

COCOANUT GROVE NIGHT CLUB FIRE

Boston, MA

November 28, 1942

Includes:

Fire investigation report by Robert S. Moulton

Looking Back at the Cocoanut Grove,
based on research by William Reinhardt.

Fire Journal (1982) 76 #11: 60-63.

Last Dance at the Cocoanut Grove
by Casey C. Grant.

NFPA Journal (1991) 85 #3:74-80, 82, 84, 95.

Searching for Answers to the Cocoanut Grove Fire of 1942
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FIRE INVESTIGATIONS

NATIONAL FIRE PROTECTION ASSOCIATION

1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101 USA

Telephone: 1-617-984-7263

E-mail: investigations@nfpa.org

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by

ROBERT S. MOULTON

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The Cocoanut Grove Night Club Fire

By Robert S. Moulton*

Four hundred and ninety-two people lost their lives in the fire in the Cocoanut Grove night club in Boston on the evening of November 28, 1942. Many others were seriously injured.

In any disaster, such as this, it is difficult to determine the exact circumstances of the fire and the sequence of events in the few moments between the start of the fire and its fatal results. The main facts of the fire are, however, all too clear.

The Cocoanut Grove was a typical night club. The building was crowded to capacity on the Saturday night after a football game. No exact figures are available as to the number of people in the building, but it appears that the number was about 1,000, as compared with the reported official seating capacity of something over 600. Gaiety was at its height, the several bars were crowded, tables around the bars were filled to capacity with every available square foot of floor space occupied. The show was about to begin soon after 10 P. M.

Fire started in the Melody Lounge, a basement cocktail lounge. Feeding on the highly combustible decorations, artificial cocoanut palms and cloth-covered ceilings and walls, it spread with great rapidity. The fire went up the stairs from the Melody Lounge cutting off the only visible means of exit. The people on the main floor had no warning of impending tragedy. Some of the surviving witnesses said the first they knew of the fire was when a girl with blazing hair ran screaming across the room. Others first saw flames flashing through the air just below the ceiling. There was a mad rush for the exits. The main doorway, which was the only exit that most of those present knew, was blocked by a revolving door which quickly jammed and some 200 of the victims were piled up behind it. The flames also flashed through a corridor to the Broadway Cocktail Lounge and here 100 victims piled up behind a door swinging the wrong way which blocked access to the outside doorway. A door leading to Shawmut Street was partially opened by an employee, but other doors were locked. A few people escaped from the basement by crawling out of a small cellar window. Some escaped through the small windows of toilet rooms. A few made their way up the stairs to the second-floor dressing rooms in the converted tenement buildings that formed the Broadway end of the club and got out through windows onto

roofs. It is not known just where in the building all the victims perished and just how many made their escape through windows and over the roof. So rapid was the travel of the fire and the noxious smoke and gases that many apparently collapsed at their tables without even making a move towards the exits.

The fire department was on hand immediately. In fact, they were there even before the fire started as there had been an alarm for a burning automobile in the immediate vicinity just before the Cocoanut Grove fire and men and apparatus were therefore on hand and went to work even before the alarm for the Cocoanut Grove fire was sounded. The fire department opened doors, broke in windows and rescued as promptly as possible all the victims who were still alive. The windows of the building were completely obscured from the inside except for the glass block windows on the Broadway side and the fire department was somewhat delayed in gaining access. One door, that at the head of the stairs leading to the Melody Lounge, was reported not to have been opened at the start of the fire, presumably because the firemen did not know that this door opened into the building.

The inside walls of the main building were so flimsy that had anyone known just where the outside windows were located it might have been possible for some of the trapped victims to smash through the walls and windows. It is reported that one of the employees who knew the location of the door on the Shawmut Street side opened one half of the double door but could not open the other half. In general, however, the occupants were in complete ignorance of the possible means of emergency exit. With many of the doors locked, and with such a fast-spreading fire, accompanied by noxious fumes, it is doubtful whether complete knowledge of the arrangement of the building would have resulted in saving any large number of lives.

The building was not one which the layman would have considered a fire trap. A one-story structure, except for the Broadway addition, with brick and stucco exterior walls, there was nothing about the exterior appearance to alarm the casual visitor. The interior, with its low ceilings, combustible wall and ceiling finish and flammable decorations, was actually a death trap, but the building structure itself was "fireproof" and people who frequented night clubs and were

When this report was prepared, Mr. Moulton was Technical Secretary, National Fire Protection Association, and Secretary NFPA Committee on Safety to Life which has jurisdiction over the Building Exits Code. The statements in this report represent the personal opinions of the writer.



The locale of the tragedy. The Coconut Grove, located on the edge of Boston's hotel and theatre district, had been converted from old buildings. The original area of the Grove near the center of this picture had formerly been a garage and a motion picture film exchange. The Broadway extension, a recent addition to the night club, incorporated three small tenement buildings. These extend above the roof of the main one-story section seen in this picture.

familiar with the typical atmosphere in such places apparently did not consider the possibility of danger. There was a great deal of drinking and this may have slowed the reaction time and befogged some of the victims, creating conditions more than usually conducive to panic. We cannot believe, however, that the presence of liquor was any material factor in the loss of life.

The Coconut Grove, a typical night club, was one of the "hot spots" of Boston. Started in prohibition days by a notorious gangster, since murdered, it subsequently changed management and at the time of the fire was regularly frequented by the better class of people in Boston. The more people who can be gotten into such a place, the more profit for the management and the testimony after the fire indicated that the extreme congestion was more or less usual, particularly for Saturday nights.

DESCRIPTION OF THE PROPERTY

The main building of the Coconut Grove night club was a one-story and basement structure of irregular shape about 100 feet long and having a depth of approximately 90 feet extending through the block from the entrance on Piedmont Street to Shawmut Street in the rear. Both of these streets are narrow and do not exceed 35 feet between building lines.

The original property is reported to have been erected in 1916. It was of reinforced concrete construction. Before being converted to night-club usage it had been both a garage and a motion picture film exchange. Numerous alterations, including several extensions, had been made to the property at various times. A rolling roof had been installed over the dance floor to permit open air dancing in the summer.

It is not clear when all of the various alterations were made, but one, made during the fall of 1942, was the addition of the Broadway Cocktail Lounge which extended the night club property along Shawmut Street to Broadway. This lounge was installed in a group of some three or four old brick-joisted buildings varying in height from two to three and one-half stories. This extension was connected to the main property by a passageway and by doorways leading to dressing rooms for entertainers also located in the Broadway extension. On the upper floors of the Broadway wing were dressing rooms and a tenement which was reached by an entrance on Shawmut Street.

Plans of the floor layouts for the first floor and the basement, shown approximately as they existed at the time of the fire, are printed on page 2. These diagrams make clearer than can a written description, the locations of various bars, lounges, dining and dance floors. They also indicate the locations of the various exits.

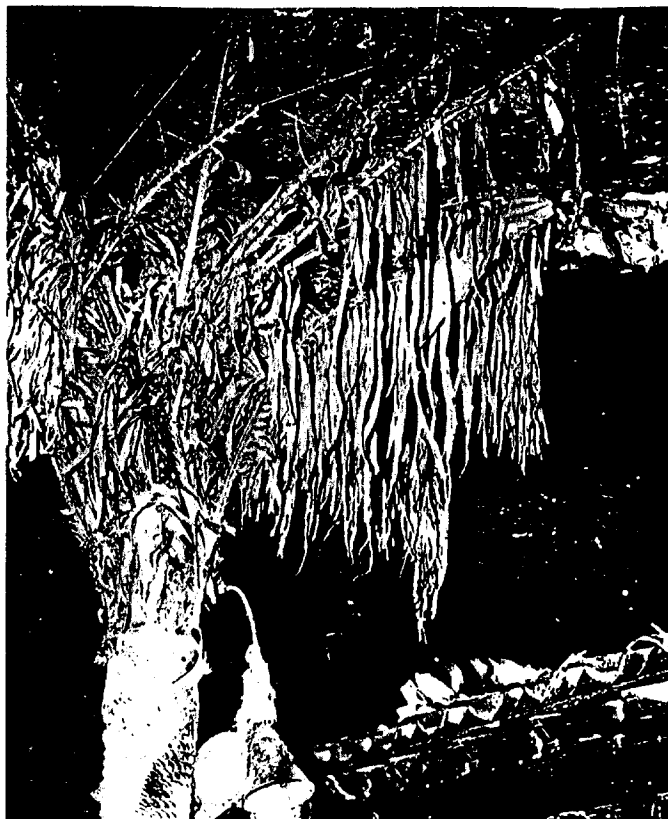
Perhaps among the important points that should be spotted on the plans are the means of exit from the basement Melody Lounge, and the location of the revolving door at the main exit. Another important factor was the location and arrangement of the exit from the New Cocktail Lounge off Broadway. Other doors which could have served as exits but which were locked at the time of the tragedy, are shown on the plan. Shortly before the fire it is reported that the Boston building inspector had inspected the building and found the exits adequate in his opinion.

