DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

AND

FIRE OFFICES' COMMITTEE

JOINT FIRE RESEARCH ORGANIZATION

FIRE RESEARCH NOTE

NO. 574

FIRE PROTECTION SERVICES IN THE U.S.S.R.

November 1964

Fire Research Station.
Boreham Wood.
Herts.
('phone ELStree 1341)

F.R. Note No. 574

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During May, 1964, the State Committee for the Co-ordination of Scientific Research in the U.S.S.R. agreed to receive a delegation from the Department of Scientific and Industrial Research to exchange information on fire research. So that the exchange should cover as wide a field as possible, Her Majesty's Chief Inspector of Fire Services and the Director of the Fire Protection Association were invited to join the party from the Fire Research Station, the final representation being:-

Mr. D. I. Lawson, Director, Joint Fire Research Organization.

Mr. H. M. Smith, H.M. Chief Inspector of Fire Services.

Mr. N. C. Strother Smith, Director, Fire Protection Association.

Mr. K. N. Palmer)
Mr. G. J. Langdon-Thomas) Joint Fire Research Organization.

The visit was to last a fortnight and after indicating the topics we would like to discuss the itinerary was left to the host country. In September we visited three cities - Moscow, Leningrad and Volgograd (Stalingrad). Two-and-a-half days were spent discussing various aspects of research and testing and the rest of the time was devoted to general fire matters, visits to plant, etc.

TIMETABLE

Moscow

September 7 — Meeting with officials of Directorate of Fire Protection, Russian Federative Republic Ministry of the Maintenance of Public Order (equivalent to the Home Department in Great Britain) and of All-Russian Voluntary Fire Protection Association. Visit to Moscow State University.

November, 1964.

September 8 — Meeting with officials of Moscow Fire Protection Directorate and Moscow Voluntary Fire Protection Association.
Visits to Ordzhonikidze factory, and to view fire-fighting equipment and appliances.

September 9 — Meeting at Faculty of Engineers of Fire Protection.
Viewing films on fire protection.

September 10 — Sightseeing.

September 11 — Visit to Central Scientific Research Institute for Fire Protection.

Leningrad

September 12 — Meeting with officials of Leningrad Fire Protection Board and Voluntary Fire Protection Association. Visits to Leningrad Fire Testing Station and Fire Technical Exhibition. Viewing films on fire protection.

September 14 — Meeting at Leningrad Fire Technical School.
Visit to Junior Voluntary Fire Brigade.

September 15 — Sightseeing.

Volgograd

September 16 — Visit to Volzhskaya hydro-electric power station. Visit to Volgograd Central Fire Station (H.M. Chief Inspector of Fire Services).

September 17 — Meeting with officials of Ministry of the Maintenance of Public Order and Volgograd Fire Protection Board.

Moscow

September 18 — Meeting with officials of Ministry of the Maintenance of Public Order, All-Russian Voluntary Fire Protection Association, Moscow Fire Protection Directorate, Moscow Voluntary Fire Protection Association, Central Scientific Research Institute for Fire Protection.
Meeting with Assistant Minister, Ministry of the

Maintenance of Public Order, and Assistant Minister of Foreign Affairs, Russian Federative Republic.

September 19 Depart for London.

PEOPLE INTERVIEWED

Major General I. M. Zemskii	Chairman, Directorate of Fire Protection, Russian Federative Republic Ministry of the Maintenance of Public Order.
Engineer Lieutenant Colonel A. K. Mikeev	Assistant to Chairman.
Mr. N. A. Viktorov	Head of Technical Department of Fire Protection Ministry of the Maintenance of Public Order.
Mr. P. M. Bogdanov	Chairman, All-Russian Voluntary Fire Protection Association.
Mr. R. A. Perelyet	United Kingdom desk, Foreign Relations Department, U.S.S.R. State Committee for Co-ordination of Scientific Research.
Mr. I. N. Troitskii	Chief, Moscow Fire Protection Directorate.
Mr. K. S. Krichiverov	President, Moscow Voluntary Fire Protection Association.
Mr. V. F. Obukhov	Deputy Director, Higher Educational Establishment of Fire Protection Engineers.
Mr. A. N. Smurov	Director, Central Scientific Research Institute for Fire Protection.
Mr. I. V. Ryabov	Deputy Director.
Mr. B. I. Konchaev	Chief, Leningrad Fire Protection Board.
Mr. V. M. Sokolov	Assistant Chief.
Mr. M. E. Yurko	Chairman, Leningrad Voluntary Fire Protection Association.
Mr. B. W. Megorcky	Head, Leningrad Fire Testing Station.

Mr. M. P. Zacharov	Head, Leningrad Fire Technical School.
Mr. I. A. Glebov	Chief, Volgograd region, Ministry of the Maintenance of Public Order.
Mr. - Fomin	Chief, Volgograd Fire Protection Board.
Mr. A. V. Kuzeev	Assistant Minister, Ministry of the Maintenance of Public Order.
Mr. U. I. Volsky	Assistant Minister of Foreign Affairs, Russian Federative Republic.

PROFESSIONAL FIRE BRIGADES

RUSSIAN FEDERATIVE REPUBLIC

The Russian Federative Republic is one of fifteen which together constitute the U.S.S.R. It is the republic with the largest population, 121 million (about two-thirds that of the U.S.S.R.) and covers 17 million square kilometres, extending from Leningrad in the west to Vladivostock in the east, and from the northern coast to the Caucasus in the south. Its greatest width is 10 000 kilometres and it is divided into 72 administrative regions.

Each region has a Council controlling the Fire Protection Department and the fire brigades are administered by these departments. The regions are further sub-divided into districts each having an Inspectorate of Fire Protection.

The fire brigades have two functions: fire prevention and fire extinction. The fire prevention function includes inspection and the compiling of standards or Fire Codes in which the results of research are taken into account.

Building work is governed by the State Construction Committee, on which the Inspectorate of Fire Protection is represented, and the designs for new buildings must be approved by the Committee, the tendency being towards standardized designs. Buildings are inspected during construction to ensure that they are being built to specification, and if the standards are ignored, fines can be imposed up to £2 per worker and even more important, the work may be stopped.

MOSCOW FIRE BRIGADE

The Brigade is responsible for an area of 886 square kilometres containing a population of 6.4 million. Altogether there are 86 million square metres of living space, and this area is increasing annually by 5 million square metres. The public buildings with which the Brigade is concerned include 900 schools, 91 cinemas, 23 theatres and 53 museums.

The city is divided into 17 administrative districts, with two fire stations per district. There are about 3 000 professional firemen in the Brigade (i.e. about 4.5 firemen per 10 000 population). They are on duty for 24 hours followed by 48 hours off duty and facilities for resting between 11 p.m. and 6 a.m. are provided. The telephone is used for calling the Brigade either by using a special button in public kiosks or by dialling 01. The numbers of false calls are so low that no records are kept. Each station has at least two appliances: a water tender and a self-propelled pump. Low pressure sprays are used but high pressure fog is not, although it was thought that a combined appliance might be useful.

