FLOW IN PIPELINES
Fire Technol; 12(1):18-32, 1975

The complete manual calculation of pressure drops in the piping used in a Halon 1301 total-flooding fire extinguishing system is not practical. The flow of nitrogen-pressured Halon 1301 is a two-phase flow phenomenon involving a mixture of liquid and vapor in which the ratio of vapor to liquid increases as the pressure drops from the friction loss. With two-phase flow, the rate of pressure drop increases as the fluid proceeds through the pipeline because the velocity of flow must increase as the volume of fluid expands. Since it is not practical to use a manual method for two-phase calculations, a simplified linear approach or a complete calculation by computer is indicated. 13 figs. (Author)

1006. Teslenko G, Rode AA, Petrov I and Kucher V
USE OF THE COMPOUND 3.5 IN CABLE TUNNELS
Pozhar delo; (4):22-23, 1976 (Russian)

The 3.5 compound (ethyl bromide/carbon dioxide mixture in a ratio of 70:30) has proved to be very effective in fire protection of power plants and elsewhere. According to incomplete data, ten fires in cable tunnels have been extinguished in the last 2 years. It does not conduct current, does not freeze down to 170°C, and fixed systems are compact and economical, but is toxic at high concentrations. Tests and the effectiveness of the compound for suppression of cable tunnel fires are described. 2 tables

1007. Anon
EXTINGUISHING FIRES WITH FOAM AND WETTING AGENTS
Fire Internat; 5(53):59-69, 1976 (English, French, German; Spanish summary)

The advantages and necessity of introducing foams and wetting agents based on surfactants into general fire-fighting practice and of extending their application are illustrated by the experience gained in the the USSR. The general requirements for six Soviet foam compounds are listed in a table. Soviet and US foam compounds are compared. The paper was a Soviet contribution to the CTIF symposium at Berlin in June and read for the Soviet delegation in their absence. 1 fig, 2 tables, 1 photo.

1008. Brzustowski TA, Kaptein M and Sullivan HF
THE ACTION OF "SUBSURFACE" FOAM IN EXTINGUISHING OIL-TANK FIRES
Arch Termodyn Spal; 7(2):165-174, 1976 (English; Polish and Russian summaries)

The results of laboratory experiments were used as the basis for analysis of a proposed physical model of the action of subsurface foam in extinguishing oil-tank fires. The model is used to predict the condition of foam flakes arriving at the edge of the flame, and from this prediction to suggest the parameters for safe design. 2 figs, 1 table, 8 refs.

1009. Baratov A, Vogman L and Volkova V
FIRE-EXTINGUISHING POWDER COMPOSITIONS
Pozhar delo; (6):28-29, 1976 (Russian)

The chemical composition, grain size, specific area and specific weights of fire-extinguishing powders most commonly used in the USSR are summarized in two tables. The effectiveness of powders in extinguishing fires is buttressed by the results of extinguishing seven test fires: an aircraft interior, a chemical propellant, a methane-air mixture, woodboard, combustible liquids, sodium, and aluminum compounds, among others. 2 tables.

1010. Kawa S and Horinouti K
DEVELOPMENT OF FIRE-EXTINGUISHING AGENTS (PRECIPITATION). PART I.
Rep Fire Sci Lab (Japan); (12):20-25, 1975 (Japanese)

A detailed analysis is made of the chemical properties of new fire-extinguishing solutions developed at the chemical laboratory of the Institute of Fire Engineering and Firefighting Methods (Tokyo) for use in fire extinguishers. The study of these solutions has made it possible to obtain exhaustive results on their chemical and physico-chemical properties, as illustrated by numerous reactions in analytical terms. The external reaction conditions are indicated, as is the percentage of participating components. A description is given of the design and operating principle of the test stand used to study the effectiveness of the new fire-extinguishing solutions. Identical rectangular pieces of a material ensuring an intense even flame during combustion were used to simulate the fire. The pieces are stacked to form a tall rectangular prism resembling a rectangular, multi-story building. Photographic and tabular materials are given, illustrating the process of fire simulation by this method. It is stated that such a stack of flammable specimens ensures maximum stable flame

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b. Extinguishing Agents and Additives—Continued

burning intensity and maximum flame stability to the fire-extinguishing stream, making it possible to increase appreciably the objectivity of the data obtained from the results of the studies. It is recommended that this stacking structure and this type of combustible piece be used in the future for various kinds of fire tests. 6 figs. (RZh)

1011. Ojima M, Matsubashi S and Torii N
STUDY OF GELATINIZATION OF WATERS. PART 2
Rep Fire Sci Lab (Japan); (12):88-93, 1975 (Japanese)

It is reported that large expenditures of water to extinguish fires are stimulating the development and production of means to gelatinize (thicken) water. A brief survey is made of contemporary achievements in the water thickening area; described in particular are some of the most recent aggregates for thickening. Water thickening yields fundamental technical advantages with regard to fires. First of all, it becomes economically feasible to transport water as a fire-fighting agent in fire vehicles and special pumpers to the scene of a fire, especially when there are no fire hydrants in the vicinity; secondly, thickened water is more efficient in fire extinguishing than ordinary water. Given are the results of complex tests in which the effectiveness of using thickened water to extinguish fires under different conditions was evaluated. Used as the thickening reagent was NaOH, in three different consistencies: 0.05%, 0.1%, and 0.3%. It is shown that the degree of thickening depends strongly on the temperature. For example, for a temperature increase from 14 to 41°C, the degree of thickening of a 0.05% solution drops from a value of 1.22 to 0.65 (in conventional units) and of a 0.1% solution from 1.33 to 1.02. With increasing concentration of alkali, the temperature dependence of the degree of thickening becomes weaker and even becomes inverse: for a 0.3% solution the temperature rise in the same range leads to an insignificant increase in the degree of thickening, from 5.14 to 5.23. Also studied were the hydrodynamic properties of water at various degrees of thickening. The throughput (for thickened water) of fire hoses with an inner diameter of 65 mm and a length of 20 cm connected to a pump with a measurable rpm was studied. Two types of nozzles were used, one for delivery of a solid stream and one for a fog stream. The pressure was varied from 1.5 to 3.5 kg/cm², and the flow rate for the first playpipe increased from 430 to 640 l/min and for the second from 580 to 870 l/min. It is noted that the fire-hose throughput determined in this manner characterizes the coefficient of water viscosity, which was not specially measured. 11 figs, 7 tables, 5 refs. (RZh)

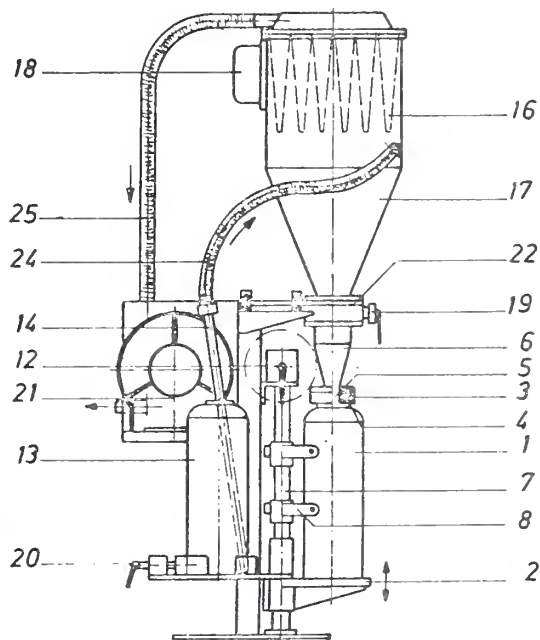
1012. Erben A
HIGH EXPANSION FOAM METHOD WITH CARBON DIOXIDE ADDITIVE AND DEVICE FOR IMPLEMENTING THE METHOD
FRG Patent No. 1,559,679; Cl A62C 5/04, A62C 27/28, Appl 28 Feb 1966, Discl 10 Jul 1975, Assignee: Enka Glanzstoff AG

The patent is granted for a high-expansion foam fire-extinguishing method with CO₂ pressure feed. The novelty of the method is proportioning of the CO₂ at a level at which the foam temperature at the generator outlet is 2 to 8°C (preferably 6°C). The new method is recom-

mended for the suppression of fires of combustible liquids with a specific weight less than water and high volatility. Examples of extinguishing test fires of methanol and carbon disulphide demonstrate the high efficiency of the method.

1013. Stoeffler BH
APPARATUS FOR FILLING CONTAINERS WITH DIFFICULTLY FLOWABLE MATERIALS
US Patent No. 3,942,561; Cl 141/67, (B65B 1/16), Appl 11 Mar 1974, Discl 9 Mar 1976, Priority: Germany, Appl. 7312224[U], 31 Mar 1973, Assignee: Vulcan-Werk Wilhelm Diebold, Germany

Apparatus for filling containers with difficultly flowable material, comprising a separator including a filter, a funnel-shaped outlet, and a dust-free butterfly valve for controlling flow of powder through said outlet; and a suction device for conveying said powder by suction to said separator; said outlet adapted to be connected to the container to be filled; said separator being operable to filter powder from the air conveying said powder into the separator and allowing the separated powder to fall into said funnel-shaped outlet. The invention is especially designed for emptying and filling fire-extinguishers. 8 claims, 8 drawing figs. (Author)



1014. Mark W and Landgraf W
SYNTHETIC FOAM COMPOUND, ESPECIALLY FOR THE SUPPRESSION OF FIRES OF WATER-MISCIBLE ORGANIC LIQUIDS
FRG Patent No. 1,621,721; Cl A62d 1/00, Appl 11 Nov 1967, Discl 17 Apr 1975, Assignee: Total Foerstner und Co

The foam compound is a synthetic agent containing a wetting material as the foam-making component, such as ethanolamide polyglycol ester of an aliphatic acid (monoethanolamide polyglycol ester of coconut acid,

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b. Extinguishing Agents and Additives—Continued

diethanolamide polyglycol ester of lauric acid, or mixtures of them), high-polymeric substances of vegetable or synthetic origin, which, when the foam compound contacts the burning fluid, form an intermediate layer (e.g., thermally depolymerized alginate) and a foam regulator (glycol esters). Data are given from comparative tests of the new compound and a compound in which sulfonate was used instead of ethanolamide polyglycol ester. The time required for complete disintegration of a foam layer applied to the surface of 300 ml of burning methanol in a porcelain basin with a volume of 1000 ml was 12 min for the new compound and 1 min for the sulfonate, test conditions being the same. (RZh)

1015. Corrie JG

THE EFFECT OF FOAM LIQUID CONCENTRATIONS ON FIRE PERFORMANCE ON LABORATORY FIRES. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1047, 9 pages, 4 figs, 3 refs, Jan 1976

The effect of deterioration of foaming solutions of fluoroprotein and fluorochemical liquids has been simulated by dilution, and the consequent change in performance has been measured by means of the new 0.25 m² test fire described in FR Note No. 1007. The results obtained are compared with earlier ones on the Defence Standard 42-3 fire of 0.28 m² area, over which the new fire is shown to have advantages. (Author)

c. HYDRAULICS AND WATER SUPPLIES

1016. Browet L

WATER REQUIREMENTS FOR FIRE EXTINGUISHMENT - 1000 l/min OR 120 m]
Rev Belge Feu; (30):34-37, 1976 (French)

The Belgian departmental decree on the supply of water for life suppression by the communities has aroused critique from many sides. The author examines the individual stipulations, which he then expands by resorting to practical experience. The topics examined are the properties of the water; the question of the meaning of "1000 l/min supply rate"; and the "2-hour period" during which this quantity of water must be available. The fire suppression measures, which leave such broad room for interpretation, also result in discrepancies. It is emphasized that consumption is governed by the fire at hand and not by theoretical calculations, fluctuating between 225 and 2100 l/min. 2 tables. (Fachdok 12/0914)

1017. Merkle T

OPERATING PRINCIPLE, DESIGN AND EXPERIENCE WITH PRESSURE REDUCERS IN WATER-SUPPLY TRUNK LINES
Mitt Inst Wasserbau Univ Stuttgart; (35):423-437, 1975 (German)

Manufacturing and hydraulic requirements for water-pressure regulators in the water-supply lines of large power installations are discussed. The hydraulic characteristics and tactical data and specifications for various designs of water-pressure regulators are presented, and the regulations for their use are given.