The interior of the night club was decorated with various colorful fabrics, artificial leather on the walls and cloth on the ceilings. The original structure was concealed from interior view by suspended ceilings and false walls made of light wooden frame covered with light wallboard or plywood which served as backing for the fabric. Imitation coconut palm trees were located in the main dine-dance hall and in the Melody Lounge in order to lend "atmosphere". Testimony was introduced at the various investigations of the fire, regarding the supposed flameproofing of the decorations. A fire department inspector, later indicted, testified that he had tested the artificial palms, and found them flameproof. Tests made following the fire to compare the flame resistance of remains of these fabrics, with reputedly similar materials, are not conclusive because of the leaching effect of hose streams, heat and other factors present in the fire. There seems to be little doubt, however, regarding the fact that the fire, when underway, flashed rapidly through the property involving much of the decorative materials.

STORY OF THE FIRE

Witnesses agree that the fire was observed first in the basement Melody Lounge. Much comment has been made in newspapers over the reported confession of a 16-year-old bus boy that he struck a match for light while replacing a light bulb and that an imitation palm tree thus was ignited. However, other testimony indicates that flames were also observed breaking out near the false walls of the lounge, and that the walls had been hot for some time prior to the fire. Other testimony indicated that electrical wiring in the lounge had been installed by an amateur unlicensed electrician and that defective wiring or some other cause of fire may have precipitated the disaster. Actually, however, the exact source of ignition was a factor of considerably less importance than was the inadequacy of exit facilities and the extensive use of combustible decorations.

While the number of persons inside the entire night club property at the time of the fire has been estimated at approximately one thousand, the specific number in the basement



One of the few remaining specimens of the artificial coconut palms. Light fixtures were made from coconut shells with the wiring concealed in the foliage.

Melody Lounge is not known. There is agreement that the night club was crowded. When the cry of "fire" was raised in the Melody Lounge most of the occupants appear to have rushed for the stairway which presented the only obvious exit. This stairway led to a narrow hallway on the first floor which in turn emptied into a foyer passing the check room and leading to the main entrance. Had not the door leading to the street from the hallway at the head of the stairs from the Melody Lounge been locked, a much more direct means of exit would have been available. This locked door undoubtedly was responsible for many fatalities. Persons escaping from the basement were unable to pass into the street but were piled up in the corridor and foyer while attempting to reach the main exit. A number of persons even failed to reach the first floor. Rescue workers removed a number of bodies and several still living persons from the basement. Apparently a few persons made their escape from the lounge by going to the kitchen section. Some of these guests and employees attempted to escape by means of stairways to the main floor but found that escape by that route was impossible because of the heat at the main floor. A few persons escaped through a basement window into a courtyard and a few others survived the fire by seeking refuge in a large refrigerator.



The main entrance of the Cocoanut Grove on Piedmont Street. Revolving door opening may be seen through right archway, locked swinging door through center archway. See exit detail photographs at bottom of page.

All accounts agree that the flames flashed into the main floor a very few moments after the outbreak of the fire. It is reported that some persons lost their lives before they had opportunity to escape from the tables where they were seated. Reports indicate, however, that some of the persons who attempted to leave at the first indication that a fire was in progress in the basement made good their escape. Others who delayed even momentarily or who started for the check-rooms to obtain their wraps, were caught in the rush for the

exits when the magnitude of the fire became apparent. It was reported by some witnesses that the electric lights failed early in the fire, but in the confusion they may not have distinguished between failure of the lights and dense smoke obscuring the normally dim illumination.

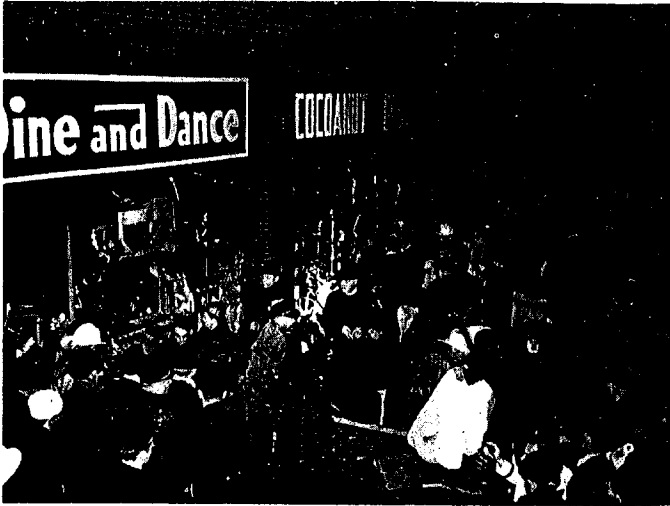
Several persons who escaped from the main dining room reported that flames appeared to roll through the air rather than to spread along the surface of the ceiling. Flames quickly swept through the passageway into the new cocktail lounge off Broadway. Many guests in this section were trapped behind a door which opened inward. Glass block window enclosures are said to have seriously hampered the attempts of firemen to rescue the occupants of this section.

It is reported that perhaps 100 of the fatalities occurred behind the Broadway entrance, more than 190 feet distant from the stairway leading from the basement lounge where the fire started. Some 200 persons were trapped behind the revolving door at the main Piedmont Street entrance. In addition to those who succumbed inside the building a considerable number died after removal from the building due to severe burns and lung injuries resulting from the effects of heat and fire gases.

A considerable number of those in the dance hall section escaped through the Shawmut Street door. A few escaped by means of stairs leading to the second floor of one of the buildings facing Shawmut Street, from which they escaped to a roof or were taken down ladders by firemen. A few others escaped through the windows of toilets.



Left: The revolving door opening with only the center pivot remaining. Some 200 people were trapped and perished inside this door. Center: Looking towards Piedmont Street through the door at the head of the stairs from the Melody Lounge. This door, locked shut, would have furnished exit to the street from the basement. Note remains of wall finish typical of the interior decoration. Right: Exterior view taken through the same doorway at the head of the stairs from the Melody Lounge. Door equipped with panic hardware but locked shut.



Soldiers and sailors assisted firemen and ambulance workers in carrying out the victims.

FIRE FIGHTING OPERATIONS

By mere coincidence, an alarm had been sounded for an automobile fire on Broadway only a few yards from the night club at 10:16 P. M. This was not over five minutes before the disastrous night club fire broke out. Response to this alarm consisted of four engine companies, two ladder companies, a rescue squad, water tower, salvage company, the deputy chief of Division 1, and the chief of District 5. Most of these units were at the scene of the automobile fire when the cries for help from the night club brought their immediate assistance. It is also reported that one of the more distant companies responding to the automobile fire was just arriving as flames broke from the night club and that this unit went to work immediately without continuing on to the scene of the initial call.

The first alarm of fire given specifically for the night club fire was received from another box located about 150 feet from the Piedmont Street entrance of the night club. This alarm was received at 10:21 P. M. and was answered by the deputy chief of Division 2, the chief of District 7, and at least two engine companies not due at the previous box. This was followed at 10:24 P. M. by a third alarm and at 10:35 by a fourth alarm. These calls brought fourteen engine companies, three ladder companies and three district chiefs not assigned to the previous calls. At 11:03 P. M. a fifth alarm was sounded, bringing five more engine companies. In addition, two additional fire department rescue squads were specially called to the fire.

Obviously much of the fire department work centered around rescue activities. However, fire fighting operations were carried out promptly as part of the rescue operations. Structural damage appears to have been chiefly to interior decorations, partitions, and included a hole burned through



A truck-load of coffins at the Boston Northern Mortuary.

a joisted section of the roof at one point above the main building. Flames also extended upward in one of the smaller buildings facing Shawmut Street but were readily controlled.