Fire hydrants are usually spaced 80 - 100 metres apart, and their positions are indicated on nearby walls. The distance between hydrants and buildings is governed by regulations.

LENINGRAD FIRE BRIGADE

The city has a population of 3.6 million and is divided into 19 administrative districts having one or two fire stations in each. There are 24 stations altogether, and they are manned by 1 200 professional firemen, i.e. 3.3 per 10 000 population. They also work a 24-hour shift, followed by 48 hours off. It was estimated that 80 per cent of their time is spent on fire prevention, and the remainder on fire extinction and matters pertaining to this.

One interesting piece of apparatus which we saw in Leningrad was an oxygen breathing apparatus weighing about 30 lb. The oxygen was compressed to 200 atmospheres in a cylinder having a capacity of 2 litres. Oxygen was delivered at a rate of 1.1 - 1.3 l/min; this is considerably lower

than that of British sets. The equipment was stated to have a duration of 4 - 6 hours but it was thought to be rather heavy and work was in hand to lighten and simplify it. The latest apparatus is general use (KIP7) had a duration of 1 - 2 hours.

VOLGOGRAD FIRE BRIGADE

Volgograd, formerly Stalingrad, is being entirely rebuilt and at present has a population of 600 000. The Fire Brigade has six stations and a strength of 352 professional firemen, about 6 per 10 000 population.

ALL-RUSSIAN VOLUNTARY FIRE PROTECTION ASSOCIATION

In addition to the professional fire service, there are also the Voluntary Fire Brigades within the All-Russian Voluntary Fire Protection Association; these have no counterpart in the United Kingdom.

The aims of the Association are to prevent fire, to extinguish fires where there is no professional brigade as on farms, to form industrial fire brigades and to assist with fire propaganda, such as posters, films and press notices. It has 4 million members (including 92 000 young firemen aged between 12 and 18 years) in 80 000 primary voluntary organizations which are run by Councils elected locally. The membership fee is 10 kopecks (about 10d) per annum and additional income is obtained from the State and from the earnings of 22 000 full-time civilian employees. The total income is about 50 million roubles (£20 million) per annum.

The full-time employees earn income by various activities, such as cleaning chimneys, recharging fire extinguishers, impregnating clothes and fabrics with fire-retardant materials, installing lightning conductors and spark arresters and repairing fire equipment. There are strong social pressures to join the Voluntary Fire Protection Association. It was explained that with State ownership it was only good citizenship to want to protect communal property.

MOSCOW VOLUNTARY FIRE PROTECTION ASSOCIATION

There are now 227 000 members in 6 600 primary organizations within the Association, which was founded in 1857. There are 4 000 separate voluntary brigades, which actively participate in fire-fighting, attached to specific organizations such as factories, hotels and hospitals. A further 400 junior brigades contain 11 000 members.

The main purpose of the primary organizations, which are spread throughout the city, is publicizing the causes of fire.

Members of the voluntary brigades are given certain privileges which include 6 days more leave per annum from their places of employment, a special uniform for those participating in fire-fighting, and the opportunity to attend courses of instruction.

LENINGRAD VOLUNTARY FIRE PROTECTION ASSOCIATION

The membership is 235 000 and is divided into 50 fire commands. The activities of the Association are similar to those of the Russian Federative Republic. One difference is that each school in Leningrad has its own voluntary brigade, and the teachers also instruct the children aged between 7 and 12. In addition, posters and films are regularly shown in the schools. We were impressed by the enthusiasm of the Junior Voluntary Fire Brigade in Leningrad. It has its own fire appliance and fire station equipped with fire detectors, sprinklers and a telephone. The Brigade demonstrated its ability to extinguish a fire in a shed with great efficiency.

TRAINING ESTABLISHMENTS

FACULTY OF ENGINEERS OF FIRE PROTECTION

The Faculty was founded in Leningrad in 1933 but was subsequently transferred to Moscow. It received its present status in 1957, and is responsible to the Ministry of Higher Education.

The students must have a High School education and must also have worked for three years in the fire service before entry. The full-time courses last for four years or alternatively, it is possible to take a

five-year correspondence course. (The correspondence courses attracted about 50 entrants when they were started, but recently members have risen). There is no age limit for entry but an examination has to be passed before a course can be taken. About 45 qualified men are produced each year. Altogether, the internal students are given 4 000 hours of instruction of which half is devoted to practical work. The syllabus is made up of Social sciences - 9 per cent, General technical subjects - 32 per cent, Building construction - 20 per cent and Fire prevention and safety technique - 39 per cent.

A number of the text-books are written by teachers of the faculty. The standard of the laboratories is high, with facilities for advanced experiments in physics and chemistry. There is good use made of models to demonstrate different methods of construction in building, the operation of industrial plant and for the display of different fire situations. The wall space is extensively used for charts, photographs of visits by personalities, fire-applied sports or notable fires. The charts are very good and are well illustrated, each one either describing equipment or giving information on fire protection. Institutes have boards of honour on which are displayed photographs of contemporary students and staff who are considered to be meritorious. This seems to be general practice even in factories.

The Faculty is divided into six departments:-

(i) General technical sciences: higher mathematics, physics, theoretical mechanics, engineering construction.

(ii) Fire prevention in construction: safety techniques, codes, fire prevention in heating and ventilation systems, fundamentals of heat transmission.

(iii) Fire prevention in technological processes: oil and chemical industries, aspects of automation.

(iv) Fire prevention in electrical equipment and installations.

(v) General and special chemistry: combustion.

(vi) Fire technique: hydraulics, fire tactics, roof venting.

LENINGRAD FIRE TECHNICAL SCHOOL

The School was started in 1906 but up to the Revolution in 1917 only 117 students in all had been accepted. The present annual rate of graduation is about 150 and the school receives students from all over the Russian Federative Republic. Students enter from school, at the age of 17 to 18, and study full-time for three years or they can take correspondence courses. The latter students come into Leningrad twice yearly for examinations at State expense. There are about 500 correspondence students at present. As in Moscow, the internal student gets a total of 4 000 hours' tuition, half of which is practical training. On satisfactory completion of the course a Diploma of Middle Technical Education is awarded. The students, when qualified, are attached to brigades as officers in charge of watches or as fire prevention inspectors.

The syllabus is as follows:
(i) Higher mathematics, (ii) Fire prevention: technological processes, construction, electrical, (iii) Applied hydraulics, (iv) Fire tactics, (v) Organization of fire brigades, (vi) Fire-applied sports and (vii) Physical training.

The School is proud of its Library, which contains 100 000 volumes. Besides technical books there are substantial collections of works on literature, sociology and politics. Two thousand books are by British authors popular in Russia and these include Shakespeare, Dickens, Galsworthy and Jerome K. Jerome.

The School also provides courses for Junior Fire Inspectors to train eventually as Commanders. The entrants are generally drawn from fire brigades, but school-leavers can also be taken. The courses run for 9 months.