1018. Briers E

WATER REQUIREMENTS FOR FIRE SUPPRESSION. Part 1. Assoc Nat pour la Prot Contre l'Incendie (Belgium); DT 13, 21 pages, 10 figs, 14 tables, 14 refs (French)

Deciding on the fire-fighting means in an occupancy is usually not a simple problem. It requires thorough study of the hazard and a subsequent study of the means to be employed. In most cases the extinguishing agent will be water, and the problem to be solved will consist in applying the water to the fire at the desired time in sufficient quantity and in the most suitable form. The aim of this report is to facilitate understanding and resolution of the problems which arise in this area, especially with regard to evaluation of the water requirements, the supply process, and calculations of facilities. (Author)

d. INSPECTION

1019. Anon

FIRE PREVENTION IN PLANTS

Bull mens Chambre Commerce ind Meurthe-et-Moselle; (10):21-26, 1975&13(French)

In recent years the number of industrial fires and the losses resulting from them has been increasing. The chief reason is industrial growth: increase in the area and size of industrial buildings, increase in cost per unit area, and the use of materials on a polymer base, with increased fire hazard, in structures. The sequence of procedures established in France for the inspection of industrial enterprises, by insurance organizations, is briefly described. The principal requirements for various buildings and factories are enumerated. The use of fire-hazardous materials in construction may lead to a 100% increase in insurance premiums. The steps that can be taken to reduce insurance premiums are listed. It is noted that the problem of ensuring fire safety in industry is so serious and difficult that it should be the concern of all involved, not only the insurance companies. 3 figs. (RZh)

1020. Almagambetov N

WAYS OF IMPROVING THE OPERATING EFFICIENCY OF STATE FIRE INSPECTION AGENCIES (USSR)

Pozhar delo; (4):8-9, 1976 (Russian)

A critique is made of the ineffectiveness of district and municipal divisions of the State Fire Inspectorate of the USSR. The reason for ineffectiveness is the short time spent in inspection functions, as revealed by a time-efficiency study of the inspection staff. Ways of improving performance are suggested.

e. OPERATIONAL PROBLEMS

1021. Rode K

THE ART OF COMMANDING TACTICAL FIRE UNITS AND VEHICLE COLUMNS

Brandhilfe; 23(6):130-132, 1976 (German)

Correct leadership in the fire service and the qualifications of leaders in general are discussed in this article. The fire-service officer should concern himself with the relatively simple conceptual model of how to "command tactical units" and should use the model as a basis for

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e. Operational Problems—Continued

his command task, his deliberations and decisions. He should also master the most important aspects of how to "control vehicle columns". In a concluding section an attempt is made to define the concept "disaster". 2 figs. (Fachdok 12/0905)

1022. Lankau IE

A RECENT FEDERAL SUPREME COURT (FRG) DECISION ON SPECIAL PRIVILEGES AND RIGHT-OF-WAY IN THE TRAFFIC REGULATIONS

Brandschutz; 30(7):168-169, 1976 (German)

In a recently published decision (BGH, Opinion VI ZR, dated Dec 16, 1974) the Federal Supreme Court (FRG) has taken a position with regard to certain aspects of special rights and the right-of-way as expressed in the traffic regulations. The guiding principle of the decision is worded as follows: motor vehicles with privileges according to paragraph 38 of the Traffic Regulations, when they have turned on their blue lights and acoustic signals, are permitted to take advantage of the open lane made for them by other road users even if they should stop. This holds even when the right-of-way is regulated by light signals. The case on which the review decision is based is cited. The traffic regulation text is given in full in an insert. (For related articles see pp 170-171, 172-173, 174 and 192 of this issue of *Brandschutz*.) (Fachdok 12/0858)

1023. Rath K

THE DUTY TO EXERCISE CARE WHEN INVOKING THE "SPECIAL PRIVILEGES" GRANTED BY THE TRAFFIC REGULATIONS

Brandschutz; 30(7):170-171, 1976 (German)

Attention is drawn to the fact that opinions expressed with regard to the old version of the Traffic Regulations remain in force, since the legal situation of the new paragraphs 35 and 38 of the Traffic Regulations has undergone only a formal change compared to the old version of paragraph 48. A Federal Supreme Court (FRG) decision from Jan 11, 1971, and the facts of the case on which the decision was based, are discussed, and the rules of conduct derived from this opinion for drivers of vehicles exercising the right-of-way are pointed out. The driver of such a vehicle may make use of his special privilege only when all indications show that another road user has noticed him and yields him these privileges. (For related articles see pp 168-169, 172-173, 174 and 192 of this issue of *Brandschutz*.) (Fachdok 12/0882)

f. PUBLIC EDUCATION AND PUBLIC RELATIONS

1024. Koenig G

TEENAGE GIRLS IN THE YOUTH FIRE SERVICE

Feuerwehr; 26(4):96-97, 1976 (German)

The youth fire-service supervisor of the District of Stade (FRG) reports on his experience with the two-year-old youth fire service of Drachtensen, to which girls also belong. At the start of the program an entire catalog of problems to be solved was compiled, but these problems soon proved to be only theoretical. The female members (13-16 age group) turned out to be more sensible than boys of the same age, worked more intensely with and

exhibited the same interest in the firefighting equipment as the boys; in short, the girls' performance in the firefighting equipment area was outstanding. Nothing more could be expected of the teamwork of the group members either. (Fachdok 12/0623)

g. RESCUE OPERATIONS

1025. Kropivnyanskiy V

EXPERIENCE IN TRAINING BREATHING APPARATUS TEAMS

Pozhar delc; (1):19, 1976 (Russian)

Team and section chiefs of the gas and smoke protection service of the Lvov Fire Protection Administration are trained in organizing rescue work either on the training grounds or at various plants of the district. Training covers methods of evacuating valuable items, extinguishing fires, as well as coordination between the reconnaissance team, the safety command post and the breathing apparatus teams at the command and control point. The team training schedules and programs are outlined.

1026. Anon

OPTIMUM GUIDING SYSTEM FOR EVACUEES DURING AN EMERGENCY

Technocrat (Japan); 9(1):88, 1976

The Matsushita Electric Works (Japan) has worked out a system of signs and symbols to aid evacuation in case of fires in buildings or in underground shopping centers. The direction is indicated by arrows; the way in which the arrow points can be changed to conform to the optimum direction of motion of the flow of evacuees. The system consists of a control panel, signal lamps, emergency exit signs and fire alarm devices. In case of fire, the system indicates the point where the fire has broken out and the most favorable evacuation route shows up on the control panel. The location of the exits is indicated by lights and buzzers, which guide people when vision is clouded by smoke.

1027. Anon

SAFE TO GROUND THROUGH THE CHUTE

ZS Magazin; (6):20-21, 1976 (German)

A new expedient for rapid evacuation of highrise residents in case of fire and other disasters was demonstrated at the end of May (1976) at the administrative building of a large insurance company in Cologne (FRG). The expedient was a rescue chute through which people can slide safely to ground alongside a building. This device is promising for faster and less hazardous evacuation of endangered buildings, especially in the case of highrise fires, than has been provided to date by more conventional means, such as ladders and the like. The chute is manufactured in Japan in lengths of 150m and is made of heat-resistant fabric. The fabric is not supposed to require any maintenance. 3 figs. (Fachdok 12/0862)

1028. Fujita T

OPTIMIZATION OF THE STRATEGY FOR EVACUATION FROM FIRES CAUSED BY A STRONG EARTHQUAKE. SIMULATION OF THE FIRE SPREADING IN URBAN AREAS

Keisoku jido seigyō gakkai ronbunshu; 11(5):501-507, 1975 (Japanese; English summary)

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

g. Rescue Operations—Continued

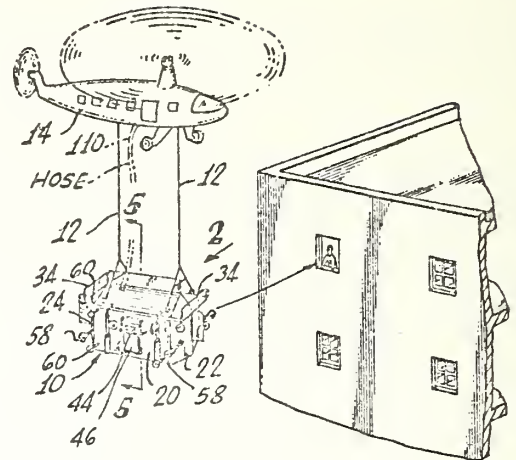
The choice of an optimal strategy and routes for the evacuation of people during fires caused by earthquakes is an urgent problem for Japan, which is subjected to frequent seismic effects of varying intensity. A brief survey is made of the evacuation plans developed to date for different Japanese cities. It is noted that this problem can be solved effectively in general form only by an analytical approach using machine information-processing methods, since physical modelling cannot take into account all the statistical factors, but can solve the problem only under certain specific conditions for individual cases. An analytical method is proposed for setting up computer programs based on the theory of fire spread, the so-called "small contour" theory. This theory takes into account the area engulfed in fire, or any fire source, as a set of an infinitely large number of vanishingly small sources. Each such elementary fire source has equiprobable characteristics of fire spread in all directions and in rate of spread. In constructing potential topological maps of fires for specific areas of a city, the elementary characteristics are summed algebraically and vectorially; as a result, the directions of subsequent spread are predicted on the basis of the configuration of the fire-engulfed area. 11 figs, 7 refs. (RZh)

1029. Zephinie G
EVACUATION SYSTEM PARTICULARLY APPLICABLE FOR THE RESCUE OF ENDANGERED PERSONS
French Patent No. 2,232,920; Cl A62B 1/00, B65g 11/00, Appl 5 Jan 1973, Discl 3 Jan 1975