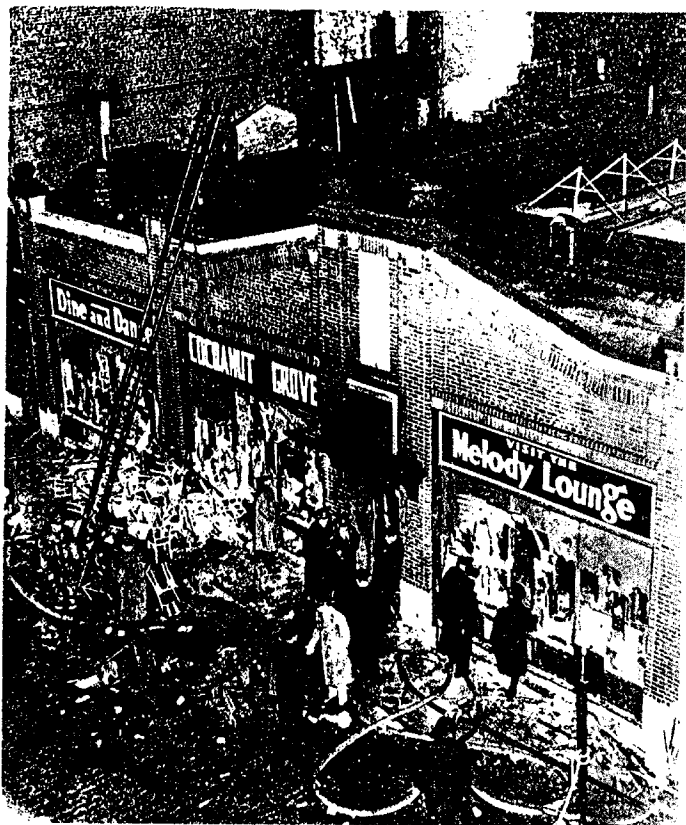
Undoubtedly the fact that the original portion of the building was of concrete construction minimized the amount of structural damage once the flames had flashed through the combustible decorations.

In addition to the rescue work done by the Boston Fire Department, valuable assistance was rendered by the police, city hospital ambulance attendants, ambulance and rescue squad crews sent by the fire departments of neighboring cities and towns, civilian defense, American Red Cross workers, U. S. Coast Guard shore patrol members, and others.

ACTIVITIES OF EMERGENCY ORGANIZATIONS

The work of emergency civilian medical services is credited with saving many lives. It was estimated that one Coconut Grove fire victim reached the Boston City Hospital every 11 seconds, which is a faster rate than casualties were taken to any hospital during London's worst air raids. The magnitude of medical attention necessitated by this tragedy is reflected by the fact that more blood plasma for burn shock was used in Boston on the first day of the disaster than was used in Hawaii after the Pearl Harbor raid.

The Boston Metropolitan Chapter of the American Red Cross mobilized more than 500 workers within 30 minutes after being routinely alerted by the fourth alarm of the Boston fire department. One hundred and fifty Motor Corps ambulances took victims and families of victims to hospitals and morgues and trained Red Cross registration clerks helped staff the Northern and Southern Mortuaries. As the horribly



The Shawmut Street side of the building the morning after the fire. The center door, partly opened by an employee after the fire started, served as an emergency exit for many on the main floor. At the left was the narrow service door, locked. The walls projecting above the roof of the main section were those of the converted tenement used for dressing rooms for night club entertainers.

burned victims crowded hospitals, the Nurses Aides Corps mobilized nearly 500 aides to relieve overworked regular hospital staffs, and the nursing service mobilized close to 300 volunteer nurses for the emergency service of the first few days. Later, more than 100 trained nurses were assigned to duty, at Red Cross expense, to help carry the burden of caring for the injured.

Two hundred and twenty-five units of dried blood plasma, collected from volunteer donors by the Red Cross, were released to the Boston City Hospital. At the same time the Blood Donor Center of the Boston chapter issued a special appeal for more donors to replace the amount diverted to the disaster, and the public response skyrocketed the week's collection to the all-time high of 3,789 units. The Center opened Sunday to make appointments and more than 1,200 calls were recorded in less than 9 hours. In its rehabilitation work more than 530 families were offered Red Cross aid.

A disaster card system, intended for use in case of a bombing attack on Boston, was quickly utilized by the Boston Committee on Public Safety to list the victims of the tragedy. To facilitate matters the names of the dead at the hospital or morgue were entered on pink cards, those injured on

green cards and those missing on white cards. These cards were placed alphabetically in a master file so that volunteers, sitting at telephones, could give callers accurate information immediately. One telephone operator at Committee headquarters handled more than 1,000 incoming calls, including long distance calls from as far away as Seattle and San Francisco, in 8 hours.

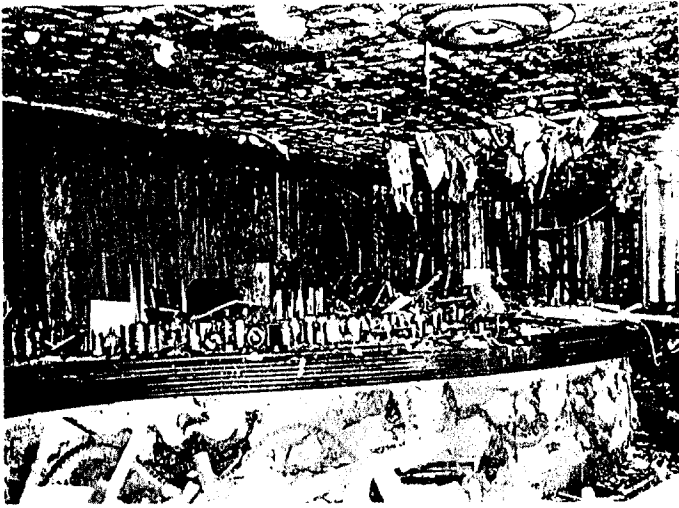
Four hundred officers and men from the First Naval District of the U. S. Coast Guard assisted in fire fighting and rescue work. The first group of Coast Guardsmen arrived shortly after 10:30 in trucks and beach wagons. Many of the men detailed to the fire remained on duty until 4 A. M. Details from the First Service Command, U. S. Army and First Naval District, U. S. Navy, as well as auxiliary firemen and policemen, also responded to aid in the rescue work.

It is noteworthy that the Regional Office of Civilian Defense put the protective services of the Boston Committee on Public Safety to a city-wide test less than a week before the fire and was satisfied with the result. One glaring flaw in existing Boston disaster plans was revealed, however, and that is that while the various agencies were mobilized and dispatched in an efficient manner, there was no apparent central authority in charge at the fire. When the military arrived the police were in doubt as to their authority and there was also some question as to the relation between the Red Cross and workers from the Boston Committee on Public Safety. There must be proper integration of all disaster agencies, otherwise resultant confusion may well cause a breakdown of fire fighting and rescue work at such disasters.

TREATMENT OF VICTIMS

Boston hospitals learned of the disaster about 10:30 P. M. when their accident admitting wards were suddenly faced with stretcher bearers bringing casualties into the wards and when police calls came in requesting ambulances and personnel to come to the fire. In this way, activation and mobilization of the hospital organization set up under civilian defense for the handling of air raid casualties occurred from two sources and got under way promptly. Non-resident staff was notified to report through a predetermined and posted fan-out schedule. All leaves for hospital help were cancelled. Upon notification by radio, doctors from 30 miles around Boston and medical students from Greater Boston colleges reported. More than 200 of the Navy's medical personnel treated survivors and rescuers, both civilian and military. Medical authorities from all over the nation wired offers of help.

Victims who escaped quickly either went unaided or were sent by police to hospitals in taxis. The streets were choked

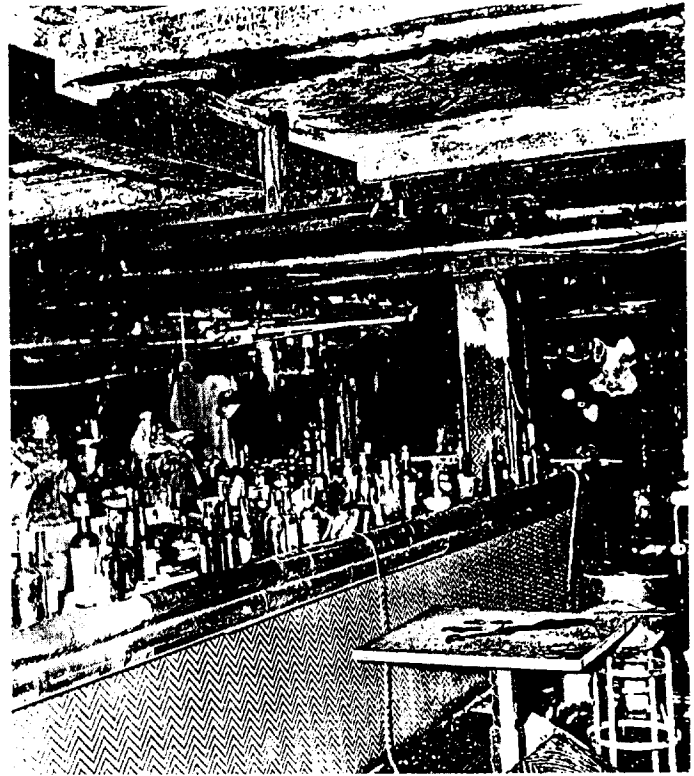


The Broadway Lounge bar. The passage, leading to the main floor area is in the center background of this picture. Note that light wooden members of ceiling are not burned.

with firefighting equipment and vehicles trying to get victims to hospitals. As emergency vehicles converged on the scene, traffic control became more complicated and impossible. Many expired en route to hospitals. The dead who were extricated from the fire were placed in a garage across the street from the night club. Those who died en route or after arrival at hospitals were placed in hospital morgues to await collection and handling by the Emergency Mortuary Service. The Mortuary Service, by 1:30 A. M., had over 400 bodies accounted for in the various morgues throughout the city.