OTHER VISITS

ORDZHONIKIDZE PLANT

This plant manufactures machine tools. It is well-equipped with modern automatic machinery and the work turned out seems to be of a very high quality. The lay-out is different from British factories in that

the density of plant is higher in relation to the floor space. Great use is made of safety posters, particularly those relating to fire precautions and the standard of housekeeping would compare well with most British factories. Smoking is permitted. There is no evidence of sprinklers or fire detectors but extinguishers are provided and these carry maintenance tags.

We were invited to sound the alarm at a central point and within a minute, a fire engine turned out with a crew of four dressed for fire-fighting; these workers would normally be engaged on production. No serious fire had ever occurred in the factory and the fire engine had not been used apart from practice drills.

VOLZHSKAYA HYDRO-ELECTRIC POWER STATION

The Volzhskaya Power Station lies a few miles from Volgograd and is one of a number of stations in the Volga scheme. The head of water is small (some 70 ft) and the generators have therefore to be capable of working with a large through-put at this small head. The turbines producing a total output of 2 600 MW, rotate at about 1 rev per second generating current at 13 kV which is subsequently stepped up to 500 kV for transmission to Moscow. Direct current transmission is not yet used on this line but pilot experiments are to begin shortly on one of the 22 generators. The turbine blades are of variable pitch, each blade weighing about 18 tons. The rotor has a diameter of about 45 ft. The oil temperature in the rotor hydraulic system, the rotor and its field are continuously monitored so that an alarm can be given long before any dangerous build-up of temperature occurs. Any incipient plant failure is displayed on a huge illuminated board in the hall showing the number of the faulty generator. The 22 generators are below the general level of the generator hall and can be physically isolated from each other by fire-stop doors. Fire-fighting hydrant connections are provided for each generator. The whole of the plant runs almost automatically and only 14 shift engineers look after this mammoth concern, the main hall

of which is nearly half-a-mile long.

MOSCOW UNIVERSITY

Moscow University, completed in 1953, now has 25 000 students; 6 000 live in rooms in the University itself and another 4 000 in rooms nearby. The University has its own fire brigade and a pumping system designed by the students provides water for fire-fighting throughout. The spire is nearly 800 ft high and the main facade nearly 1 500 ft long.

FIRE STATISTICS

RUSSIAN FEDERATIVE REPUBLIC

The annual total number of fires in the Republic was stated to be about 19 500. This total excludes fires in chimneys, forests, ships at sea and trains in motion. It corresponds to 0.16 fires per 1 000 population per annum. For comparison, the United Kingdom total in 1962 was 167 000 fires, or 3.1 fires per 1 000 population.

The direct fire loss in 1963 was given as 17 million roubles, i.e. £6.8 million which is equivalent to £56 per 1 000 population. The United Kingdom fire loss in 1962 was estimated as £56 million, or £1 040 per 1 000 population.

The annual rate of fatalities in fire is about 150, i.e. about 1.2 persons per million population. In the United Kingdom in 1962 the total fatalities were 667, corresponding to a rate of 12.6 persons per million population.

It was estimated that 35 per cent of fires caused no significant damage or loss.

MOSCOW

The total number of fires in 1961 was 1 015, which corresponds to a rate of 0.16 fires per 1 000 population which is the same as for the Russian Federative Republic. For comparison, the London figure for 1962 was 4.2 fires per 1 000 population.

The majority of the fires in Moscow, 69.4 per cent, are small and are called 'ignitions'. The proportion of the total is about twice that

for the Russian Federative Republic. The Voluntary Brigade extinguishes 17.4 per cent of the fires before the arrival of the professional brigade.

The causes of fires are summarized in Table 1.

Table 1

Distribution of causes

Cause of fire	No. of fires
Careless adults	306
Careless children	171
Heating installations and irons	138
Lightning	3
Others	212

LENINGRAD

In 1963 the total number of fires was 338, which is a rate of 0.094 fires per 1 000 population. This rate is substantially less than in Moscow and the Russian Federative Republic. In addition, the number of fires in Leningrad are diminishing annually in spite of the growth of industry. The annual direct fire loss is given as 48 000 roubles (£19 200), which is a rate of £5.3 per 1 000 population. This rate is only about one-tenth of the stated loss for the Russian Federative Republic as a whole.

It was estimated that 50 per cent of the fires were extinguished by the Voluntary Brigade, or by the general public, and only 8 per cent of fires were serious which would mean that only one or two serious fires per annum were attended from any one fire station.

About 80 per cent of fires occur in buildings. A summary of causes of fires is given in Table 2 and their location in Table 3. Fires due to the carelessness of adults and children represent about half the total; a similar figure was given in Moscow.

Table 2

Causes of fires in Leningrad

Cause of fire	Percentage of total fires
Carelessness, general	45
Lightning	19
Domestic electricity	13
Chimneys and stoves	12
Careless children	7
Welding, electric or gas	4

Table 3

Location of fires in Leningrad

Location of fire	Percentage of total fires
Inside domestic buildings	46
Inside industrial buildings	13
Rural areas, farms	5.4
Offices	20.1
Construction sites, temporary buildings	7
Cinemas, theatres, hospitals	5
Shops, warehouses	3.5

In both 1963 and 1964 (to date) there had been only one fire in an ocean-going ship in Leningrad and it was estimated that about 25 - 30 ships could be tied up at any given time.

FIRE RESEARCH

The Central Scientific Research Institute for Fire Protection, Moscow, is the centre of fire research in the U.S.S.R., and was founded in 1937. Its main lines of activity are (i) Fire prevention, (ii) New methods of fire extinguishing, (iii) Applied hydraulics, (iv) Automatic equipment for fires,

(v) Fire detection and (vi) Fireproof properties of materials.

The Institute is responsible to the Ministry of the Maintenance of Public Order and is governed by a Scientific Technical Council of 30 members who represent the Ministry and other interested organizations. Its income is 150 - 200 thousand roubles (£60 - 80 000), half of which is provided by the State budget and the remainder by organizations interested in specific items of work. The staff number about 130.

The types of work undertaken are scientific research, consultation, standardization, and testing for industrial organizations (on a fee-paying basis if of specific interest only). In addition liaison is maintained with the 20 Fire Testing Stations distributed throughout the U.S.S.R. (p.17). Two topics in particular were mentioned in this context - extinction of large-scale timber fires and the extinction of ship fires by high expansion foam. The results of work are published in information bulletins, the magazine 'Fire Service', technical journals, newspapers, and on radio and television. Text-books are written, which are used in the training of firemen. No annual report is issued.

The Institute has six main sections:-

(i) Chemical: properties of combustible materials, dusts, flash points.

(ii) Fire technique: causes, electrical apparatus.

(iii) Fire prevention in buildings: fire-resistant constructions.

(iv) Fire detection.

(v) Fire extinguishing and applied hydraulics.

(vi) Drawing office and information.

Recent work carried out at the Institute includes:-

(i) High pressure water sprays.

(ii) Automatic high expansion foam installations.

(iii) Fire detectors.

(iv) The development of a theoretical approach to the prediction of fire-resistance using thermal diffusion. No account was taken of the effect of end restraint.

(v) Extinction of flammable liquid fires.