The system is an improved design of a well-known rescue means in the form of a chute. It is proposed to make the chute not all in one piece, but sectional, so that when in use, the wide upper portions of each section are at the window level of a building. This permits evacuation from any floor without changing the location of the entire device. The chute is made in two layers, which improves braking and insulation from possible heat sources. A pneumatic pocket to serve as a landing buffer is provided in the lower portion. A continuous cable with devices to hold people is proposed in one of the versions. In this case the rate of descent is controlled by means of an electric motor with cable connection. Several versions of devices for affixing the chute to the building are described. The chute can be used in combination with a derrick. 11 drawing figs. (Author)

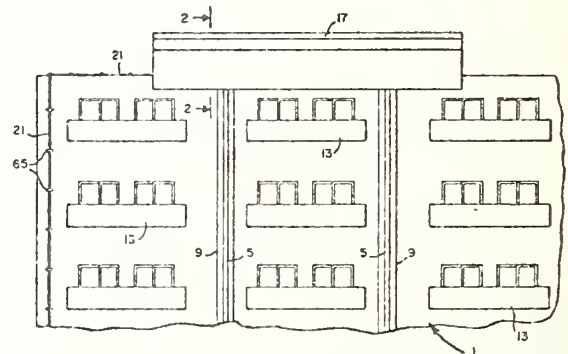
1030. Smith CP, Jr
EMERGENCY RESCUE DEVICE
US Patent No. 3,931,868; Cl 182/63, (A62B 1/02), Appl 12 Aug 1974, Discl 13 Jan 1976

A helicopter-supported gondola is provided with means for stabilizing the position of the gondola with respect to the exterior wall of a building so that people trapped within the building may be removed from it and safely lowered to the ground. Means are provided for stabilizing the gondola so that the downdraft from the helicopter can be used to control the position of the gondola, and other means are provided to hold the gondola firmly to the side of the building so that people may move from the building to the gondola. 8 claims, 8 drawing figs. (Author)



1031. Dorcich RL
ESCAPE ELEVATOR
US Patent No. 3,945,469; Cl 187/6, (B66B 9/00), Appl 4 Jan 1974, Discl 23 Mar 1976

The invention comprises an escape elevator which is especially useful with tall building. The escape elevator slides up and down the outside of the building along a pair of spaced tracks. The tracks serve to hold the elevator close to the building as well as to provide guidance for the up-and-down motion of the elevator. The elevator car or cage extends to either side of the tracks sufficiently to overlap egresses from the building such as balconies. The power winches which operate the elevator are located adjacent to the top of the building. A shielded cable is provided which leads from the winches to a point adjacent to the ground floor of the building. A remote control box is attachable at the point adjacent to the ground floor of the building. Also attachable at the control box is an external power supply to which power to operate the elevator is supplied. The elevator is thus not dependent upon the internal power supply of the building. The remote control device can be operated from a considerable



FIRE TECHNOLOGY ABSTRACTS

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

g. Rescue Operations—Continued

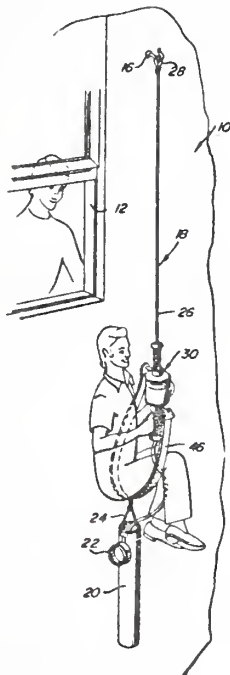
distance from the building, whereby the operator, who in most cases will be a fireman, can best observe the fire in the building and direct rescue and fire-fighting efforts. 9 claims, 7 drawing figs. (Author)

1032. Hunter CR

PORTABLE FIRE ESCAPE

US Patent No. 3,949,832; Cl 182/7, (A62B 1/14), Appl 4 Dec 1974, Discl 13 Apr 1976

An elongated flexible tension member is provided including a first end attachable to an upper floor portion of a building and a free end portion which may depend downwardly to ground level. A slide member is engaged with the tension member for guided movement therealong and defines a handgrip to be held by a user moving downwardly along the tension member with the slide. The slide further supports a seat portion therebelow upon which the user may be seated while grasping the handgrip defining slide and moving downwardly therewith. Also, the slide includes readily actuatable and deactuatable friction brake and clamping structure for selectivity and variably braking the descent of the slide and seat portion supported therefrom along the tension member. 10 claims, 7 drawing figs. (Author)

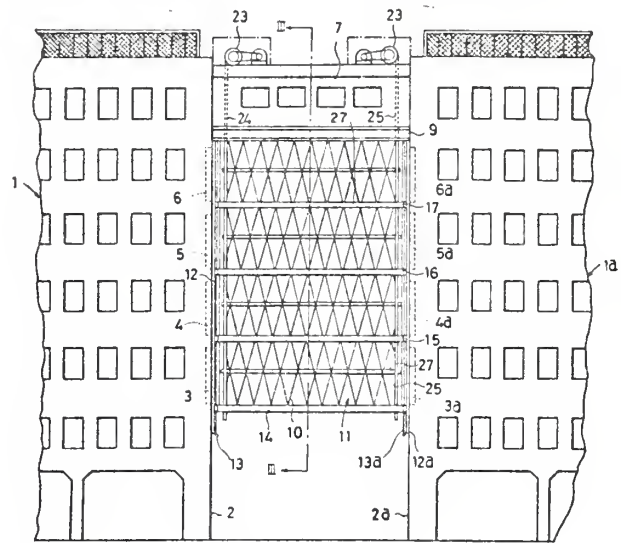


1033. Okada S

MULTIFLOOR-TYPE ESCAPE BRIDGE APPARATUS FOR USE IN MULTI-STORY BUILDING

US Patent No. 3,951,232; Cl 182/84, (E04G 3/00), Appl 4 Dec 1973, Discl 20 Apr 1976, Assignee: Tokyo Shutter Co, Ltd, Osaka, Japan

This invention provides a multifloor type escape bridge apparatus between two buildings for use in highrise buildings in an emergency situation, such as fire. In a normal situation, the necessary members, e.g., expanders, floor boards, suspension ropes and winding mechanisms, are suspended in folded position beneath a support means. In case of emergency, the expanders secured to the support means are lowered so as to place at each floor of the building, a board providing connections between corresponding openings at the opposite walls of adjacent buildings, enabling individuals to escape from one building to the other. 14 claims, 9 drawing figs. (Author)



1034. Anon

DEVICE TO RETAIN A DOOR FOR A SET PERIOD OF TIME

French Patent No. 2,244,363; Cl E05C 17/08, Appl 19 Sept 1973, Discl 11 Apr 1975, Assignee: SERPRO

This device is intended to keep fire doors equipped with an automatic closing system open for a fixed period of time to allow personnel to escape through these doors and to ensure closing of the doors in case of fire. The device is a cylindrical housing containing a bolt which holds the doors open by engaging a stop in the wall adjacent to the doors. The bolt is actuated by two springs, one fixed to the top of the housing, the other to a piston with valves moving within the housing, which is filled with a viscous fluid. Under the pressure of the springs, the fluid is forced upward by the piston into the space above it, the piston moves down and the bolt is released from the catch in the stop; then the doors close automatically. The open-door time is governed by the time required to displace the fluid, which depends on the viscosity of the fluid and the size of the space between the housing walls and the doors. When released, the bolt displaces the piston, opening the valves in it and preparing the device for a new operating cycle. The housing contains a plug made of a readily fusible material. When a fire breaks out, the device stops operating, and the door is kept from closing. 5 drawing figs. (RZh)

FIRE TECHNOLOGY ABSTRACTS

8. FIRE OPERATIONS: PREVENTION AND SUPPRESSION

g. Rescue Operations—Continued

1035. Anon

HYDRAULIC RETARDING DEVICE FOR A FIRE PROTECTION INSTALLATION

French Patent No. 2,240,606; Cl A62C 37/00, Appl 10 Aug 1973, Discl 7 Mar 1975, Assignee: Cie Centrale Sicli

The invention relates to an automatic device for covering hatches in fire doors after personnel alarmed by a warning signal have left a danger zone. The hydraulic retarder has two chambers. After a detector has signaled the outbreak of a fire, the fire warning device is triggered and fluid entering the retarder begins to flow over from one chamber into the other through a special calibration aperture with diameter chosen as a function of the desired time of delay of the actuator signal. When all the fluid has drained from one chamber into the other, a plunger rises, forcing fluid into the pipeline, which forms the signal for actuating the fire device. 1 drawing fig. (RZh)

1036. Melinek SJ and Baldwin R

EVACUATION OF BUILDINGS - SOME EFFECTS OF CHANGES IN PERFORMANCE STANDARDS. Building Res Estab (UK), Fire Res Station; BRE CP-95-75, 6 pages, 4 figs, 1 table, 8 refs, Oct 1975

The object of the present paper is to explore the effects of making small changes in the time allowed for evacuation and the number of floors to be evacuated. These effects will be of two kinds: a) changes in cost: more staircase capacity will cost more; b) changes in evacuation time for the whole building.

A decrease in overall evacuation time represents, potentially, a situation of greater safety, although data on behavior of people in fires would be required to assess this increase in numerical terms. However, this increase in safety would be balanced by an increased cost, either in construction, or through loss of amenity, and it is this cost which is the main concern of this paper.

The effect of changes in evacuation performance on the exit capacity required is assessed by using data on the movement of crowds, recently reviewed by Melinek and Booth. It will be postulated that, in office buildings at least, the cost is determined primarily by the loss of earnings through loss of rentable space. (Author)

1037. Nash P

THE EXTINCTION OF AIRCRAFT CRASH FIRES. Building Res Estab (UK), Fire Res Station; BRE CP-53-76, 8 pages, 10 figs, 8 refs, Jul 1976

This paper discusses one of the most severe fire situations, the aircraft crash fire, its problems and the development of extinguishing agents. The paper was reprinted from *Fire Prevention*, 1976, No. 112, pp. 24-30. See *FTA* 1(1/2), abstract 25.

1038. Melinek SJ

AN ANALYSIS OF EVACUATION TIMES FROM BUILDINGS; Paper No. 5

Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 49-58

Sponsor: Fire Res Sta, Bldg Res Estab (UK)

The evacuation of buildings to a protected area represented by a staircase is considered. Data for the

estimation of total evacuation time from buildings are presented. 2 figs, 1 table, 18 refs. (Author)

1039. Bazjanac V

INTERACTIVE SIMULATION OF BUILDING EVACUATION WITH ELEVATORS

Annual Simulation Symp, 9th, Rec of Proc; 1976, Mar 17-19, Tampa, FL, pages 15-29

Sponsor: IEEE

This report describes a minicomputer-based interactive simulation model which was used to experiment with strategies of partial and total evacuation in office buildings in downtown San Francisco. Experiments show that elevators can move a lot of people to safety even during brief periods of safe operation at the beginning of emergency, if the evacuation is preplanned and started promptly. 5 refs. (Author)

h. TACTICS

1040. Angermair T

HELICOPTERS IN FIRE-SERVICE OPERATIONS

Brandaus; 84(5):167-170, 1976 (German)

The effectiveness of helicopters in fire-extinguishing operations (forest fires) and rescue operations (highrises) is the subject of this article. The operational tactics of the two "Lama" helicopters of the Innsbruck (Austria) fire department, which are available day and night, are outlined. The rescue sequence during a disaster exercise at the Voest highrise in Innsbruck using various rescue devices is described and the rescue capacity of the individual devices during this exercise is illustrated in a table, from which conclusions are drawn. 2 figs, 1 table. (Fachdok 12/0815)

1041. Anon

DUAL FOAM ATTACK ON SHIP FIRE

Fire Internat; 5(52):41-42, 1976 (English, French, German; Spanish summary)

Both medium- and high-expansion foams were used successfully to control a serious fire in the engine room and one lower hold of an 8,000 ton motor vessel berthed in Salford Docks, England. The fire source in the engine room was burning oil, which ignited bales of cotton and Arcton cylinders in the hold. The firefighting measures are described. 2 photos.