The Field Casualty Service of the Civilian Defense emergency Medical Service in the City of Boston pivoted primarily on eight of the city's general hospitals (Beth Isreal, Boston City, Carney, Faulkner, Massachusetts General, Massachusetts Memorial, Peter Bent Brigham and St. Elizabeth's). These hospitals had a total casualty capacity of 876. There were, in addition, fifteen other community hospitals in the City of Boston, which brought the total casualty capacity for the 23 hospitals in the city to 2,640. Facilities for 181 Cocoanut Grove victims were required. Boston was districted and so organized that the pivotal general hospitals received ambulance-borne casualties initially from predetermined districts. Each hospital had worked out, in detail, its emergency mobilization plan and observers at the Boston City and Massachusetts General Hospitals, which received more than 80 per cent of the casualties, reported that everyone did his duty efficiently and effectively.

The Massachusetts General Hospital was indicative of the speed in which Boston hospitals swung into action. Between 10:30 P. M. and 12:45 A. M., 114 casualties were received. Seventy-five were dead on arrival but the 39 living patients were assembled in beds in the Emergency Ward by 1:30 A. M.; by 1:45 the burns of all patients were dressed,



The bar in the Melody Lounge after the fire. Ceiling decorations burned off but little structural damage. Wicker covering on outside of bar mostly unburned.

shock adequately treated and asphyxiation patients had received oxygen therapy. In the first 24 hours following the disaster 120 units of frozen blood plasma were used on 33 patients (average of 3.6 units per patient).

Both the Massachusetts General and Boston City Hospitals were well prepared for burn treatment as a result of research projects conducted under the auspices of the Federal government and the National Research Council. The military asked the Massachusetts General about six months before the fire to experiment with specific therapies on all burn cases. Only one technique—application of boric ointment and compression bandages—was used for surface burns at the Massachusetts General; three techniques were used at the Boston City, vaseline ointment, triple aniline dyes and the combination of tannic acid and silver nitrate. Naval doctors found that while triple aniline dyes produced good results the sulfa salve had fastest healing qualities and provided greatest comfort. It was also found that sulfadiazine administered internally as first aid and penicillin, given six days later when staphylococci could have been anticipated, proved very effective. Boston hospitals, local and regional OCD and Red Cross had 2,959 units of blood plasma on hand the day of the disaster and 1,308 units were used on victims. 1,102 units being used at the Boston City Hospital alone.

Most of the victims died from burns and inhalation of smoke and flames. It is interesting to note the statement of

Dr. William H. Watters, associate medical examiner for the Southern Suffolk District, who said that he remembered only one broken bone—a rib—in the hundreds of bodies he examined, indicating that people died too quickly to fight for their lives. Apparently the victims were overcome by something more than carbon monoxide.

THEORIES ON CAUSE, SPREAD AND FUMES

Certain facts of the cause and spread of the fire from its point of origin in the Melody Lounge are fairly well established by the published testimony of witnesses, but there seems to be an element of mystery still unexplained. The fire was first seen in a corner of the Melody Lounge immediately after a bus boy lit a match to see to replace an electric light bulb in an artificial palm tree. Neither the boy nor anyone else says that he saw the match actually touched to the tree, but the flames appeared almost immediately. The fire perhaps could have been started by defective amateur wiring to the fixture in the tree instead of by the match, but the immediate source of ignition would not appear to have any important bearing upon what happened later.

The flames spread very rapidly. The testimony of some witnesses indicates that the fire was seen along the wall near the floor almost at the same time as in the branches of the palm tree, but there is considerable confusion in the statements as to just what happened during the first few moments of the fire.

From the Melody Lounge the fire spread up the stairway and with almost incredible rapidity throughout the main first floor area and through the corridor into the new Broadway Cocktail Lounge. It appears clear from testimony corroborated by a considerable number of different witnesses that fire was first seen on the first floor as flame rapidly traveling a little below the ceiling. Different witnesses described this flame differently, but all agreed that it was a yellow or yellowish flame. The flame was quickly followed by a dense cloud of smoke which has been described as black rather than brown or any other color. This smoke apparently contained toxic gases and people collapsed unconscious in what appears to have been a matter of only a few seconds, according to some testimony, although the fact that some of the people were actually able to make their way out of the building raises some doubt as to the time element.

The victims showed definite evidence of carbon monoxide which would account for their quick collapse. Delayed symptoms accounted for many deaths after the fire and these must have been due to something more than carbon monoxide. Only a relatively small number of those killed and injured suffered serious external burns and the cause of the majority of the deaths seems to have been due to lung effects.

Numerous theories were advanced to account for the rapid spread of fire, and for the fumes which were described by survivors as acrid but which were not identified. A brief discussion of each theory follows.

ORDINARY FIRE THEORY

All of the facts can perhaps be accounted for without seeking any mysterious or unusual explanation. The combustible decorations, cloth finish on the ceiling and other readily combustible materials could have caused a quick, hot and fast-spreading fire. The exhaust fans in the main floor area could have caused a draft up the stairs from the Melody Lounge making for a rapid spread of fire such as occurred in the night club fire in Detroit in 1929 when twenty-two lives were lost under somewhat similar circumstances. The presence of carbon monoxide can be explained by the restricted air supply. Any fire in ordinary combustible materials where there is a dearth of oxygen produces some carbon monoxide, the percentage of carbon monoxide depending upon the extent of the oxygen deficiency. Several poisonous gases may be produced by the burning of woolen materials, furs, and other ordinary building contents. Lung injuries to the victims could be explained by the inhalation of ordinary smoke and superheated air. Inhalation of even plain air at a temperature of 150 to 200 degrees or higher can cause lung injuries which are not immediately fatal but which cause death after a period of time. The clinical symptoms in such lung injuries are said to be almost identical irrespective of whether the cause is superheated air or some chemical fumes.

While the theory that the cause and spread of fire and the character of the fatalities may be accounted for by the ordinary burning characteristics of the combustible materials present, the extremely rapid spread of the fire and the character of the fatalities raise a question as to whether there may have been some other unexplained element which caused the fire to spread with greater rapidity than can be accounted for by this theory and also to produce more noxious fumes. It seems clear that even without any other element a large number of fatalities would have occurred and the various other theories that have been advanced could furnish at best only a partial explanation.

ALCOHOL THEORY

It is an admitted fact that there was a large consumption of liquor in the Cocoanut Grove on the night of the fire and a number of newspaper stories have been published advancing the theory that the atmosphere was so charged with alcohol vapors from the breath of drinkers and from liquor exposed on bars and tables that it was a flash of alcohol vapor which was responsible for the start and rapid spread of the fire. While it is doubtless true that a large amount of alcohol was present, this theory does not seem particularly plausible. It does not seem possible that there could have been sufficient alcohol vapor in the breath to have created a flammable mixture in the Melody Lounge. Evaporation from drinks on tables in sufficient quantity to furnish a flammable mixture is not theoretically possible unless the liquor is served straight and warm which is contrary to practice in such places. Ethyl alcohol in 50% concentration by volume, which is about the

maximum of any ordinary liquor, does not produce flammable vapors except at temperatures above approximately 85° F.

PYROXYLIN THEORY

There was a considerable amount of artificial leather used on the walls of the building. The usual type of artificial leather contains some pyroxylin (cellulose nitrate). The burning of pyroxylin materials is very rapid and may produce oxides of nitrogen which would account for the fatalities. At first glance, this theory seems plausible but further analysis raises doubt as to whether this could have been an important factor. In the first place, most of the cheap artificial leather or so-called "leatherette" materials do not contain any high percentage of pyroxylin. There is some pyroxylin material used but it is compounded with other ingredients so as to modify considerably the burning characteristics. Samples of the artificial leather from the building have been tested subsequent to the fire and while it appears clear that the material is readily combustible there was no report that the material contained a sufficiently high percentage of pyroxylin to have been a major factor in the disaster. Furthermore, the formation of oxides of nitrogen from pyroxylin materials occurs primarily where a large mass of the material decomposes. The formation of oxides of nitrogen is relatively slight where the material burns in a single sheet with free air supply.