(vi) Prevention of electrical fires.

The Institute is also interested in fire-retardant paints, the problem of smoke in fires, and extinguishing fires with a jet engine inert gas generator.

During the visit a series of demonstrations and exhibits was provided as follows:-

(i) Extinction of oil fire by a water spray. The fire was in a circular tray 8.5 metres in diameter and was extinguished by a water spray produced by a nozzle at a pressure of 8 atmospheres. All drops were said to be smaller than 150 microns.

(ii) Extinction of diesel oil fire by the base injection of air. The fire was in a tank of about 1 metre diameter.

(iii) Use of ethyl bromide as a vaporizing liquid extinguishing agent. Because of its toxic properties methyl bromide was not used.

(iv) Dust explosibility classification tests. A weighed amount of the dust under test was blown into a vessel 10 cm in diameter and 30 cm high containing a small hot coil. The dusts were classified according to the minimum concentration at which explosion occurred:-

Class I - < 15 g/m^3

Class II - 16-65 g/m^3

Class III - 66-250 g/m^3

Class IV - > 250 g/m^3

(v) Flash point of oils. The oil was heated in a small enclosure and the temperatures were measured at which the vapour could just be ignited by a flame or could still be ignited by a hot coil. These determinations gave lower and upper flash points.

(vi) Combustibility of plastics. A small specimen was heated electrically in air inside a water jacket; the rise in temperature of the water was measured. An estimate could then be made of the heat evolution due to the combustion of the plastic. If the plastic evolved less than one-half of

the input heat at all temperatures, it was deemed to be non-combustible.

(vii) Ignition of solids in an oven. Specimens of a combustible solid were suspended in an oven and the times required for ignition (t) at various values of temperature (T) were measured. Log t was then plotted against $^1/T$. The relation between T and the linear dimension of the specimen (x) was found to be of the form $\log T = A - n \log x$, where A and n are constants.

(viii) Fire detectors. Three types were demonstrated, one actuated by heat, another by ultra-violet light; the head containing a two-transistor amplifier, and an ionization detector operated by smoke. The detector actuated by ultra-violet light could be triggered by a match held 10 metres away.

(ix) Hydraulics. A double outlet standpipe was shown, which could be used either as a hydrant or for normal water supplies in rural areas. A trigger-operated spray gun working at a pressure of 60 lbf/in^2 and delivering about $\frac{1}{2}$ gal/s was also seen and a fixed foam head delivering $\frac{3}{4}$ gal/s of detergent foam demonstrated.

(x) Fire-resistance tests. All furnaces were oil-fired. Beams and floors were tested in a horizontal furnace, about 10 ft x 20 ft and a load of up to 10 tons was applied by filling tanks with water; these were connected to the specimen by a lever. The temperature and the deflection of the specimen were measured. Panels were tested in a vertical furnace, about 6.5 ft x 6.5 ft and were not loaded. Walls were tested in a vertical furnace, about 8 ft x 4 ft, under load. For columns, two three-sided wall furnaces were placed back-to-back to form an enclosure. Spread-of-flame tests as known in the United Kingdom were not used. Any tests with fire-retardant paints were carried out in small buildings though the impression gained was that fire-retardant paints were not widely used.

FIRE TESTING STATIONS

There are 20 Fire Testing Stations distributed throughout the U.S.S.R. and they are independent of the Central Scientific Research Institute for Fire Protection although they work in liaison with it. They also work closely with the chief of the local fire brigade.

The functions of the Stations are to attend fires and to study their behaviour and to carry out research on problems of local interest (e.g. crops, forest, ships, etc.) but there is no participation in fire-fighting. In addition, the Stations make films on aspects of fire-fighting.

We were shown a film of a fire test carried out in a timber storage area. Tracked vehicles made from obsolescent tanks were being used as mobile monitors carrying 2 500 gal of water. These enabled the fire-fighters to get up to the burning area and discharge water at a rate of about 7 gal/s.

The Leningrad Fire Testing Station has three main laboratories - temperature measurement, chemical and photographic and the staff consists of 6 engineers, 1 design engineer, 3 photographers, 3 drivers and 1 secretary.

Work on the production of inert gas by a jet engine is being undertaken at the Novo Sibirsk Testing Station. The issuing gas was stated to have an oxygen content of 6 - 7 per cent. The equipment had also been used to produce foam having an expansion of 200 - 300.

BUILDING CONSTRUCTION AND LIFE SAFETY

CONSTRUCTION

Building construction for fire purposes is divided into a series of grades, I - V, Grade I having elements of construction with a fire-resistance from 1 - 5 hours depending upon its function and Grade V having a nil fire-resistance being combustible with the exception of the separating wall which is required to have a fire-resistance of 5 hours. The principles laid down in the Fire Regulations have, it would appear,

been considerably influenced by the Ministry of Works Post-War Building Studies Report No.20.

Although the time to see constructional works was very limited, it was evident that the majority of buildings were constructed in load-bearing brickwork with sand, cement rendering and colour wash finishes. It was, therefore, difficult to identify concrete slab construction from the more conventional types of structure.

From observations of buildings under construction and a visit to a new multi-storey block of flats constructed in reinforced concrete with storey-height panels, it would appear that by virtue of the heavy sections employed, little difficulty is experienced in attaining the standards of fire-resistance required by the regulations. A reconsideration of the fire-resistance requirements may be necessary when lighter forms of construction become generally available.

Space above buildings to reduce potential fire spread is a requirement of building control, the distances between buildings being related to the type of construction of the adjacent occupancies. It is interesting to note in this connection that building regulations in Scotland and the proposed regulations for England and Wales make a similar, if somewhat more scientific, approach to this problem.

MEANS OF ESCAPE

Escape requirements are related to occupancy, the broad occupancy grouping being residential, public and industrial, the requirements for escape purposes being related within each occupancy group to the type of construction and the height of the building above ground level.

In any of the buildings which were visited either domestic or public, staircases were without enclosures. We were informed that in domestic buildings over three storeys in height, a special fire-fighting staircase is required. In public buildings open staircases are permitted to the full height of the building provided that the construction is non-combustible and the general fire-resistance is not

less than 3 hours. In domestic buildings above five storeys, alternative means of escape are required and a variety of methods may be adopted. Escape upwards to the roof and re-entry into the building to a secondary means of escape is generally acceptable. Rescue by fire brigade ladders is also considered normal practice and external escapes are permitted for certain classes of building, where the fire-resistance of the structure is high.

Internal linings would, from an inspection of a number of buildings visited, appear to be predominantly non-combustible, but there is evidence of plastic finishes in rooms in the more recent domestic buildings, the intermediate grade 'difficult to ignite' being used between the non-combustible and combustible materials. The general impression gained from visits to a number of different types of occupancy was that structurally they would, in most cases, retain their integrity in a burn-out. There was little evidence of compartmentation to reduce structural loss and consequently if a fire occurred, evacuation of many of the buildings would be necessary.