1042. Hayward ET

DEVELOPMENTS IN SHIP FIRE-FIGHTING PROCEDURES

Fire Internat; 5(53):18-21, 1976 (English, French, German; Spanish summary)

Considered are various aspects of British ship fire-fighting procedures, such as machine compartment fires in chemical carriers, requiring "boundary cooling"; the need for light-weight breathing apparatus with a minimum 60-minute duration and rapid refilling (possible use of liquid oxygen); the effectiveness of various foam compounds (tests of the neglected medium-expansion foam are recommended); and the use of dry powder in bulk in mobile fire appliances. Oxygen-starved fires are also being studied at the Fire Research Station at Borehamwood (UK).

9. PLANNING

h. Tactics—Continued

1043. Tanner AC
FIGHTING FIRES ON VERY LARGE CRUDE CARRIERS

Fire Internat; 5(52):28-32, 1976 (English, French, German; Spanish summary)

Crude oil cargoes present a considerable fire and explosion risk, especially when the tanks are empty but still gassing. Most tanker fires result from spillage, explosion and collision. Particular attention is devoted to fighting tank fires, the principal requirement being the supply of adequate foam compound and delivery equipment. Some aspects of fighting tank fires are presented for various types of tank damage, especially for a tank that has been holed. Methods of attacking burning oil on the water and in the superstructure are suggested. An attempt should be made to acquire a copy of the loading schedule indicating full and empty tanks. Boarding the vessel is only at the Master's request, and he will also authorize the use of foam compound. 1 photo.

1044. Kasawara Y
TESTS OF A CL-215 FIREFIGHTING AIRCRAFT
Kasai; 25(4):234-240, 1975 (Japanese)

The parameters of a specialized CL-215 firefighting aircraft are given, along with a description of the design and operating principle as well as of operational flight tests. This aircraft is intended for use in extinguishing major forest fires, fires in rural areas, floating oil fires, fires in coastal and port installations, oil tankers, and the like. A sod landing strip measuring 450 x 50 m is sufficient for takeoff and landing. A high-expansion fire-extinguishing foam is prepared in the aircraft by mixing specific proportions of a high-expansion fire-extinguishing powder and water, 5.8 tons of which are held in an on-board container. The test results illustrate the effectiveness of using an aircraft to extinguish the different kinds of fires under various meteorological conditions. A review is given of the aircraft and helicopter fire-fighting means available in Japan. 9 figs. (RZh)

1045. Guise AB
HOW TO FIGHT NATURAL GAS FIRES
Fire Internat; 5(53):41-49, 1976 (English, French, German; Spanish summary)

A study of data from 241 fire tests leads to five recommendations on how to cope with natural gas fires: (1) assume that all fires in escaping natural gas will be impinging fires, (2) use potassium bicarbonate-base dry chemical where wood fires are unlikely to result from the original gas fire or where water is available, (3) use multi-purpose dry chemical where water is not available and fires are likely to occur in wooded or brush areas, (4) use mobile equipment with hoselines equipped with nozzles that produce high-velocity concentrated streams at the highest dry chemical flow rates manageable by one person, (5) provide special reflective clothing for the firefighters and reflective head covering having a large plastic face shield for wide vision. 8 figs, 1 table. (Author)

1046. Evans EM and Nash P
THE BASE INJECTION OF FOAMS INTO FUEL STORAGE TANKS
Fire Prev Sci Technol; (14):18-26, 1976 (English; German and French summaries)

Various systems for injecting protein and fluoroprotein foams beneath the surface of gasoline and kerosene stored in fixed-roof tanks of 6.1 and 10.6 m diameter and 6.1 m height were investigated. The development of the foam layer was observed and the fuel pick-up was measured. It was concluded that the method should be effective for extinguishing fires in larger tanks. 3 figs, 4 plates, 8 tables, 3 refs. (Author)

1047. Tesoro G and Backer S
EXTINGUISHMENT IN APPAREL TEXTILES. Massachusetts Inst of Technol, Fibers and Polymers Div; NBS GCR-76-71, 60 pages, Oct 1975
Availability: NTIS PB-254 751/1GA

An experimental investigation of the extinguishability during combustion of various apparel fabrics was conducted. Cotton, wool, nylon, cotton/polyester and FR cotton/polyester were ranked according to burning behavior under test conditions of DOC-FF-3-71 with the addition of heat sinks near the fabric. Stationary and movable heat sinks of various thermophysical properties, geometries, dimensions and speeds were considered. It was found that extinguishability is affected by fiber type and finish, by weight per unit area and structure. Two parameters were identified to measure relative extinguishability: (1) minimum constant spacing (between fabric and heat sink) needed to induce extinguishment, and (2) the maximum char length obtained after extinguishment in the case of a variable fabric-to-heat-sink spacing. It is concluded that relative differences in ease of extinguishment of nonthermoplastic fabrics can be quantitatively and reproducibly measured. Color illustrations reproduced in black and white. (Author)

9. PLANNING

a. BUDGETING

1048. Mork E and Reiser JW
A FIRE SERVICE DEMAND CHARGE STUDY. Tacoma Fire Dept, Tacoma, WA; NSF RA-760036, 118 pages, Jan 1976
Availability: NTIS PB-252 605/1GA

The research analyzes the demand for public fire protection service from various types of property. The cost of providing the service was then compared with the financial contributions made for that service. Ways for reducing disproportionate fire-flow requirements were sought. "A Fire Service Demand Charge System" was sought which rewards property owners for reducing demands for service from public fire protection and distributes the cost for providing fire protection more equitably among its users. This study proposes a fire service demand charge to be placed on buildings making excessive demands upon public fire protection. The Fire Service Demand Charge would provide the building owner another tool to consider when making decisions about

FIRE TECHNOLOGY ABSTRACTS

9. PLANNING

a. Budgeting—Continued

installing private fire protection. Small building owners would then not be subsidizing cost for public fire protection for buildings other than their own, as a sampling of Tacoma indicates they now do. There would be a gradual downward pressure on cost for public fire protection as private fire protection reduces demand. (Author)

b. LOGISTICS

1049. Walker WE

THE DEPLOYMENT OF EMERGENCY SERVICES: A GUIDE TO SELECTED METHODS AND MODELS. New York City Rand Inst; R-1867-HUD, 71 pages, Sep 1975
Availability: NTIS PB-253 395/8GA

A nontechnical summary is presented of the models and methods to assist in the analysis of problems associated with the deployment of emergency vehicles such as police cars, fire engines, and ambulances. Personnel of emergency service agencies and local government officials, especially those involved in planning for the delivery of emergency services, should find this report a useful guide to some of the available tools for setting deployment objectives, measuring performance, and developing new policies. In addition to descriptions of eight deployment models, six case studies are described in which the models were used as part of a deployment study. Other reports are also described, including a training course in deployment of emergency services, a review of police patrol allocation methodologies, and a review of deployment methodologies for fire departments. (Author)

1050. Chaiken JM, Ignall EJ and Walker WE

DEPLOYMENT METHODOLOGY FOR FIRE DEPARTMENTS. HOW STATION LOCATIONS AND DISPATCHING PRACTICES CAN BE ANALYZED AND IMPROVED. New York City Rand Inst; R-1853-HUD, 80 pages, Sep 1975
Availability: NTIS PB-253 394/1GA

This report, written primarily for fire department administrators and planners, reviews mathematical models that have been developed to assist fire departments in analyzing and improving the deployment of their fire-fighting resources. The methods have been tested and applied in cities across the country. The key issues discussed are: Determining the number of fire companies to have on duty city-wide and in each region; determining locations for firehouses; developing a policy for redeploying fire companies when large numbers of companies are busy at fires; and developing a policy for dispatching fire companies to alarms. The appropriate models are described and compared, but not discussed in detail, since the reader is directed to source documents. Also included is a list of steps that should be followed in performing a well-managed deployment study. (Author)

c. OPERATIONS ANALYSIS

10. HUMAN BEHAVIOR, SOCIAL, AND MEDICAL PROBLEMS

[For more complete coverage of the behavioral and medical literature see: *Psychology Abstracts* and *Index Medicus*.]

a. ARSON

1051. Anon

ARSON: SOME PROBLEMS AND SOLUTIONS
Nat Fire Prot Assoc, Boston, MA; 146 pages, 1976

The book is a compilation of thirty-five recent articles from *Fire Journal*, *Fire Command*, and *Fire Technology* on the serious problems of arson in the U.S. Tips on arson investigation and prevention are given with detailed accounts of incendiary fires, some fatal, in all occupancies. The book is intended for arson investigation officials and fire department training programs.

1052. Moll KD

ARSON PSYCHOLOGY AND PUBLIC POLICY
Fireline; :3-5, May 1976

The article deals with the question of why people start fires. Eight classes of malicious fires are identified: 1) fraud fires to collect insurance; 2) political fires to dramatize an issue; 3) "pyro" fires for emotional relief or sexual gratification; 4) crime cover up; 5) spite fires; 6) vanity fires to glorify the individual; 7) "psycho" fires without rational motive; and 8) vandalism fires for excitement. Three possible methods of suppressing criminal motives are suggested: education of the general public, rehabilitation of criminals already caught; and deterrence of potential criminals through the threat of punishment. 5 refs.

b. COMBUSTION TOXICOLOGY

1053. Parks S

INHALATION INJURY IN BURN PATIENTS
West J Med; 124(3):244-248, 1976

The article deals with inhalation injury in the form of a discussion within the framework of "trauma rounds" The patient under discussion is an 18-year old male who, while under the influence of drugs, fell asleep while smoking and sustained burns involving both arms. Apparently inhalation injury also resulted. The course of medical treatment is discussed. Possible causes are determined on the basis of tables of carbon monoxide poisoning and carboxyhemoglobin levels, severity and symptoms, and sources of noxious chemicals in smoke (compound-noxious combustion products). 2 tables.