MOTION PICTURE FILM THEORY

The presence of a quantity of cellulose nitrate motion picture film would have readily accounted for both the rapid spread of the fire and the character of the fatalities. The building where the fire occurred had once been used as a motion picture film exchange and it is conceivable that a quantity of scrap film may have remained in some concealed space or out-of-the-way corner. There is also the theory that a number of reels of cellulose nitrate motion picture film may have been brought into the building on the night of the fire by some employee of one of the several nearby film exchanges. A few reels of motion picture film, wrapped in an ordinary paper parcel rather than in the standard metal container and placed against a hot steam pipe or some other source of heat, could have gradually decomposed with the evolution of flammable and toxic gases. This, however, does not seem particularly consistent with the first observation of the fire around the artificial palm tree. If there had been film decomposing in the concealed space behind the false walls, the expected results might have been a little more consistent with the testimony of witnesses.

A related theory that has been advanced is that there was a photographer who took pictures of the patrons and may have had a quantity of photographic film somewhere in the basement. However, it would be expected that such film would be of the cellulose acetate or safety type rather than the nitrate type and even if it had been the nitrate film the usual method of packing of the film and the relatively small quantity that would have been present would seem to rule out gases from this source as a cause of the disaster.

REFRIGERANT GAS THEORY

There were air-cooling units in the Melody Lounge served by a refrigerating unit located in a corner behind the false wall.

After the fire some of the refrigerant tubing was found broken or melted. However, none of the commonly used refrigerant gases is flammable so this would seem to rule out any refrigerant gas as being in any way responsible for the initial flash. Some of the refrigerant gases used are toxic. However, there seems no reason to assume that the copper tubing would have melted or broken to release the gas during the first minute or two of the fire and it thus appears that refrigerant gas may be dismissed as a factor in the early stages of the fire when most of the fatalities occurred.

FLAMEPROOFING CHEMICALS

Some of the chemicals commonly used for the flameproofing of combustible decorations give off ammonia and other gases when heated. This has resulted in the theory that the presence of some flameproofing chemicals, in an inadequate quantity to prevent combustion, may have contributed to the formation of noxious gases. This is perhaps a possibility although the published testimony seems to make it rather doubtful as to whether flameproofing chemicals were actually applied to the Melody Lounge decorations or, if applied, whether there were enough of the chemicals present to have produced any appreciable amount of toxic gas. Furthermore, the reported symptoms of the victims would not seem to be accounted for by ammonia fumes in the relatively light concentration which could have been produced from this cause.

GASES FROM FIRE EXTINGUISHER

There is some testimony to the effect that one or more fire extinguishers were used on the fire in the artificial palm. This has led to the theory that toxic gases may have been produced by the fire extinguishing liquid. This theory, however, seems to lack any supporting evidence. There is nothing about the circumstances of the fire to lead us to feel that extinguishing liquids, if used, were in any way a factor in the fatalities.

INSECTICIDE THEORY

It seems probable that in a basement kitchen such as in the Cocoanut Grove there may have been a good deal of trouble with roaches and other insects and that some sort of insecticide may have been used. There are reports that some sort of liquid was sprayed around rather generously, although there is no definite evidence as to just what this liquid may have been or when it was used. Unless the insecticide used had a flammable liquid base and had been applied in a relatively short interval before the fire, it would not be expected that it would be a factor. However, if vapors had accumulated in the concealed spaces behind the walls, their presence might readily account for the initial flash.

GASOLINE THEORY

The Cocoanut Grove building at a previous time had been used as a garage and one of the theories advanced was that there were gasoline tanks underneath the basement floor which had never been drained of gasoline and which in some way may have given off vapors that were present on the night of the fire. While this is a possibility, there seems to be no evidence to substantiate it. Gasoline vapors are heavier than air and would be expected to accumulate along the floor level. The reported spread of the fire just under the ceiling would seem wholly inconsistent with the gasoline vapor theory.

ELECTRIC WIRING THEORY

Testimony clearly shows that the wiring in the Cocoanut Grove had in part at least been installed by an unlicensed electrician. It appears that the wiring may have been overloaded and not properly fused. This leads to the theory that some of the wires may have been heated sufficiently to decompose the insulation and form flammable and toxic gases. This is perhaps a possibility but we have no report that any of the investigators has found any of the wiring in the building in such condition as to indicate this as a probable cause.

SMOLDERING FIRE THEORY

The rapid spread of the fire and the presence of large quantities of carbon monoxide could readily be accounted for if there had been a fire smoldering for some time in some concealed space. Such a fire might build up quantities of carbon monoxide and could produce sufficient heat to touch off the flash which would spread the fire very rapidly through the combustible decorations. There is some testimony that some of the walls were hot before the fire and that one or two patrons being disturbed by the hot walls left the building shortly before the fire broke out. It is not clear, however, that the hot walls referred to were anywhere near the reported point of origin of the fire. There were a sufficient number of concealed spaces in various parts of the building to have harbored a fire which could have smoldered undetected for a long time. The Melody Lounge where the fire started had interior walls furred out from the concrete exterior walls leaving a concealed space varying from a few inches to several feet. There was also a concealed space above the cloth covered ceiling. Fire could readily have smoldered for some time in such a space and produced all sorts of flammable and noxious gases. The only flaw in this theory is that physical examination of the ruins after the fire fails to show any evidence that there was such a smoldering fire behind the false walls in the immediate vicinity of the point of reported origin of the fire.

EDITORIAL COMMENT

The Cocoanut Grove night club fire probably has received as much publicity as any other fire disaster in recent history. Statements by the NFPA were carried by all the press services, widely published throughout the country, and quoted by radio commentators. The following editorial from the CHRISTIAN SCIENCE MONITOR a few days after the fire is quoted in full below as typical of the editorial comment following the fire.

NOBODY TO BLAME!

Naturally no one wants to take the awful responsibility for the killing of 449* people in Boston's Cocoanut Grove. But the process of whitewashing is sickening. If the results of investigations so far were to be accepted the blame would rest wholly on the crowd which was panicky or befuddled, on a sixteen-year-old bus boy who may have accidentally touched an artificial palm

*The total deaths reported at that time.

tree with a match, and on Boston's building laws. The law is a particularly tempting and undefended scapegoat.

But so far city officials, owners of the property, operators of the night club, and all others who would ordinarily be held responsible have been beautifully exonerated. Particularly, remarkable is the record of the city officials charged with inspection of such premises. The Building Commissioner maintains that the place had proper and adequate exits, pointing out that the law lists night clubs as restaurants and does not impose the same requirements on them that it does on hotels and places of assembly like theatres and churches. This legal deficiency can and undoubtedly will be made good, not only in Boston but wherever it exists in the Nation.

But one reason it exists is because dine-dance-drink places have too often been closely connected with politicians. For this same reason, it will be very hard to convince the public that proper enforcement of the laws already existing would not have prevented this disaster. How much good are more laws if the report of a fire inspector made on November 20 could describe the Cocoanut Grove conditions as "good"? Eyewitnesses testified that this was a "flash" fire, spreading with unbelievable rapidity in "stuff that looked like straw" on the ceilings and through fake palm fronds. Yet the fire inspector says that he tried to light several palms with matches and his report says "no inflammable decorations."

This isn't good enough. No one was to blame! But action will be taken to prevent another Cocoanut Grove, and somebody could have taken action to prevent this one. And not merely by passing new laws. A national expert on fire prevention, Robert S. Moulton, technical secretary of the National Fire Protection Association, says it is too soon to determine just what part was played by "the chaotic condition of Boston's building laws, incompetent enforcement, political influence and careless management." Yet he intimates all had a part, and citizens may well insist on the part being determined.

All these are causes which can be dealt with. All could be improved were this fire to purify Boston's concepts of city government. For a generation Boston has been satisfied with government on the night club and race track level. The laws will be improved. But conditions under them will be better only as citizens insist on better men to enforce them.

INVESTIGATIONS AND INDICTMENTS

Several investigations were started immediately after the fire. The fire commissioner of the City of Boston, proceeding in accordance with Massachusetts state law, inaugurated an investigation hearing the testimony of a large number of surviving witnesses. The Commonwealth of Massachusetts also conducted an investigation handled by the State Fire Marshal and other state authorities.

Attorney General Robert T. Bushnell was in charge of the state action on the criminal aspects of this fire. The Grand Jury, already in session when the proceedings were begun, handed down the following indictments as its term

expired December 31. All of those indicted were arrested. Final court action is also given below.