PROPAGANDA

Russian propaganda for fire prevention is very thorough. It starts in school with children being given fire prevention instruction by teachers and schools often have their own fire brigade. Use is made of films of which it was stated about five were produced each year throughout the U.S.S.R. Two examples of these were shown built around the following themes:-

(i) Teacher objects to children using candles and flammable trimmings on Christmas tree - teacher upopular - one boy leads opposition to teacher - it is discovered teacher once displayed great heroism in saving child's life in fire - boy ashamed - teacher popular again.

(ii) Mother leaves children in flat to go to shop - is delayed by neighbour - children play with stove - fire starts - youths brave fire to rescue children, one child still unaccounted for - fire brigade arrives, finds child and brings her to safety - distraught mother learns her lesson.

Children are also encouraged to join a junior voluntary fire brigade outside school. They are provided with helmets, uniforms, belts and badges and also a fire engine and hose, the engine being driven by an adult. The 'headquarters' is equipped with a field telephone and sprinklers.

The general public are expected to join voluntary fire brigades, usually at their place of employment, for which they get privileges (already mentioned) and this appears to engender a stricter attitude to fire prevention than in the United Kingdom. Smoking is prohibited in the auditorium of theatres, in stores and in places of public assembly and discarded cigarette ends are not generally seen in public places.

Fire propaganda is used on book-markers distributed through shops. Leaflets are also put through letter-boxes with newspapers and the post. Match-boxes carry general propaganda and these are naturally a vehicle for fire information. One main road intersection in Moscow carries a large illuminated sign about the dangers of discarding lighted matches. This stands out clearly because there is less illuminated advertising used than in the United Kingdom. The fire posters are striking, make bold use of colour and carry a minimum of wording. These are prepared by the Ministry of the Maintenance of Public Order and are displayed in works, schools, etc.

In addition to the above, it was stated that great use is made of the press, radio and television to carry fire propaganda.

No systematic attempt had been made to measure the impact of all the propaganda, but it was stated that fires attributed to children are fewer in Leningrad (5 per cent of all fires) than in the rest of the U.S.S.R.

(18 per cent) and this was thought to be due to the greater attention given to these age groups in Leningrad.

GENERAL CONCLUSIONS AND SUMMARY

The most striking difference between the U.S.S.R. and the United Kingdom is the greatly reduced incidence of fire. In Moscow the fire incidence was stated to be 0.16 fires per 1 000 population per annum which is typical of the figure for the Russian Federative Republic as a whole. This rate may be compared with 3.1 per 1 000 population per annum in the United Kingdom. It is all the more remarkable because, in spite of an impressive re-building programme, there still remains a not inconsiderable proportion of sub-standard building, predominantly of timber construction. In Leningrad and Volgograd the fire incidence was stated to be 0.09 and 0.12 per 1 000 population per annum respectively. The discrepancy between these and the United Kingdom figures is so large that some time was spent trying to explain the difference. The figures were stated to include the attendances of voluntary brigades and even trivial fires. Perhaps the difference is partly attributable to a difference in reporting (statistical analyses comparable with those of the United Kingdom are not made) and partly due to different building traditions but possibly the biggest factor is the greater awareness of the public to fire danger through the All-Russian Voluntary Fire Protection Association. Certainly during the fortnight we spent in the U.S.S.R. we did not see or hear a fire engine on its way to a fire, so that it would be safe to assume that their fire attendance figures are considerably lower than ours, whatever differences there may be in reporting.

The fire losses are minute by our standards. Direct losses were given as follows:-

	Annual direct loss	Annual loss per head of population
Russian Federative Republic	£6.8m	£0.057
Leningrad	£20 000	£0.005
Volgograd	£20 000	£0.028

These figures may be contrasted with the direct fire losses in the United Kingdom which, according to the latest figures of the British Insurance Association, are about £1.2 per head (most European countries have a per capita direct loss varying between £0.5 and £2). Perhaps some of the difference is due to buildings being State owned and the loss may therefore not be recorded; apart from this, there may be other differences in reporting. In spite of these very low figures for fire losses, the Russian insurance rates on contents of houses are comparatively high; 10/- per £100, the comparative rate in the United Kingdom being only 5/-. The premium income for Volgograd amounts to £56 000, a premium density of 1/8d per annum per head of population. The balance between premium income and claims was stated to be absorbed by fire protection work.

The training of fire engineers is very thorough and lasts for three to four years, about 4 000 hours of teaching. The scientific and engineering standards are high. Models are extensively used for fire situations and to illustrate building construction. Technical posters are well illustrated; they convey the basic message together with graphs and any formulae needed for understanding the problem. The teachers in the fire technical institutes write text-books covering various branches of fire protection. The laboratories in which practical work is carried out are very well equipped with modern apparatus. One laboratory is devoted to automation control systems.

Great emphasis is placed on physical training and fire sports are standardized, competitions being held throughout the U.S.S.R. Some of the competitors in a demonstration gave very fine performances over obstacle courses which included high fences, cat-walks, and involved running over the roofs of huts before extinguishing a standard fire. Another race included hook-ladder drill up a four-storey tower.

The Central Scientific Research Institute for Fire Protection is about 130 strong and this number is to be increased in the future. It is backed by 20 Fire Testing Stations, the members of which attend fires

and carry out fire investigations. Each testing station specializes in a particular subject appropriate to its geographical region. The stations design fire-fighting equipment, e.g. spray heads, foam generators, foam sprinkler heads, etc. The furnace equipment at the Central Scientific Research Institute is small and rather limited and no doubt it will be replaced before long. The Institute is considering the prediction of the fire performance of structures by studying thermal diffusion. When asked about the problems of providing restraint for structures during test, it was stated that a full-scale fire would be carried out on any type of building the State was about to construct.

The Research Institute expressed interest in our work on the problems of smoke on escape routes, the toxic and smoke hazards of plastics and the production of foam from the jet engine. A film showing the buildings and activities of the Joint Fire Research Organization was shown several times in Moscow.

The Central Scientific Research Institute for Fire Protection had not received any reports from the Joint Fire Research Organization, possibly because in the past these had been sent to the Ministry of Construction. One publication, however, 'Fire and the Atomic Bomb', had been translated into Russian for Civil Defence training. About one-hundred research publications were left in Moscow together with Home Office Training Manuals and Fire Protection Association publications and in return our hosts presented us with books. It was agreed that the Institute and the Joint Fire Research Organization should interchange publications.

We were naturally interested in the fire precautions in the buildings we visited which included hotels, department stores, theatres, offices and museums. Fire extinguishers were always in evidence and these usually carried a paper tag showing the date of the last inspection. The hotels and an apartment house we saw did not have enclosed staircases nor did we see alternative staircases for escape. None of the buildings we visited had a sprinkler system though of course as the total number of buildings seen was small, it would be unwise to draw any general inference.

Any report would be incomplete without reference to the generous way in which we were received. The hospitality of our hosts was so prodigious that it is doubtful if we would have survived another week. No matter what time we departed from one place and arrived at another, a delegation of senior officials was there to see us off and to meet us. Our hosts were very keen to show us examples of their engineering achievements and their culture whenever we were not dealing with fire matters. The outstanding impression we were left with was of a genuine desire for friendship and co-operation and without doubt the visit will bring about a more ready interchange of information between the two countries. A report based on such a short visit must of necessity be incomplete but at least it will show the lines along which future co-operation can move.