1054. Truhart R, Boudene C and Jouany JM

STUDY OF THE ACUTE TOXICITY OF MAJOR TOXICANTS PRODUCED DURING COMBUSTION OR PYROLYSIS OF MATERIALS
Arch Mal Prof Med Trav Secur Soc; 36(12): 707-738, 1975 (French)

FIRE TECHNOLOGY ABSTRACTS

10. HUMAN BEHAVIOR, SOCIAL, AND MEDICAL PROBLEMS

b. Combustion Toxicology—Continued

The symptoms and mechanism of intoxication for 30 min. from major toxicants involved in pyrolysis and combustion products, i.e., CO, CO₂, HCl and HCN, and the recovery conditions were studied in rats and rabbits. The intoxication methods were spontaneous and controlled ventilation. A three-coordinate physiogram was set up for every condition to permit comparison between the different compounds or conditions of intoxication. Arterial pressure, EKG and EEG were continuously recorded during intoxication and for a four-hour recovery period. The lack of O₂, CO and HCN induces different kinds of cellular hypoxia; HCl acts as a very aggressive gas, but its toxicity depends greatly on the amount penetrating the respiratory tract. The aspects of intoxication and the possibility of immediate recovery in each case are described. 16 figs, 8 tables, 4 refs.

1055. Michal J
TOXICITY OF PYROLYSIS AND COMBUSTION PRODUCTS OF POLY-(VINYL CHLORIDE)
Fire Mater; 1(2):57-62, 1976

The pyrolysis and combustion products of poly(vinyl chloride) and those of some of its polymers, especially copolymers of vinyl chloride with vinylidene chloride, were analysed using gas chromatography and gas chromatography mass spectrometry. The toxic effect of the individual products on the human organism was evaluated and presumed total toxicity of the poly(vinyl chloride) combustion products (0.3 g PVC products per m³) was determined. 3 figs, 1 table, 17 refs. (Author)

1056. Bowes PC, Edgington JAG and Lynch RD
THE INHALATION TOXICITY OF POLY-VINYL CHLORIDE PYROLYSIS PRODUCTS. Dept of the Environ and Fire Offices' Committee (UK), Fire Res Station; Fire Res Note 1048, 36 pages, 2 tables, 15 refs, Feb 1976

A limited study has been made of the toxic effects of hydrogen chloride, representing the major toxic component of the pyrolysis products of polyvinyl chloride, in the presence of carbon monoxide generated by the combustion of a wood-based material (hardboard).

In the presence of the mixed gases, at concentrations within the range of approximately 2000-20,000 mg/m³, deaths among rats and guinea pigs exposed for 30 minutes were primarily due to carbon monoxide poisoning, but the hydrogen chloride was found to enhance the response to the carbon monoxide. However, this enhancement occurred mainly at concentrations of hydrogen chloride which could be lethal when present alone.

There appears to be sufficient evidence available to indicate that the presence of hydrogen chloride at lethal concentrations in fire gases containing lethal concentrations of carbon monoxide could marginally increase the fatalities in fires. It is probable, however, that the most important effects of the presence of hydrogen chloride will accompany sub-lethal exposures, first because the highly irritant nature of the gas may result in more people being prevented from using escape routes in the early stages of fires in buildings by concentrations of fire gases and smoke which may be otherwise relatively harmless at the time and, second, because survivors may suffer long-term, even permanent, injury from high concentrations of this gas. These are the aspects which appear most to require further study. (Author)

1057. Gaume JG
ANIMAL EXPOSURE DURING BURN TESTS. Douglas Aircraft Co, Inc, Long Beach, CA; NASA CR-137802, MDC J7133, 64 pages, Jan 1976
Availability: NTIS N76-20800/8GA

An animal exposure test system (AETS) has been designed and fabricated for the purpose of collecting physiological and environmental (temperature) data from animal subjects exposed to combustion gases in large-scale fire tests. The AETS consists of an open wire mesh, two-compartment cage, one containing an exercise wheel for small rodents, and the other containing one rat instrumented externally for electrocardiogram and respiration. The ECG and respiration sensors are located in a belt placed around the torso of the subject, electrode wires forming an umbilical to a connector in the top of the compartment. A cable extends from the connector to the power supply and signal-conditioning electronics. These are connected to a dual-beam oscilloscope for real-time monitoring and a magnetic tape recorder having three or more channels. Endpoints observed are bradycardia, cardiac arrhythmias, changes in respiratory pattern, respiratory arrest and cardiac arrest. The ECG record also appears to be a good method of monitoring animal activity as indicated by an increase in EMG noise superimposed on the record during increased activity of the torso musculature. Examples of the recordings are presented and discussed as to their significance regarding toxicity of fire gases. (Author)

1058. Crockett PW
TOXICITY OF GASEOUS HALOGENATED ORGANIC COMPOUNDS (A BIBLIOGRAPHY WITH ABSTRACTS). Nat Tech Inf Service, Springfield, VA; NTIS PS-76/0432/5GA, 93 pages, Jun 1976
Availability: NTIS

Subject areas include toxicological studies on halogenated hydrocarbon gases used as fire extinguishers, anesthetics, solvents, pesticides, and aerosol propellants. (This updated bibliography contains 88 abstracts, 18 of which are new entries to the previous edition).

1059. Saito F
EVALUATION FOR THE TOXICITY OF COMBUSTION PRODUCTS. Ministry of Constr, Tokyo, Japan, Bldg Res Inst; BRI 65, 24 pages, 11 figs, 4 tables, 7 refs, Mar 1976

An evaluation method is derived for the toxicity of a single gas component (CO and HCl), toxicity of gaseous mixtures, and the influence of temperature on the physiological effects of CO gas. The toxicity of combustion products is then determined by animal experimentation (mice) and a relation is derived between the composition and concentration of the gas and the duration of exposure.

1060. Tsuchiya Y and Sumi K
TOXICITY OF DECOMPOSITION PRODUCTS - PHENOLIC RESIN. Nat Res Council of Canada, Div of Bldg Res; BRN 106, 8 pages, 1 fig, 3 tables, 5 refs, Dec 1975

Toxic gases and vapors produced by fires are responsible for the majority of deaths in building fires. In this

FIRE TECHNOLOGY ABSTRACTS

10. HUMAN BEHAVIOR, SOCIAL, AND MEDICAL PROBLEMS

b. Combustion Toxicology—Continued

note, experimental data on the toxic decomposition (combustion and pyrolysis) products of phenol-formaldehyde resin (phenolic resin) are presented and the toxic hazard created by the products is evaluated. Phenolic resins are used in the building industry as foam insulation and adhesives for laminates. (Author)

1061. Saito F
EVALUATING METHOD FOR THE TOXICITY OF COMBUSTION IN FIRE

Human Behavior in Fire Symp, Main Reports; 1975, Nov 20-21, Tokyo, Japan
Sponsor: Japan Fire Sci Assoc,

Some suggestions on evaluation of the toxicity of combustion products from construction materials are introduced. The method of evaluating the materials is described, the course of a fire being divided into initial and spreading stages. The toxicity of a material, T(s), varies with the fire conditions. To determine fire-produced gaseous products, either instrumental analysis or animal experimentation must be improved. The author prefers toxicity evaluation by means of an evaluation equation composed of the sum of each component and the analysis should be conducted by analytical tools. The present experiments using animals represent a tentative effort; more accurate methods await development. 10 figs, 5 tables, 12 refs, 18 pages. (Author)

c. EMERGENCY MEDICAL SERVICES AND FACILITIES

1062. Anon
A JOB ANALYSIS STUDY OF EMERGENCY MEDICAL SERVICE CLASSES, DETROIT FIRE DEPARTMENT (FINAL REPORT). Civil Service Commission, Intergovernmental Personnel Programs Div, Chicago, IL; USCSCP R-3AU, 171 pages, Aug 1974
Availability: NTIS PB-252 928/7GA

A study was conducted to develop an applied electric job analysis methodology and content validation strategy applicable to public sector employment. Knowledges, skills, abilities and personnel characteristics for the classification of Emergency Mobile Medical Technician Trainee (EMMTT) were identified and weighted in order of importance to the job using this methodology. From the resultant job analysis data base, content-valid examination materials and a performance appraisal device were developed. Use of the performance appraisal device for peer ratings ran into operational difficulties because of adverse union reaction. Methods for circumventing this problem in future studies and for implementing the selection battery are suggested by the authors.

d. INJURIES AND FATALITIES

1063. Isrig BC, Stephenson SF and Fulton RL
ROLE OF PULMONARY INFECTION IN THE PATHOGENESIS OF SMOKE INHALATION
Surg Forum; 26:204-206, 1975

Pulmonary failure, a frequent cause of death from fires, occurs early as a result of smoke inhalation or late as a complication of burns. Bacterial pneumonia is a factor

contributing to pulmonary failure in either of these situations. Clinically, smoke inhalation has been associated with the development of pneumonia, but few laboratory experiments to document the pathophysiology have been conducted. Initial respiratory insufficiency seen after smoke inhalation is caused by noxious products. Previous studies indicated that smoke-inhalation injury in the absence of bacterial infection was moderately severe, but not treatment-resistant. This experiment assesses the effect of bacterial insult on smoke-injured lungs. 1 table, 1 ref. (Author)

1064. Stanislavskiy LV, Tatarenko VA and Krolenko NI
POSSIBILITIES OF THE WICK-LIKE BURNING OF CLOTHING AND PECULIARITIES OF THE RESULTANT INJURIES
Sud Med Ekspert; 18(3):49-52, 1975 (Russian; English abstract)

Wick-like burning of clothing is a peculiar type of thermal action. It begins with ignition of the clothing; burning leads to melting of the body fat; the fat saturates the clothing, thus maintaining intense burning. Lower-lying body tissues become dehydrated and also begin to burn. Finally, extensive portions of the body, including bones, are destroyed. This phenomenon has been observed only when clothing or bedding has been ignited after death of the victim, but the possibility of wick-like burning of the clothing of a helpless victim cannot be ruled out. 4 figs. (Author)

1065. Ide K, Tsukamoto S, Saito M, Sudo T, Sato Y and Kuniyoshi T
CAUSES OF DEATH RELATED TO FIRES
Human Behavior in Fire Symp, Main Reports; 1975, Nov 20-21, Tokyo, Japan
Sponsor: Japan Fire Sci Assoc, Inc.

The causes of fire-related fatalities are analyzed statistically on the basis of examinations of victims by the Medical Examiner's Office, Tokyo Metropolitan Government. The results are presented in the form of tables and figures and are analyzed in terms of causes of fatalities. 17 figs, 10 tables, 37 pages.

1066. Tsukamoto K
A STUDY OF THE NATURE OF THE CAUSES OF ACCIDENTAL DEATH IN FIRES
Human Behavior in Fire Symp, Main Reports; 1975, Nov 20-21, Tokyo, Japan
Sponsor: Japan Fire Sci Assoc, Inc.

The actual circumstances surrounding the causes of death in fire have not yet been fully determined. Generally, the causes are attributed to burning, poisoning, suffocation, etc. In recent years, death from smoke has been mentioned as a cause. Although explanations of toxic gases from combustion exist, the kinds of gases remain as yet unclear. These causes have not been pursued consistently by most investigators. A rigorous examination of the bodies of victims must be made within the context of forensic medicine. Actual cases of fire fatalities are discussed in the article in an attempt to establish the causes of death. 4 figs, 1 table, 14 pages.