DEFENDANTS, CHARGES AND DISPOSITION

MOONEY, JAMES H., Boston Building Commissioner
- Failure to enforce law prohibiting use of place of public assembly until a certificate had been issued by a Building Department inspector. Acquitted.

WELANSKY, BARNETT, Principal Owner of the Grove
- Manslaughter and conspiracy to violate the building laws. Guilty; sentenced to 12 to 15 years.

WELANSKY, JAMES, Brother of Barnett - Manslaughter and conspiracy to violate the building laws. Acquitted.

LINNEY, LIEUT. FRANK J., of the Boston Fire Department, Whose duty it was to inspect the Grove - Accessory after the fact of manslaughter, and willful neglect of duty. Acquitted.

GOLDFINE, JACOB, Manager of the Night Club - Manslaughter. Acquitted.

BUCCIGROSS, CAPT. JOSEPH, Night Police Captain of Division 4 - "Wilfully and corruptly failed, neglected and omitted to enforce" the fire laws. Not prosessed.

BODENHORN, REUBEN, Designer of the Night Club - Conspiracy to violate building laws. Acquitted.

RUDNICK, SAMUEL, Contractor Who Built the New Bar and Lounge - Conspiracy to violate building laws. Guilty; Sentenced to 2 years.

GILBERT, DAVID, Foreman for Rudnick in Building the New Bar and Lounge - Conspiracy to violate the building laws. Acquitted.

ELDRACHER, THEODORE, Fire Prevention Bureau Inspector - Failure to report violations of the building laws and to report insufficient exits. Acquitted.

In addition to handing down the above indictments, the Grand Jury made the following statement:

We, the Suffolk County Grand Jury, have heard testimony assembled up to the present time relative to the Cocoanut Grove case and have returned indictments thereon. In addition to facts upon which our indictments are based, we have found certain conditions which in the interest of public safety must be corrected as speedily as possible.

Realizing that we, as a Grand Jury, have no power to correct such conditions and that our term of service is about to end, we wish to record certain conclusions which the evidence compels us to draw, even though such evidence may fall short of establishing wilfulness or corruption required to make neglect of duty a criminal offense:

1. We have found among members of various departments charged with the protection of public safety laxity, incompetence, failure to fulfill prescribed duties effectively and also lack of complete knowledge of duties.

2. We have found shifting of responsibility and a tendency by various officials in different important departments to rely too much on their subordinates without exercising sufficient and proper check on such subordinates. Officials in each department seemed to attempt to shift responsibility to some other department, and vice versa.

3. We have found no complete coordination between Building Department, Fire Department, Police Department and Licensing Board with respect to various types of inspection intended to be made to insure public safety in addition to protecting the public health, morals, etc.

We hope that by thus calling attention to conditions which have come within our knowledge the more effective and immediate remedying of such conditions may be made possible.

Respectfully submitted,

Suffolk County Grand Jury.

December 31, 1942.

The statement was signed by the entire panel.

PANIC

All reports of the Cocoanut Grove tragedy indicate that there was a panic, a rush for the main exit, and then helpless victims fell and were caught in the rush of others coming behind them. The story of the panic here is only a repetition of what has happened in many previous fire disasters.

Fire experience all too clearly shows that the fear of being burned to death or suffocated, the rush of smoke and hot gases, and the sight of spreading flame completely alter the pattern of logical human behavior. Under such conditions people do not behave like thinking human beings. A mad rush to escape in any possible way without regard to others is characteristic of mob psychology in such cases.

The prevention of fatalities due to panic, and panic has been a major factor in most fire disasters, can only be accomplished by eliminating the conditions that are conducive to panic. Occasionally a strong personality can calm a panicky crowd and bring order out of chaos but this should not be relied upon.

The NFPA Committee on Safety to Life whose members have made a life-long study of fatal fires and who have had extensive personal experience in dealing with fire emergencies, have come to certain reasonable conclusions which are embodied in the provisions of the Building Exits Code. First and foremost, of course, is the prevention of the start of fire, but granted that despite all precautions fire may start from some unexpected cause, provision should be made to get everyone away from the area of the fire in a calm and orderly way. Experience shows that as long as people are moving freely toward an assured place of safety there is little danger of panic even though fire may be rather close behind them. This emphasizes strongly the importance of free and unobstructed exit with nothing to delay or block the flow of people. Doors must swing with, rather than against, the exit travel. There must be no reduction in exit width along the path of travel as, for example, by a narrow door forming a bottleneck at the foot of a flight of wide stairs.

Exit details should be designed so as to minimize the danger of stumbling and falling, for when one person falls others are likely to pile up and the exit become blocked. This calls for such features as adequate railings on stairs, the avoidance of steep and narrow steps, and sufficient lighting for all exits so that people can see their way clear. Above all, the path of escape must be clearly marked so that there is no question from any point in the room as to the direction to go to reach an exit, and once in the exit passage or stairway there should be no doubt as to which way to travel to reach the open air. An exit not clearly marked may have little or no value.

REVOLVING DOORS

The evidence in the Coconut Grove fire clearly indicates that the revolving door became jammed, blocked the exit and was directly responsible for a considerable portion of the loss of life. The NFPA Building Exits Code prohibits revolving doors as exits in places of assembly, and furthermore requires that in other occupancies where revolving doors are used swinging doors must be immediately adjacent or within twenty feet.

Revolving doors are widely used because of their convenience in preventing objectionable drafts and facilitating the satisfactory solution of heating and ventilating problems. They are, however, manifestly unsuited for emergency egress. Some revolving doors of the collapsible type are supposed to be so arranged that the mechanism that holds the leaves of the doors in place will be released under unusual pressure thus affording free passage on both sides of the center pivot. The NFPA Committee on Safety to Life has considered the claims of the manufacturers of such types of doors but has not seen fit to modify the above noted general requirements. The difficulty is that the self-releasing feature requires careful adjustment and there is some question as to whether it is possible to have the door adjusted to release under sufficiently slight pressure to avoid trouble under fire and panic conditions and at the same time not have it release so easily as to interfere with normal operation. The question of maintenance also enters the picture. While it is possible that a so-called self-releasing revolving door might be designed, constructed and maintained so as to provide a safe exit, the NFPA Committee on Safety to Life has not felt that there is sufficient assurance of this to justify recognizing the revolving door as an emergency exit from a place of public assembly. Representatives of the Committee have made a number of inspections of so-called self-releasing revolving doors under actual operating conditions. In one case an inspection was made of a door which was cited by a manufacturer as being a good example of the self-releasing

type. In the attempt to release the door under a simulated panic rush, the chairman of the committee suffered a painful arm injury.

The Building Exits Code does not prohibit revolving doors if alongside the revolving doors there is adequate capacity of swinging door exits. The theory is that if the revolving door is jammed the crowd will pass to the swinging doors at the sides.

In many buildings where large numbers of people congregate the problem of heating and ventilation is solved by having double sets of swinging doors with an intermediate vestibule.

LOCKED DOORS

It should be obvious to anyone that all exit doors in a place of public assembly should be kept unlocked whenever the place is occupied. This is so elementary that no code or law should be needed, but experience all too often shows that this elementary factor of fire safety is disregarded. The reasons advanced for locking exit doors are many. Inspectors who find doors locked hear all sorts of explanations. It is necessary to lock the door to prevent access of sneak thieves, that paying guests may get out the fire escape without paying their bills, that boys or pranksters make improper uses of the door which can only be prevented by keeping it locked, that employees may sneak off through exit doors, and many others. It must be recognized that in the minds of the people who lock the doors these reasons are valid. They simply lose sight of the major purpose for which the door was provided.

A little intelligent consideration of any individual case will usually permit devising some method to prevent the improper uses of an exit door without blocking it for its intended emergency use. If it is only necessary to keep people from entering a building through a fire exit door, a form of lock can be provided which will not permit opening from the outside but which can be readily opened from the inside. One rather common method is to provide an automatic alarm so if anyone opens a door a loud gong will ring. In other cases all that is necessary is to provide a little extra care and supervision. If, however, an owner states that no such measures are effective and he must lock exit doors for normal operation of his premises, it would appear to be clear evidence that the premises are unsuited for public occupancy and should be closed forthwith.

A related problem is the common practice of blocking exitways by furniture storage, screens, draperies, etc., placed there by people who again forget the fundamental purpose of the emergency exit. Filling a stairway with storage of extra chairs, placing a table directly across an exit doorway or concealing an exit by a screen or decorations of some

kind renders the exit practically valueless and is substantially the same as locking it for all practical purposes.