ACKNOWLEDGMENT

This paper has been prepared by the Joint Fire Research Organization of the Department of Scientific and Industrial Research and Fire Offices' Committee; it is published by permission of the Director of Fire Research.

APPENDIX

Extracts of books presented by the Ministry of the Maintenance of Public Order to the delegation are given below. The originals are in Russian and are in the Library of the Joint Fire Research Organization from which they may be obtained on loan. Acknowledgement is made to the National Lending Library for Science and Technology for its help in getting the subject headings translated.

1. MIKEEV, A. K. et al. Handbook on standard technical work. (Posobie po normativno-tekhnicheskoi rabote). Izdatel'stvo literatury po stroitel'stvu "Stroiizdat". Moscow, 1964.

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2. ROMANENKO, P.N. and ROITMAN, M.Ya. Fire prevention in heating and ventilating systems. (Pozharnaya profilaktika otopitel'noventilyatsionnykh sistem). Izdatel'stvo literatury po stroitel'stvu "Stroiizdat". Moscow, 1964.

CONTENTS

PART TWO. VENTILATION

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3. CHERKASOV, V.N. and UL'YASHCHENKO, V.E. Fire prevention in electrical equipment. (Pozharnaya profilaktika elektroustanovok). Izdatel'stvo ministerstva kommunal'nogo khozyaistva RSFSR. Moscow, 1963.

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4. BUSHEV, V.P. et al. Fire-resistance of buildings. (Ognestoikost' zdanii). Izdatel'stvo ministerstva kommunal'nogo khozyaistva RSFSR. Moscow, 1963.

CONTENTS

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5. KUZNETSOVA, A.E. Water supply for firefighting. (Protivopozharnoe vodosnabzhenie). Izdatel'stvo ministerstva kommunal'nogo khozyaistva RSFSR. Moscow, 1963.

CONTENTS

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6. Information Bulletin. Issue 4. Fire technology. (Pozharnaya tekhnika). Stroiizdat, Moscow, 1964.

CONTENTS

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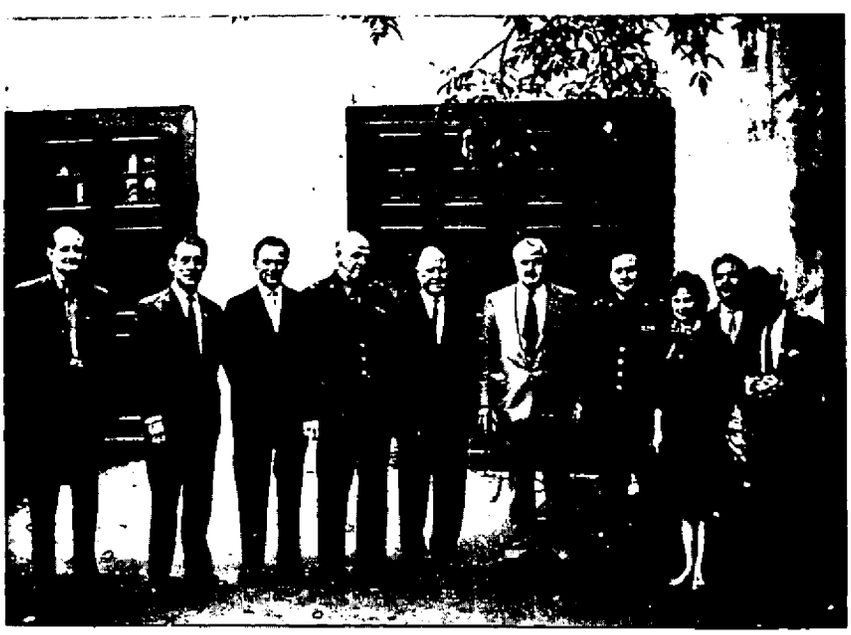
7. Information Bulletin. Issue, 1. Fire prevention and extinguishing. (Pozharnaya profilaktika i pozharotushenie). Stroiizdat. Moscow, 1964.

CONTENTS

FIRST SESSION IN MOSCOW
Left to right (standing) Mr.R.A.Perelyet, Mr.P.M.Bogdanov, Mr.K.N.Palmer, Mme G.Menshekova, Mr.N.C.Strother Smith, Mr.H.M.Smith, Mr.T.Garrett, Mr.N.A.Viktorov, (seated) Major General I.M.Zemskii, Mr.G.J.Langdon-Thomas, Lt.-Col.A.K.Mikeev

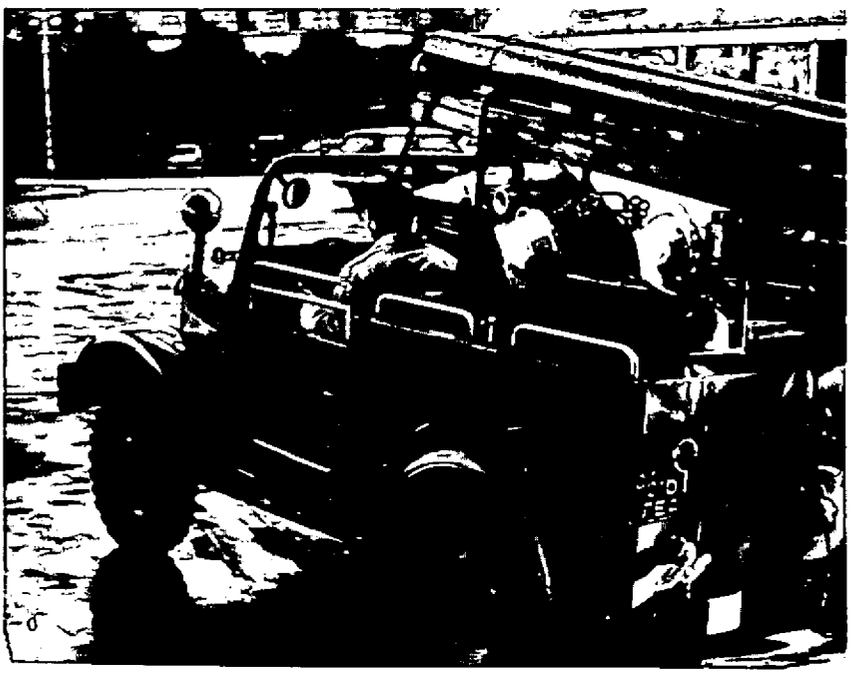


GROUP OUTSIDE CENTRAL FIRE STATION IN MOSCOW
Left to right Mr.K.N.Palmer, Mr.N.C.Strother Smith, Lt.-Col.A.K.Mikeev, Mr.I.N.Troitskii, Mr.K.S.Krichiverov, Mr.H.M.Smith, Another, Mme G.Menshekova, Mr.N.A.Viktorov, Mr.G.J.Langdon-Thomas