11. CODES, STANDARDS, SAFE HANDLING, IDENTIFICATION OF HAZARDS

e. PHYSIOLOGY

1067. Ogata I and Oyama S
GAS ABSORBENCY OF WET TOWELS
Rep Fire Sci Lab (Japan); (12):79-83, 1975 (Japanese)

Given are the results of experimental investigations during which the effectiveness of using wet towels to protect respiratory organs from toxic gases generated during fires, the cause of death of a large number of people, was determined. The absorbing properties of wet towels were studied by means of a special test stand, the design and parameters of which are examined. A sample of smoke and gas-generating material was placed in a special closed chamber, heated, and brought to ignition by means of a tubular electric heater equipped with a heat regulator. The resultant gaseous combustion products and smoke were tapped through a circular aperture in the chamber into a rigid cylindrical sectional sleeve. Removal was forced by rarefaction in the sleeve using a 28W electromechanical air pump operating from a 100 volt a-c circuit. Towels of varying wetness were placed, as a soft membrane, in the flanged intersectional joint of the sleeve. Using appropriate gas-analyzer sensors, the gas and smoke content were measured in the portion of the duct ahead of and behind the towels. The absorbing properties of the towels were determined from these measurements. Towels of different materials, differing thickness, texture, etc., were studied. The gas analyzer gave indications of the three basic toxic gaseous combustion products: CO, CO₂ and HCl. Vinyl chloride was used mainly as the flammable material. 2 figs, 6 tables, 3 refs. (RZh)

1068. Miura T
PHYSIOLOGICAL RESPONSE IN HOT ENVIRONMENTS
Human Behavior in Fire Symp, Main Reports; 1975, Nov 20-21, Tokyo, Japan
 Sponsor: Japan Fire Sci Assoc, Inc

The physiological response of the human body to heat exposure is studied on the basis of measurements in places of employment and statistical data on weather conditions.

f. PSYCHOLOGY

1069. Anderson HM
WHEN ALL ELSE FAILS
Fire Command; 43(8):54-56, 1976

The Oakland Fire Department has tried a variety of programs to curb false alarms, none with lasting results. An analysis was made of the fire boxes from which false alarms were coming. Fruitless special programs were aimed at neighborhoods containing fire boxes with high false alarm rates. The offending boxes were finally removed, but offenders have transferred their activities to nearby boxes. An automated 911 emergency telephone service is to be placed in service; when this system is fully operative, Oakland intends to re-examine the fire-box situation, with eventual removal the possible outcome. 2 tables, 1 photo

1070. Callinicos P
BIORHYTHMS USED IN DENVER FOR ACCIDENT STUDY
Fire Eng; 129(7):54-55, 1976

The three cycles comprising the biorhythm theory, that is, the 23-day physical cycle, the 28-day emotional cycle, and the 33-day intellectual cycle, are being studied in an attempt to determine fire service employee critical days to reduce accidents. The study is based on a computer analysis of 1,418 individual accidents that occurred from 1971 to 1975 in the Denver, Colorado, Fire Department. The results show that 77.32% of all listed accidents occurred on critical days. Other percentage correlations are given. 1 photo.

1071. Canter DV
PSYCHOLOGICAL ASPECTS OF BEHAVIOR OF PEOPLE IN FIRES; Paper No. 6
Control of Smoke Movement in Building Fires Symp, CIB, Proc, Vol 1 - Papers; 1975, Nov 4-5, Garston, Watford, UK, pages 59-67
 Sponsor: Fire Res Sta, Bldg Res Estab, UK

The psychological factors of relevance when considering the design of fire detection and smoke control equipment are discussed. In particular, the influence of environmental constancy and the social context are examined, together with the role of the organization which exists prior to the fire situation. Finally, the need to elaborate the study of the effectiveness of behavior in fires is explored in relation to the potential longterm effects of fire trauma. 5 refs. (Author)

1072. Yamada M
HUMAN WALKING AND FEAR IN DISASTER SITUATIONS
Human Behavior in Fire Symp, Main Reports; 1975, Nov 20-21, Tokyo, Japan
 Sponsor: Japan Fire Sci Assoc, Inc.

The first reaction of a human being on the brink of disaster is instinctive and varies in accordance with sex, age, knowledge, experience, and other factors. When the disaster is sudden and unforeseen or when it is exaggerated, human reaction takes the form of astonishment, in most cases, often upsetting even usually intelligent and composed persons. On the basis of questionnaires filled out by 208 test subjects who had been exposed to various disasters (fire-54%, earthquake-22%, flood and others-24%), the author gains insight into the mental status and human behavior in times of disaster. 11 figs, 10 tables, 1 ref, 34 pages.

11. CODES, STANDARDS, SAFE HANDLING, IDENTIFICATION OF HAZARDS

a. CODES

1073. Becker W
PREVENTIVE FIRE PROTECTION WHEN USING COMBUSTIBLE WORKING MATERIALS
Ind Digest; 15(1):35-39, 1976 (German)

Preventive fire protection viewpoints must prevail when combustible working materials are used for various applications in the Federal Republic of Germany. These viewpoints are equally valid, as a rule, for all combustible

FIRE TECHNOLOGY ABSTRACTS

11. CODES, STANDARDS, SAFE HANDLING, IDENTIFICATION OF HAZARDS

a. Codes—Continued

materials, regardless of the class they belong to. The present remarks are intended to aid the designer and user in recognizing and implementing the regulations and specifications in the engineering areas in which combustible working materials are used to any appreciable extent. Of particular importance are the fire-protection regulations for combustible solids in the construction industry, electrical engineering, and transportation, which are the prime subject of discussion here. 3 tables, 17 refs. (Fachdok 12/0821)

1074. Savel'ev P
NEW FIRE-SAFETY REGULATIONS FOR INDUSTRIAL ENTERPRISES
Pozhar delo; (3):24-25, 1976

New standard fire safety regulations for all industrial enterprises in the USSR have been issued by the Main Fire Protection Administration. The new regulations govern the organization of fire protection in industry, set forth a list of fire protection measures to be taken, define responsibility for their fulfillment (directors of plants, shops, laboratories, warehouses, etc.), and establish technical fire safety requirements for the operation and maintenance of buildings, installations, production equipment, electrical systems, and heating and ventilation systems.

1075. Wenzel W
HAZARDOUS WORKING MATERIALS - THE FIRST AMENDMENT TO THE CODE ON HAZARDOUS WORKING MATERIALS
Schadenprisma; 5(2):32-36, 1976 (German)

The first amendment to the code on working materials together with the new code on places of employment, which supplements the code on working materials, became effective on May 1, 1976 (in the FRG). The working materials' code has been appreciably revised and supplemented and abrogates a number of, in part, very old regulations, which are enumerated in article 6 of the amendment. The present article treats the principal changes made in the stipulations, such as the obligation to label 495 chemicals (exceptions to this obligation are cited), and prohibition of the use of highly dangerous materials. Handling of disease-causing agents is included in the code. Also discussed are the obligations of the employer. 8 refs. (Fachdok 12/0834)

1076. Rezic D
FIRE AND EXPLOSION STATISTICS
Sigurnost; 18(1):101-110, 1976 (Serbocroatian)

The regulation for new fire and explosion statistics, which was introduced on Jan 1, 1976, in Yugoslavia, is explained. An exact and detailed picture of the fire, damage, causes and suppression tactics can be obtained by adhering to the regulation. (Fachdok 12/0925)

b. HAZARDS IDENTIFICATION

1077. Anon
STATUTORY LABELING SCHEME FOR DANGEROUS CHEMICALS
Fire; 69(854):123, 1976

Some 800 dangerous chemicals commonly used in industry, some also in the home, are covered by a statutory labeling scheme proposed on July 6, 1976, by the Health and Safety Commission (UK). The proposed labels include easily understood pictorial warnings of the hazard presented by the chemicals. The proposals incorporate all the forthcoming changes which will substantially revise the danger category awarded to some chemicals and the risk-to-safety phrases which each must carry. 1 fig.

1078. Anon
FLAMMABLE MATERIALS TRANSPORTED BY ROAD - REQUIREMENTS, INFORMATION AND ACTION
Fire Prev; (115):28-29, 1976

The different schemes for identifying the hazards of vehicle loads, such as Hazchem, UKHIS, United Nations diamond, etc., have been integrated into the composite sign known as the United Kingdom Hazard Information Composite (UKHISC) Label. An example is illustrated in the article. The pertinent legislation and regulations concerning road transport of hazards, labeling and hazard information requirements are listed on subsequent pages 30 and 31. 1 fig. (Author)

1079. Zimmermann and Kallenbach
IDENTIFICATION OF VEHICLES TRANSPORTING HAZARDOUS GOODS
Brandschutz; 30(5):122-124, 1976 (German)

The article in *Brandschutz*, 29(9) 1975, on the identification of vehicles transporting hazardous goods gave rise to two critical comments, which are printed in this article. On the one hand, the statement that "the fire service does not place any particular value on what is revealed by the Kemler number," because the number only gives a first indication of the steps to be taken at the scene of the accident, is criticized. The second comment refers to an identification system used in England, the HAZCHEM system, which competes with the Kemler system and, in the opinion of the writer, is superior to the Kemler system. The method of identification by the HAZCHEM system is explained by figures and text. 2 figs. (Fachdok 12/0722)

c. SAFE HANDLING OF HAZARDOUS MATERIALS

1080. Int Tech Inf Inst
TOXIC AND HAZARDOUS INDUSTRIAL CHEMICALS SAFETY MANUAL FOR HANDLING AND DISPOSAL WITH TOXICITY AND HAZARD DATA
Int Tech Inf Inst, Tokyo, Japan; 591 pages, 1975

This comprehensive manual lists 702 materials with synonyms, uses, properties, hazardous potentials, toxicity, handling and storage, emergency treatment and measures, hygiene precautions, and disposal and waste treatment instructions. (Author)

d. STANDARDS

1081. Kordina K and Meyer-Ottens C
FUTURE REQUIREMENTS AND TESTS FOR CONSTRUCTION MATERIALS AND COMPONENTS
DIN Mit; 55(2):72-75, 1976 (German)

12. INSURANCE, ECONOMICS OF LOSS AND PREVENTION

d. Standards—Continued

Considerable advances have been made in the development of structural fire protection by work done in the ISO, as well as nationally, since the publication of standard DIN 4102 in February, 1970. On the occasion of the appearance of five new drafts for standard DIN 4102 the authors discuss the principal innovations to be introduced in the future requirements and tests for structural materials and components. 3 tables. (Author)

1082. Hemmeter PA and Alexander G
NBS DEVELOPS HELMET STANDARD
Fire Eng; 129(7):47-48, 1976

The tentatively titled "Performance Criteria for Structural Firefighters' Helmets", a new standard being developed at the National Bureau of Standards, provides for tests of impact resistance on at least two separate points on the helmet shell, strength tests at various temperature extremes for both conducted and radiated heat, rigorous electrical insulation test, a chin strap retention system, ear flaps, and finally, a complex impact attenuation test. The NBS criteria, not yet completed, are undergoing revision during a series of conferences with representatives of the fire service, helmet manufacturers and regulatory agencies. 4 photos.

1083. Ivanov I and Vasil'ev M
NEW STANDARD: VEHICLE PAINTING, MARKING AND LIGHTS
Pozhar delo; (4):26-27, 1976 (Russian)

A new standard (GOST 21392-75) has been published for all transport vehicles of the fire service, police, emergency medical service, emergency gas service, trolley-wire service, and para-military mine rescue units. The standard governs painting schemes, markings, recognition signs, and requirements for light and acoustic signals. The requirements of the standard are discussed and listed in a table. 1 table.