FIRE SAFETY LAWS

Following the Cocoanut Grove fire, the officials concerned were quoted in the newspapers as stating that the existing codes and laws were not adequate to assure safety in places of public assembly such as this night club. We cannot believe, however, that this disaster is chargeable to any deficiency in the law.

Following the fire there has been a wave of public demand throughout the United States and Canada for legislation to assure fire safety in places of public assembly. The majority of building codes throughout the country are antiquated and incomplete. Fire prevention legislation generally leaves much to be desired. However, there is a real danger in attempting to remedy the conditions such as were responsible for the Cocoanut Grove tragedy by the enactment of more laws. This is too apt to result in satisfying the public demand by passing a law and then leaving the law to gather dust on the statute books without any continuing or effective effort to put it into practice.

In our opinion building and fire officials can now do practically everything that is necessary to assure public safety from fire without any more laws. They will have full public support in any reasonable measures for fire prevention, safe exits, etc. The fundamental purpose of having a building official is to secure buildings that are safe for public occupancy and the fundamental purpose of having a fire official is to safeguard the public against fire. Even though there may be no further authority than a city charter, these officials can issue orders for the purpose of safeguarding the public and in all probability have them upheld in the courts. It must of course be shown that there is a hazard to the public, that the orders are reasonable, that they are not discriminatory and do not represent any capricious exercise of discretionary authority. We are convinced that within this framework any reasonable fire safety order will be upheld in the courts, and what is actually more important to effective enforcement, upheld by public opinion.

The line of demarcation of authority between building officials and fire officials varies in different cities. We will not in this discussion make any attempt to draw the line of demarcation of jurisdiction between the two departments. Each has a logical separate function. There is some necessary overlapping and effective results can be secured only through complete cooperation between the two departments. We cannot too strongly emphasize the importance of such cooperation. In some cities fire and buildings inspections are handled under a single head in order to secure proper

coordination. We feel, however, that the exact form of organization is relatively unimportant and that the major factor is a spirit of cordial cooperation between these two inspection services, and any others that may have jurisdiction.

Codes and fire laws for the most part apply to buildings erected subsequent to the date of enactment of the code or ordinance; also to any major alterations. There is apt to be resistance to anything in the nature of retroactive legislation. The argument is that a man who erected a building in accordance with the codes in effect at the time should not be penalized by being forced to alter his building to meet some subsequently enacted code. Such arguments are valid within limits but should under no circumstances be allowed to interfere with enforcement by building and fire officials of all measures necessary to abate any serious fire hazards or correct any condition that constitutes a menace to the lives and safety of the public.

FIREPROOFING OF DECORATIONS

The decorations in the Cocoanut Grove were supposed to have been flameproof but the behavior of the fire shows that any chemical treatments that were applied to the cloth ceilings and decorations were wholly ineffective. Flameproofing treatments do have value but no chemical treatment can actually make a combustible material fireproof. The best that can be expected is to make the material resist ignition from some small heat sources such as the flame of a match. Cloth and paper, no matter how treated, will not resist any severe fire.

Certain chemicals, if impregnated in the material in sufficient quantity, help a great deal, but unless supplied in sufficient quantity they are of no practical value.

Furthermore, most of the chemicals commonly used for flameproofing of decorations are soluble in water and will be washed away if the material is laundered or exposed to the weather. Even where materials are not actually washed, but are exposed to the air of rooms under varying conditions of humidity, there is some question as to the permanency of the treatments over a period of years.

Once the material is in place, it is rather difficult to make tests on the premises to determine whether all parts of the decorations retain an adequate quantity of the flameproofing chemicals.

Another objection to the use of flameproofing chemicals is that materials which have had certain chemical treatments may give off objectionable and perhaps poisonous fumes when heated.

All this points to the conclusion that safety lies in eliminating the wholesale use of combustible decorative materials

in places of public assembly, rather than relying upon flameproofing treatments of questionable value.

There are some combustible materials that must necessarily be used in the furnishings. Let these by all means be flameproofed, but do not invite disaster by covering walls and ceilings with festooned cloth or paper, autumn leaves, pine branches or any other kind of kindling.

The NFPA Committee on Flameproofing and Preservative Treatments has established performance requirements for textiles and other decorative materials which have been flameproofed. These requirements are contained in the publication "Flameproofed Textiles," NFPA No. 701, which may be obtained from the NFPA Executive Office.

NATIONAL FIRE PROTECTION ASSOCIATION

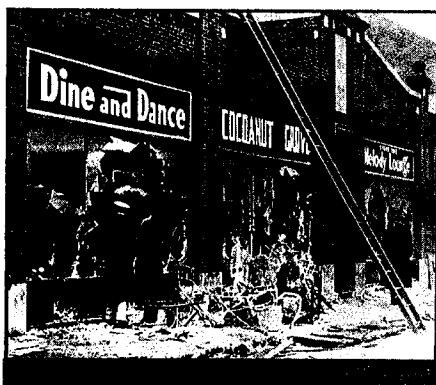
INTERNATIONAL

Executive Office: 60 Batterymarch St., Boston, Mass.

The National Fire Protection Association, a non-profit technical and educational association, was organized in 1896 to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire. Its membership includes over two hundred national and regional societies and associations and more than twenty thousand individuals, corporations, and organizations.

Membership in the National Fire Protection Association is open to any Society, Corporation, Firm, Fire Department or Individual interested in the protection of life or property against loss by fire. The valuable engineering and popular literature issued by the Association is sent, as issued, to every member. The Association is the clearing house for all the authoritative information on fire protection and prevention and members are privileged to submit to it their individual problems for solution. The Association is always glad to send samples of its publications to prospective members.

This pamphlet is one of a large number of publications on fire safety issued by the Association. The standards, prepared by the technical committees of the National Fire Protection Association and adopted in the conventions of the Association, are intended to prescribe reasonable measures for minimizing fire losses. All interests concerned have opportunity through the National Fire Protection Association to participate in the development of the standards and to secure impartial consideration of matters affecting them.



LOOKING BACK AT THE COCOANUT GROVE

On the night of November 28, 1942, fire swept through Boston's most popular night club, the Cocoanut Grove. In less than 30 minutes, the fire had traveled through the four main rooms, leaving 492 persons dead or dying. The magnitude of the tragedy was unparalleled in the United States and led to extensive investigations into its causes. These investigations not only revealed the technical causes of the fire and huge loss of life, but also hinted at a more deeply rooted problem: fire codes and their enforcement.

The Structure

The Cocoanut Grove was one of Boston's most popular night spots, featuring famed entertainers and often frequented by celebrities. The club was actually a group of four buildings connected on the ground floor. Located on Shawmut Street through the block to Piedmont Street and bordered on one end by Broadway, the site is now occupied by a hotel and theater.

The main building of the club was one-story and basement of reinforced concrete and brick masonry construction. It was originally a garage and motion-picture exchange before conversion into a night club at the end of Prohibition. The many extensions and alterations to the building ended in late 1942 with the opening of the new Broadway Lounge in a group of old two-to-three-story masonry buildings on Broadway. A passageway to the Main Dining Room connected the lounge to the main building.

The main entrance to the club was on Piedmont Street

This article is based on research by William Reinhardt as part of a seminar on Learning From Construction Failures at the Massachusetts Institute of Technology. Mr. Reinhardt is vice-president of Swenson Reinhardt Associates in Boston.

Above: The Shawmut Street side of the Cocoanut Grove the morning after the fire. The center door, which was partially opened during the fire, served as the emergency exit for many on the first floor.

through a revolving door opening into the foyer. From the left of the foyer, the lobby led past the check room and again turned left to stairs leading down to the Melody Lounge in the basement. To the right of the foyer was the Caricature Bar and straight ahead was the Main Dining Room.

Patron access to the newly opened Broadway Lounge was through a door on Broadway only and not through the connecting passageway. The basement also contained the Melody Lounge, the kitchen, and many storage rooms, while the second and third stories, which were over the Broadway section, housed dressing rooms for the employees and entertainers.

The Cocoanut Grove was virtually a rabbit warren of passageways and rooms. A brief description of these rooms is relevant here.

Foyer: The main access into the club was from Piedmont Street through a revolving door in the foyer. The walls were decorated with artificial leather over structural concrete, while linoleum covered the concrete floor. Exits from the foyer were the revolving door and a panic-fire door at the end of the lobby, at the head of the stairs leading down to the Melody Lounge. At the time of the fire, this panic-fire door was locked to prevent nonpaying customers from entering or leaving the club.