A SMART TURN-OUT OF THE MOSCOW
JUNIOR VOLUNTARY FIRE BRIGADE

ARRIVAL AT VOLGOGRAD
Left to right Mr.K.N.Palmer, Mr.G.J.Langdon-Thomas,
Another, Mr.D.I.Lawson, Mr.H.M.Smith,
Mr.N.C.Strother Smith, Mr.Fomin, Mr.I.A.Glebov

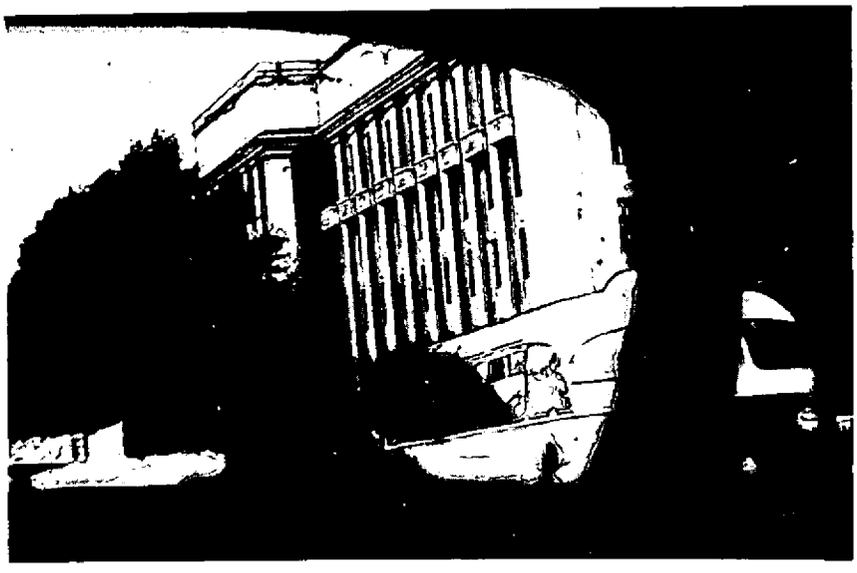
Waiting for our arrival at
Leningrad Station 8.15 a.m!



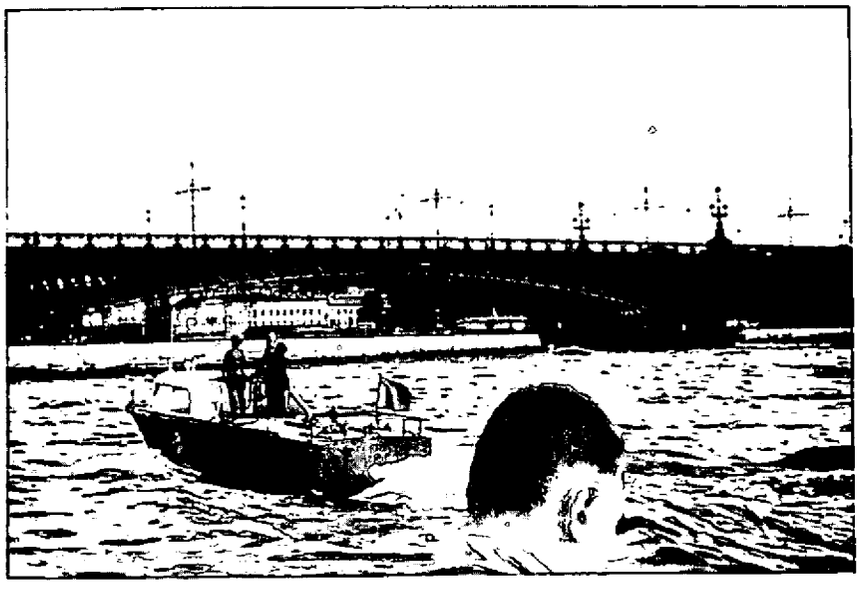
Aboard their own fire engine

JUNIOR VOLUNTARY FIRE BRIGADE
IN LENINGRAD

LENINGRAD FIRE TECHNICAL SCHOOL
(side view)

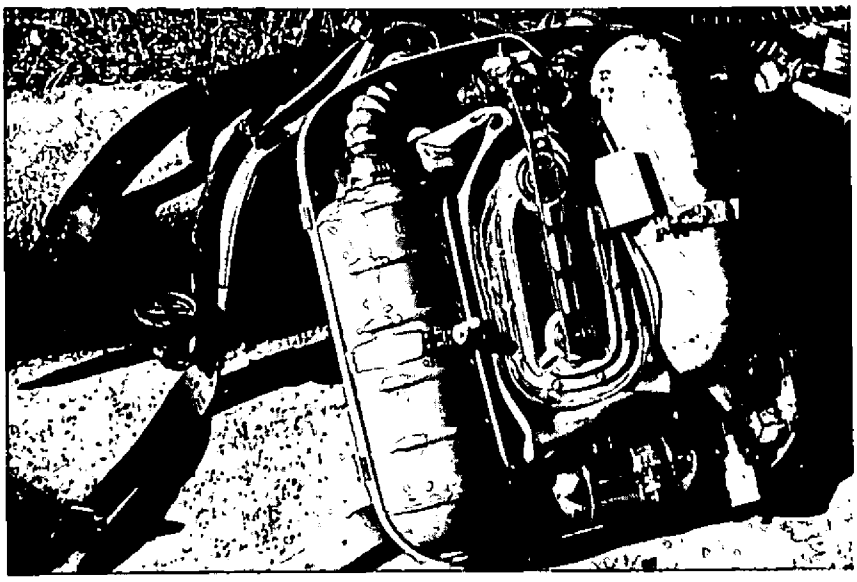


LENINGRAD FIRE TECHNICAL SCHOOL
(front view)