1084. Braun E, Cobble VB, Helzer S, Krasny JF, Peacock RD and Stratton AK
BACK-UP REPORT FOR THE PROPOSED STANDARD FOR THE FLAMMABILITY OF GENERAL WEARING APPAREL. Nat Bureau of Standards, Center for Fire Res; NBSIR 76-1072, 50 pages, 11 figs, 4 tables, 32 refs, Jun 1976
Availability: NTIS

A *Proposed Standard for the Flammability of General Wearing Apparel* was submitted to the Consumer Product Safety Commission in February 1976. This report discusses the reasons for the choices of experimental arrangement for the flammability test and the choices of pass-fail criteria. The specimen is cylindrical, to simulate a garment, and to eliminate framed specimens, which often burn differently from garments. Criteria for the fire hazard of fabrics are the time to ignite with a specified gas flame and the heat transferred to sensors inside the burning specimen. The proposed standard specifies that fabrics which transfer little heat to the inside of the specimens could be used in all garments but would have to be used in garments which cover most of the body and/or fit loosely. They would also have to be used in children's dresses and skirts (children's nightwear is

covered by an earlier standard). Fabrics which transfer larger amounts of heat, and thus have larger injury potential, could be used in garments with normal or tight fit such as most present-day shirts, slacks, etc. If such fabrics ignite in one-half second or less, they would be excluded from use in garments. These provisions in the proposed standard were based on the need to reduce the number and severity of apparel fires with minimum economic and technological impact on the fiber, textile, and apparel industry. The present report summarizes the available knowledge in the area covered by the standard and points out areas in which additional work is indicated. (Author)

12. INSURANCE, ECONOMICS OF LOSS AND PREVENTION

a. INSURANCE

1085. Proesdorf T
INSURANCE COMPANIES REWARD COMPLIANCE WITH THEIR FIRE-PROTECTION GUIDELINES
Beratende Ing; (6):14-16, 1976 (German)

Building owners, planners and architects should be familiar with the preventive fire-protection guidelines of the insurance companies, which supplement the inadequate regulations of the building codes. The article is a survey of the building classes and the features of construction measures as well as the installations for preventive fire protection and the corresponding rate reductions granted by the insurance companies. Only industrial risks are dealt with here. 2 figs. (Fachdok 12/0879)

b. LOSSES

c. RESTORATION

1086. Tomlinson E
REINSTATEMENT OF A FIRE DAMAGED BUILDING
Fire Prev Sci Technol; (15):22-26, 1976 (English; German and French summaries)

With the soaring cost of building, the refurbishing and restoration of fire damaged buildings, which might otherwise be demolished and rebuilt, has become of economic importance. This process is described for a reinforced concrete building at the Kellogg works in Manchester (UK). The fire, in October 1967, was largely restricted to the ground story, but the columns and beams in this area were severely damaged. Structural engineers, who were called in to survey the damage, advised that restoration of this zone was possible without affecting the rest of the building. A work program was prepared and approved by the senior management. Initially electricity supplies were restored and the building cleaned up. All affected columns and beams were then either replaced or strengthened with collars of reinforced concrete. The building was completely restored in 196 days and has shown no signs of deterioration during the last seven years. 8 photos. (Author)

12. INSURANCE, ECONOMICS OF LOSS AND PREVENTION

d. RISK MANAGEMENT

1087. Alvares NJ
TRADEOFFS BETWEEN RESIDENTIAL AND INDUSTRIAL FIRE PROTECTION FOR ULTIMATE PUBLIC SAFETY. Univ of California (Livermore), Lawrence Livermore Lab; UCRL-77754, 25 pages, 8 figs, 2 tables, 6 refs, Jun 1976

In 1975, fire losses in the United States totaled about 0.25% of the GNP, or 4.4 billion dollars. Statistics on distribution of fire types show that 30% involve residential dwellings; 15% industrial, institutional, and educational buildings; 21% are due to transportation-related factors; and the remaining 38% include forest, grassland, and rubbish fires. These statistics show that industrial and public facilities account for almost 50% of the financial loss statistics, while residential and transportation losses amount to 36 and 11% of the total, respectively. More than 60% of the fire fatalities are attributed to building fires, and of these, almost 90% occur in private residences.

This brief survey reveals that a relatively small number of fires are responsible for the major dollar losses, and the major loss of life in fires results from residential fires, where the number of fatalities per fire are relatively small.

Can technology be applied to reduce either the financial disaster incurred during industrial fires, or the life loss in residential fires? The evidence indicates that residential fire mortality will not be significantly reduced by technical solutions. However, there is also the potential for large life loss in industrial fires, and these could be reduced significantly by technical solutions. Therefore, increased efforts to secure the optimum amount of industrial fire protection could certainly reduce our financial losses, and possibly protect more lives. (Author)

e. SALVAGE

13. STATISTICS

1088. Mython de JL
FIRES AND STATISTICS
Face au Risque; (120):13-16, 1976 (French)

After summarizing the eight disastrous major fires of 1974 the author compares the situation in France with that in other countries. He then gives statistical reviews of residential, shop and factory fires as well as other major and minor fires, arranged by year and month since 1960, and compares the characteristic data, such as area, population density, number of fires per inhabitant and km² per year, etc. for Great Britain, France, Japan, Switzerland, and the USA. The concluding section contains a survey of the principal major fires of 1975 in France with respect to factory and shop fires. 3 figs, 3 tables. (Fachdok 12/0671)

1089. Chandler SE and Baldwin R
FURNITURE AND FURNISHINGS IN THE HOME - SOME FIRE STATISTICS
Fire Mater; 1(2):76-82, 1976

A statistical study of fires in the United Kingdom involving the ignition of furniture and furnishings is presented. This paper examines the data for one year (1970). The analysis shows that in fires starting in furniture and furnishings the chance of a fatality is over twice that in other domestic fires. The majority of furniture fires involve upholstery or bedding and over 90% were started by smokers' materials, electric appliances, space heating or as the result of the activities of children or suspected arsonists. Eighty-five per cent of the fatalities were found in the room of origin of the fire. Eighty per cent were overcome by smoke or toxic gases. Sixty per cent of the fatalities were either under 5 or over 65 years of age. Monetary values are assigned for damage, casualties and deaths in fire. These costs can be used to assess the value of fire precautions. With the values taken, the total losses in furniture fires in the home amounted to \$19 million in 1970. Life loss accounted for the major part of this sum. The expected annual loss per dwelling as a result of the ignition of furniture is thus only about \$1, and is only \$3 for all dwelling fires. This low figure suggests an approach of either selective spending on those most at risk (the elderly and handicapped) or by government activity through publicity and education. 11 tables, 9 refs. (Author)

1090. Kawasaki A
FIRES RESULTING FROM ELECTRICAL EQUIPMENT DEFECTS
Kasai; 25(4):225-226, 1976 (Japanese)

Statistical data are cited to characterize the growing number of fires resulting from incorrect handling of domestic electrical appliances or from defects stemming from underdesign and low-quality workmanship. In 1974 the number of such fires among nonindustrial fires reached 90%. One of the most frequent causes of such fires is short-circuiting. A detailed description is given of the causes, circumstances, course and consequences of typical fires of this kind that occurred in Tokyo in January of 1975. The first fire occurred when the batteries of electric wall clocks were being recharged. The charging was accomplished by means of a built-in transformer from an a-c network. The battery was connected to the network throughout the night without supervision (in accordance with the instructions for using the clocks). The cause of the second fire was a defect in an automatic fuse, which did not cut off the voltage when the load (for high-power electrical appliances) greatly exceeded the permissible value. 3 figs. (RZh)

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EXPANSIONS OF JOURNAL ABBREVIATIONS

Accid Anal Prev ... Accident Analysis and Prevention	[Consulting Engineers]
Acta Univ Upsaliensis. Acta Universitatis Upsaliensis [Transactions of Uppsala (Sweden) University]	Bezop ekspluat elektromekh oborud v shakhtakh..... Bezopasnost ekspluatatsii elektromekhanicheskogo oborudovaniya v Shakhtakh [Safety of Operation of Electromechanical Equipment in Mines]
Adv Fire Retard Text, Prog Fire Retard Ser Advances in Fire Retardant Textiles, Progress in Fire Retardancy Series	Bezop tr prom-sti ... Bezopasnost truda v promyshlennosti [Occupational Safety in Industry]
Allg Forstztg ... Allgemeine Forstzeitung [General Forestry Gazetteer]	Brandaus..... Brandaus [All Out]
Amts Mitteilungsbl Bundesanst Materialpruef ... Amts- und Mitteilungsblatt der Bundesanstalt fuer Materialpruefung [Official Gazette and Communications of the Federal Bureau for Materials Testing]	Brandforsvar . Brandforsvar [Fire Protection]
Anesth Analg ... Anesthesia and Analgesia	Brandforsvar, PoU-Brand ... Brandforsvar, PoU-Brand [Fire Protection, Research Bulletin]
Ann Surg Annals of Surgery	Brandhilfe.. Brandhilfe [Fire Assistance]
Antincendio protez civ Antincendio e Protezione Civile [Fire and Public Protection]	Brandschutz ... Brandschutz [Fire Protection]
Apave.. Revue technique du groupement des associations de proprietaires d'appareils a vapeur et electriques [Technical Review of the Group of Associations of Steam and Electrical Equipment Owners]	Brandvaern.. Brandvaern [Fire Protection]
Appl Ergon Applied Ergonomics	Brandverhuetung... Brandverhuetung [Fire Prevention]
Arch Mal Prof Med Trav Secur Soc... Archives des Maladies Professionnelles, de Medecine du Travail et de Securite Sociale [Archives of Professional Diseases, Industrial Medicine and Public Safety]	Brauwelt..... Brauwelt [Brewing World]
Arch Thermodyn Spal... Archiwum termodynamiki i spalania [Archives of Thermodynamics and Combustion]	Bull mens Chambre Commerce ind Meurtheet-Moselle Bulletin mensuel de la Chambre du Commerce Industriel de Meurtheet-Moselle [Monthly Bulletin of the Industrial Chamber of Commerce of Meurtheet-Moselle]
ASCE Proc. J Struct Div American Society of Civil Engineers. Proceedings. Journal of the Structural Division	Cah Cent Sci Tech Batim Cahiers du Centre Scientifique et Technique du Batiment [Communications of the Scientific and Technical Building Center]
ASHRAE J ... American Society of Heating, Refrigerating and Air-Conditioning Engineers Journal	Chem-Ing-Tech .. Chemie-Ingenieur-Technik [Chemistry-Engineer-Technology]
ASME Trans. Ser C. J Heat Transfer American Society of Mechanical Engineers. Transactions. Series C. Journal of Heat Transfer	Chem Tech ... Chemische Technik [Chemical Engineering]
ASME Trans. Ser H. J Eng Mater Technol American Society of Mechanical Engineers. Transactions. Series H. Journal of Engineering Materials and Technology	Combust Flame..... Combustion and Flame
BBC-Nachr .. Brown-Boveri und Compagnie - Nachrichten [Bulletin of the Brown-Boveri Company]	Combust Sci Technol .. Combustion Science and Technology
Beratende Ing..... Beratende Ingenieure	Constr Specifier.. Construction Specifier
	Cour Norm .. Courrier de la Normalisation [Standardization Bulletin]
	Densetsu kogyo Densetsu kogyo [Electrical Construction Engineering]
	Dimensions/NBS..... Dimensions/National Bureau of Standards
	DIN Mitt.. Deutsche Industrie-Normen Mitteilungen [German Standards Bulletin]
	Diteru.....Diteru [Detail: Magazine for Architects and Engineers]
	Draegerheft.... Draegerheft [Draeger Bulletin]
	Dtsch Ausschuss Stahlbeton..... Deutscher Ausschuss fuer Stahlbeton [German Reinforced Concrete Committee]