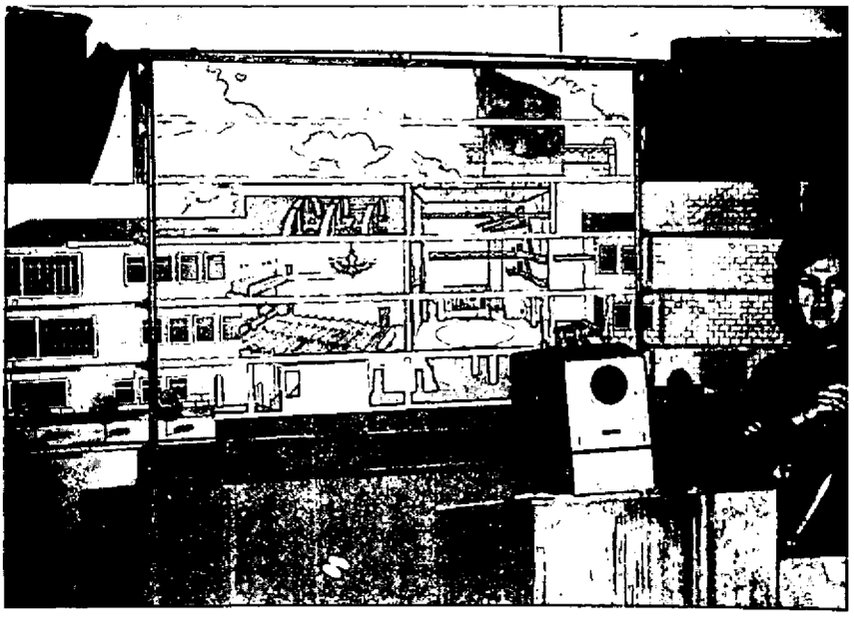
FIRE LAUNCH ON THE NEVA, LENINGRAD

A CORNER OF THE ELECTRO - TECHNICAL
LABORATORY - LENINGRAD FIRE TECHNICAL SCHOOL



RUSSIAN 4-h OXYGEN SET

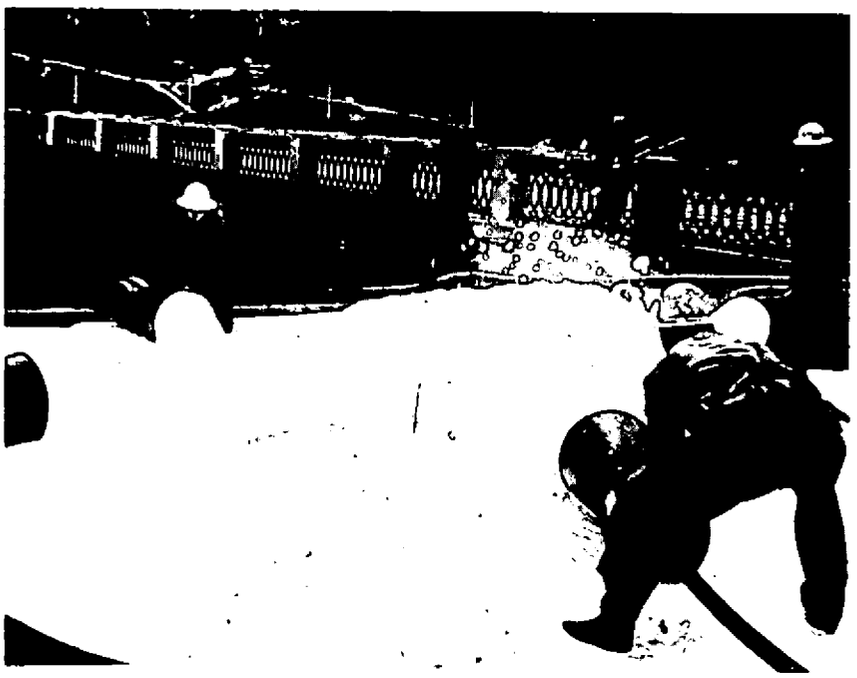
DORMITORY - LENINGRAD FIRE
TECHNICAL SCHOOL



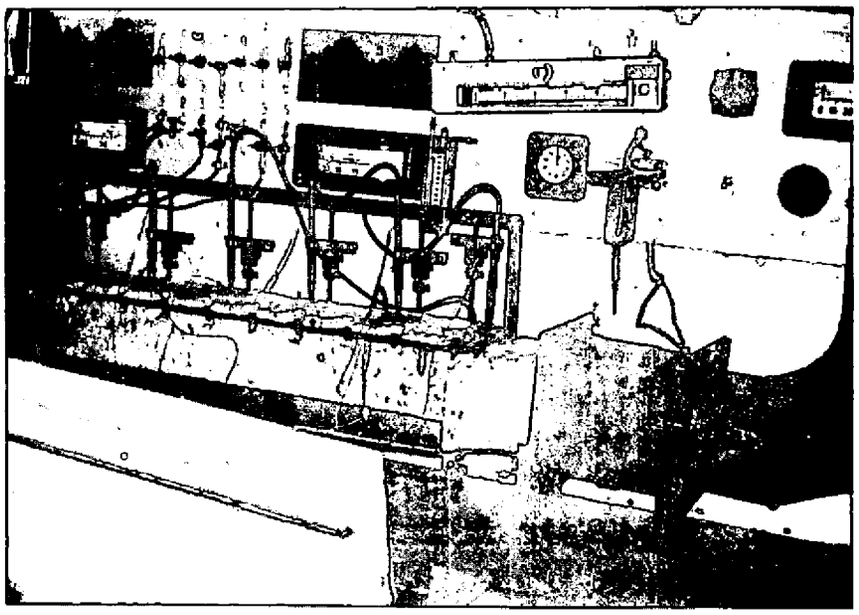
WALL DIAGRAM - PARTS OF BUILDING SLIDE
BACK TO SHOW BUILDING CONSTRUCTION
OTHERS TO REVEAL INTERIOR - LENINGRAD FIRE
TECHNICAL SCHOOL

MURAL ILLUSTRATING USE OF TANKS TO
FIGHT FIRE IN TIMBER STORAGE

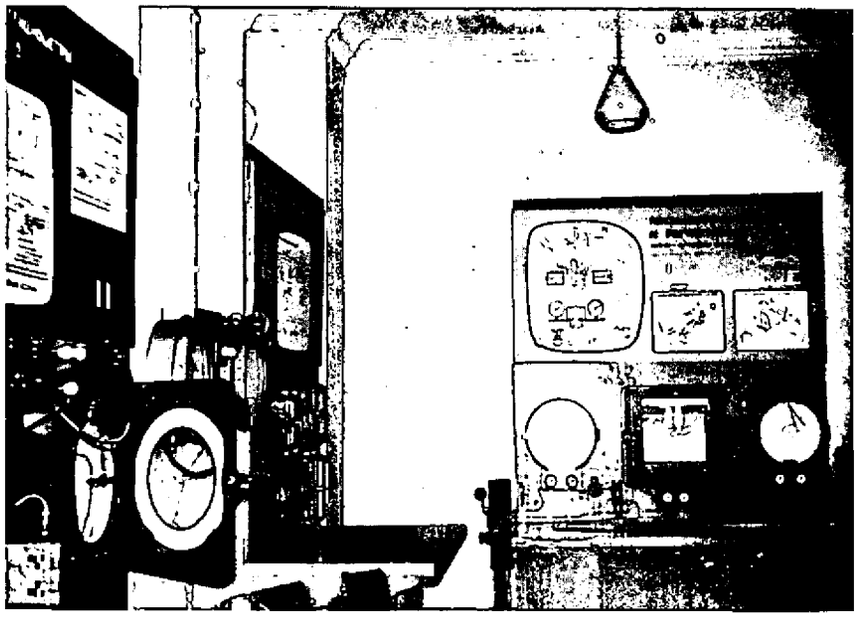
CREW OF A FIRE TENDER AT THE
ORDZHONIKIDZE PLANT



AIR FOAM GENERATORS - THE FOAM SOLUTION
IS SPRAYED ONTO A GAUZE AT THE MOUTH
OF THE GENERATOR AND AIR IS INDUCED
INTO THE SPRAY



Experiment on heat transfer from pipes



A corner of laboratory dealing with
fire safety of automated plant

FACULTY OF ENGINEERS OF
FIRE PROTECTION