EXPANSIONS OF JOURNAL ABBREVIATIONS

Dtsche Farben Z ... Deutsche Farben-Zeitschrift [German Paint Journal]	Digest/Materiels Nouveaux et Techniques Mondiales/Ingenieur Digest]
Electr Commun .. Electrical Communication	Instrum Technol .. Instrumentation Technology
Electron Ind Electronics in Industry	Internat Fire Chief .. International Fire Chief
Electron Power Electronics and Power	ISA Trans Instrument Society of America. Transactions
Elektrotech Z ... Elektrotechnische Zeitschrift [Electrotechnical Journal]	J Am Med Assoc .. Journal of the American Medical Association
Elektr Stn Elektricheskiye Stantsii [Electrical Power Stations]	J Br Fire Serv Assoc and Ind Fire Prot Assoc .. Journal of the British Fire Service Association and the Industrial Fire Protection Association
Eng Min J Engineering and Mining Journal	J Chem Educ .. Journal of Chemical Education
Environ Health Perspect ... Environmental Health Perspectives	J Combust Toxicol . Journal of Combustion Toxicology (Quarterly Supplement to the Journal of Fire and Flammability)
Exchange Exchange	J Consumer Prod Flammability . Journal of Consumer Product Flammability (Quarterly Supplement to the Journal of Fire and Flammability)
Face au Risque.... Face au Risque [Facing the Risk - Journal of the French National Prevention and Protection Center]	J Fire Flammability . Journal of Fire and Flammability
FeuerwehrDie Feuerwehr [The Fire Service]	J Fire Retard Chem Journal of Fire Retardant Chemistry (Quarterly Supplement to the Journal of Fire and Flammability)
Fire Fire	J For Journal of Forestry
Fire Chief Fire Chief	J Mines Met Fuels Journal of Mines, Metals and Fuels
Fire Command Fire Command	J Occup Med Journal of Occupational Medicine
Fire Eng Fire Engineering	J Pediatr Journal of Pediatrics
Fire Eng J Fire Engineers Journal	J Polym Sci: Polym Chem Ed ... Journal of Polymer Science: Polymer Chemistry Edition
Fire Internat Fire International	J Polym Sci: Polym Lett Ed ... Journal of Polymer Science: Polymer Letters Edition
Fire J Fire Journal	J Prestr Concr Inst Journal of the Prestressed Concrete Institute
Fireline..... Fireline	J Soc Automot Eng Jap Journal of the Society of Automotive Engineers of Japan
Fire Mater..... Fire and Materials	KasaiKasai [Journal of the Japanese Association of Fire Science and Engineering]
Fire Prev Fire Prevention	Keisoku jido seigyo gakkai ronbunshu ..Keisoku jido seigyo gakkai ronbunshu [Transactions of the Society of Instrument and Control Engineers]
Fire Prev Sci Technol ... Fire Prevention Science and Technology	Khim prom .. Khimicheskaya Promyshlennost [Chemical Industry]
Fire Prot Rev Fire Protection Review	Koatsu gasu .. Koatsu gasu/Journal of the Institute of Safety in High Pressure Gas Engineering (Japan)
Fire Technol Fire Technology	Kuki tyowa to reito ..Kuki tyowa to reito [Air Conditioning and Refrigeration]
For Sci Forest Science	Kunstst Kunststoffe [Plastics]
Fune no Kagaku.... Fune no Kagaku [Marine Engineering]	Kunstst Plast Kunststoffe-Plastics
Glueckauf Forschungsh.... Glueckauf-Forschungshefte [Glueckauf Research Journal]	Lakokrasoch materialy i ikh primeneniye Lakokrasochnyye materialy i ikh primeneniye [Paints and Varnishes]
Gorno spatat delo ... Gorno-spatatel'noye delo [Mine Rescue]	
Hansa... Hansa [Journal of Shipping, Ship Construction and Harbors]	
Hessische Feuerwehr Z... Hessische Feuerwehr-Zeitschrift [Hessian Fire Service Journal]	
Hydrocarbon Process . Hydrocarbon Processing	
IEEE Proc ... Institute of Electrical and Electronics Engineers. Proceedings	
IEEE Trans Biomed Eng Institute of Electrical and Electronics Engineers. Transactions on Biomedical Engineering	
Ind Digest . Industrie Digest [Industrial Digest]	
Ind Eng..... Industrial Engineering	
Ind Eng Chem Prod Res Dev Industrial and Engineering Chemistry, Product Research and Development	
Ind Vernice Industria della Vernice [Varnish Industry]	
Inf Process Manage .. Information Processing Management	
Ing Digest.. Ingenieur Digest [Engineer's	

EXPANSIONS OF JOURNAL ABBREVIATIONS

and Their Application]	Rev Sci Instrum..... Review of Scientific Instruments
Maschinenmarkt. Maschinenmarkt [Machinery Market]	Rubber Age Rubber Age
Maschinenschaden Maschinenschaden [Machine Failure]	Sb Tr VNII protivopozhar cborony Sbornik Trudov Vsesyuznogo Nauchno-Issledovatel'skogo Instituta Protivopozharnoy Oborony [Digest of Papers of the All-Union Fire Protection Research Institute]
Melliand Textilber Melliand Textilberichte [Melliand Textile Journal]	Schadenprisma..... Schadenprisma [Damage Prism - Journal of Damage Prevention and Research]
Mitt Inst Wasserbau Univ Stuttgart.. Mitteilungen des Instituts fuer Wasserbau der Universitaet Stuttgart [Communications of the Hydrological Institute of Stuttgart University]	Schweiz Feuerwehr Z Schweizerische Feuerwehr Zeitung [Swiss Fire Protection Journal]
Mod Plast..... Modern Plastics	Science Science
Nat Saf News National Safety News	Seewirtsch Seewirtschaft [Maritime Affairs]
Nav Eng J Naval Engineers Journal	Sharyo to Denki . Sharyo to Denki (Japan) [Railway Car and Electric Equipment]
Nav, ports, chant..... Navires, Ports et Chantiers [Ships, Ports and Yards]	Sichere Arb..... Sichere Arbeit [Labor Safety]
Not AICAP Notizario AICAP	Siemens Rev..... Siemens Review
Nuclear Saf..... Nuclear Safety	Siemens Z .. Siemens Zeitschrift [Siemens Journal]
Ohm: denki zasshi. Ohm: denki zasshi [Ohm Journal]	Sigurnost..... Sigurnost [Safety]
Offshore Serv Offshore Service	Stahl Eisen .. Stahl und Eisen [Steel and Iron]
Oper Res Operations Research	Sud Med Ekspert.... Sudebno-Meditsinskaya Ekspertiza [Expertise in Forensic Medicine]
Paper Technol..... Paper Technology	Surg Clin North Am .. Surgical Clinics of North America
Plast Technol..... Plastics Technology	Surg Forum Surgical Forum
Polizei Tech Verkehr .. Polizei-Technik-Verkehr [Police and Traffic Safety Engineering Journal]	Tech Mod Technique Moderne [Modern Technology]
Poly Eng Sci ... Polymer Engineering and Science	Technocrat (Japan) . Technocrat (published in English)
Pozhar delo . Pozharnoye Delo [Firefighting]	Telecommun J .. Telecommunication Journal
Pozhar okhrana . Pozharnaya okhrana [Fire Protection]	Text Chem Color Textile Chemist and Colorist
Prakt Anaesth Praktische Anaesthesie [Practical Anesthesiology]	Text Inst Ind Textile Institute and Industry
Prof Saf Professional Safety	Text Res J Textile Research Journal
Prom energ Promyshlennaya energetika [Industrial Power]	Tr Inzh-ekon Fak Rzh Politekhn In-ta ... Trudy Inzhenerno-Ekonomicheskogo Fakul'teta Rzhskogo Politekhnicheskogo Instituta [Transactions of the Faculty of Engineering Economics of the Riga Polytechnic Institute]
Prot Civ Secur Ind . Protection Civile et Securite Industrielle [Public Protection and Industrial Security]	Tr Vost NII po bezop rabot v gorn prom-st ..Trudy Vostochnogo Nauchno-Issledovatel'skogo Instituta po bezopasosti rabot v gornoy promyshlennosti [Transactions of the Eastern Scientific Research Institute for Industrial Safety in the Mining Industry]
Protivopozarna Zastita..... Protivopozarna Zastita [Fire Protection]	Unser Brandschutz. Unser Brandschutz [Our Fire Protection]
PTT Tech Mitt.... Technische Mitteilungen der Schweizerischen Post-, Telephon- und Telegraphenbetriebe [Technical Information Journal of the Swiss Postal, Telephone and Telegraph Service]	Vet Med Small Anim Clin..... Veterinary Medicine and Small Animal Clinician
Publ Pers Manage Public Personnel Management	VFDB Z .. Zeitschrift der Vereinigung zur Foerderung des Deutschen Brandschutzes [Journal of the Association for the Advancement of Fire Protection in Germany]
R/D..... Research and Development	
Q Rep Railw Tech Res Inst (Japan) Nihon Kokuyu Tetsudo Gijutsu Kenkyusho [Quarterly Reports of the Railway Technical Research Institute (published in English)]	
Rep Fire Res Inst Japan . Shobo Kenkyushu Hokoku [Reports of the Fire Research Institute of Japan]	
Rep Fire Sci Lab (Japan) ... Shobo Kagaku Kenkyushoho [Reports of the Fire Science Laboratory]	
Rev Belge Feu .. Revue Belge du Feu [Belgian Fire Review]	

EXPANSIONS OF JOURNAL ABBREVIATIONS

Vopr ekon pozhar okhrane	Voprosy ekonomiki v pozharnoy okhrane	draulics and Pneumatics]
[Problems of Economics in Fire Protection]		Zentralbl Arbeitsmed Arbeitsschutz
West J Med... Western Journal of Medicine		... Zentralblatt fuer Arbeitsmedizin und Arbeitsschutz [Journal of Industrial Medicine and Occupational Safety]
Yuatsu Gijutsu .. Yuatsu gijutsu [Hydraulics and Pneumatics]		ZS Magazin.... Zivilschutz Magazin [Civil Defense Journal]
Yuatsuka sekkei Yuatsuka sekkei [Hy-		

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