Caricature Bar: The Caricature Bar was raised two steps above the foyer and featured a 48-foot-long wooden bar faced with artificial leather. There were four casement windows behind the service bar facing Piedmont Street and a closed balustrade separated the raised section from the Main Dining Room. The means of egress were to the foyer, to the Main Dining Room, and into the passageway to the new Broadway Lounge.

Main Dining Room: Located on the Shawmut Street side of the building, the Main Dining Room was approximately 60 feet by 60 feet. Upon entering from the foyer, a raised terrace was to the left, dining/dancing floor was straight ahead, and a raised stage was to the right. Wood

veneer covered all windows on the Shawmut Street wall. Although the roof above the Dining Room could be opened in summer by an automatic rolling device, fabric covered the ceiling. A door exited to Shawmut Street; stairs led down to the kitchen; another door near the stage led to a door on Shawmut Street or downstairs to the kitchen; another door opened to the foyer; and a passageway led to the Broadway Lounge. Only the Shawmut Street door and the foyer were anticipated as emergency exits.

Broadway Lounge: The 40-foot-by-40-foot Broadway Lounge was located in an older building on the Broadway end of the club. The Lounge itself was of plywood covered with artificial leather, and the floor was wood. The Broadway wall had windows of fixed glass block. Exits were located by the main Broadway door and by the passageway to the Main Dining Room. The upstairs housed the dressing rooms, which exited downstairs to Shawmut Street.

Melody Lounge: The 55-foot-by-35-foot Melody Lounge was in the basement. The walls were covered with rattan and wood, and the ceiling was of suspended fabric. Artificial palm trees with light fixtures in them decorated the Lounge. The octagonal bar was covered with artificial leather, as were the seats and chairs that filled the room. Stairs went up to the first-floor lobby (and then either to the locked panic-door or the main entrance). A door to the kitchen led to a door (locked on the night of the fire) that opened to the alleyway or to the Shawmut Street service door (also locked).

Previous Inspections

Eight days before the fire, the Boston Fire Department's Fire Prevention Bureau inspected the building. According to the inspection report, the club had sufficient exits and fire extinguishers. The inspector noted that the Broadway Lounge seated 100 people, the Main Dining Room and Caricature Bar 400 people. When tested with a match, none of the decorations ignited. The report stated "no flammable decorations" and concluded that the condition of the club was "good."

The Building Department had also recently inspected the premises, because of the construction of the new Broadway Lounge. The Building Commissioner had found the only error to be the absence of a steel fire door between the new Broadway Lounge and the Main Dining Room. The door had been ordered, but it had not been delivered. The new Lounge, however, was allowed to open even though the required certificate of inspection was not issued.

The Cocanut Grove had also applied to the Licensing Board for a new license as a restaurant seating 460 people. An additional 30 seats for the new Broadway Lounge had also been requested, bringing the total occupancy to 490.

The Fire

On the night of November 28, 1942, the Cocanut Grove was busy. The 1,000 people estimated to be in the club that night included many servicemen and their dates, as well as fans from the day's Boston College football game. The Main Dining Room was so full that tables and chairs were set up on the dance floor. The Caricature Bar, the Broadway Lounge, and the downstairs Melody Lounge were "standing room only." At about 10:00 pm, the stage show was about to begin.

In the Melody Lounge, a young busboy lit a match to provide light while he replaced a fixture in an imitation palm tree. After fixing the light, he extinguished the match. A few moments later, someone noticed that the palm tree was on fire. Although the bartenders tried to extinguish the flames, the fabric ceiling was soon burning. The fire quickly spread along the entire ceiling of the Melody Lounge.

When occupants in the basement noticed the fire, they tried to escape up the stairs to the first floor. A bottleneck at the stairs slowed their escape. Some found their way into the kitchen after they could not get up the stairs, but many people were soon overcome by the dense smoke when they could not find the exits.

Meanwhile, the flames were rushing up the stairs to the foyer, 2 to 4 minutes after ignition. Many people collapsed on the stairs and the victims piled up. Occu-

One of the few artificial palms remaining in the Cocanut Grove after the fire. Wiring was concealed in the foliage. NFPA





The Suffolk County Mortuary was one of several places where bodies of Cocoanut Grove victims were taken. NFPA

pants who did reach the first floor tried to use the panic-fire door, found it bolted, continued to the foyer, and tried to leave the building through the revolving door. A few managed to escape, but the door was soon blocked.

People in the Main Dining Room and the Caricature Bar noticed the commotion in the foyer and realized that there was a fire. Most attempted to leave the way they came in, by the foyer. This caused another massive jam, for the flames were now rolling into the foyer, the Caricature Bar, and the Main Dining Room.

At this time, the lighting system reportedly failed, plunging the club into darkness. Many patrons, seeing the uproar in the foyer, turned around and started across the Main Dining Room toward a door that was being opened on the Shawmut Street side. The hundreds of tables and chairs in the dining room hampered their progress. Most people were soon overcome by the dense smoke and did not reach the door.

Meanwhile, the occupants of the Broadway Lounge were unaware of events in the Main Dining Room. However, that quickly changed as smoke and flames went up the passageway and entered the Broadway Lounge, only 5 to 6 minutes after ignition had occurred in the Melody Lounge. The Broadway door, which opened inward, was the only means for escape and people rushed for it. The mass of pressing people soon made it impossible to open the door; few escaped through that exit.

Fire Service Response

By coincidence, the fire department had dispatched several units to a car fire only a few yards down the street from the Cocoanut Grove at roughly 10:15 pm. The fire fighters were about to return to the station when they heard cries for help and saw smoke coming from the Cocoanut Grove. The first alarm for the fire was called at

10:21 pm with third, fourth, and fifth alarms at 10:24, 10:35, and 11:02 pm respectively.

It was quickly apparent that rescue activities would be the fire-fighters' major mission. Suppression forces broke the windows on the Shawmut Street side and attempted to bring out occupants. Other fire fighters broke the heavy glass windows in the Broadway Lounge in an attempt to aid in their escape.

Fire fighters on the Piedmont Street side of the club were appalled by the mound of bodies behind the foyer door and began to pull bodies out to see if anyone was still alive.

Inside the building, the interior finishings and decorations were quickly consumed and the fire soon burned itself out. There was actually little structural damage to the building, due to the predominance of reinforced concrete and masonry construction.

Rescue operations went on nonstop. Fire fighters found over 200 bodies piled in front of the revolving door in the foyer and another 100 behind the Broadway Lounge main exit. Many occupants had died very quickly, without much sign of struggle. Commandeered taxis and private cars transported the injured to hospitals. Many of the injured later died, either from burns or massive lung damage.

Many Boston residents first learned of the fire at the Cocoanut Grove when local radio stations interrupted their programming with news bulletins. Soon radio announcers were reading the names of victims over the air, a process that continued throughout the night.

The Aftermath: Investigations and Theories

After the disaster, the press, government officials, and the general public demanded to know the cause of the tragedy. Several major investigations were started almost immediately. The NFPA conducted a probe into the causes of the fire, the reasons for its rapid spread, and the high loss of life. Fire Commissioner William Reilly of Boston and the Suffolk County Grand Jury conducted their own investigations.

The NFPA inquiry led to a report written by Technical Secretary Robert Moulton. The NFPA report concludes that the immediate source of ignition had little bearing on what happened later,¹ and addressed the possible factors contributing to the high loss of life. While not assigning responsibility because of ongoing legal proceedings, the report clearly identifies violations of the *Building Exits Code* (predecessor to NFPA 101, the *Life Safety Code*®) and *National Fire Codes*.

The report cited the importance of unobstructed exits

¹ Possible ignition of the artificial palm tree by the match held by the busboy was never conclusively proven.

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and noted that exit doors must swing outward, compared to the inward Broadway Lounge door. The exits must be clearly visible (not concealed) and marked. Although the *Building Exits Code* stated the number of required exits for rooms of various capacity and use, one exit in the club (such as the foyer door) served many rooms. The report also raised the issue of sufficient exit lighting, which the Cocoanut Grove did not provide.

The NFPA *Exit Code* also prohibited the use of a revolving door as an emergency exit. Locked doors were another clear violation of the *Building Exit Code*.

The report also commented on the use of flameproofing chemicals on decorations. While some chemicals can make a combustible material resistant to a small flame such as a match, the report said, no chemical will make a combustible material resist a severe fire. The NFPA report concluded that the solution lay in eliminating the wholesale use of combustible decorative materials in places of public assembly.

According to Moulton's report, the Cocoanut Grove tragedy was not caused by deficiencies in firesafety laws. Proper enforcement of existing building and fire codes was needed, the report said. The NFPA report also emphasized the need for a clear demarcation of building department and fire department responsibilities in code enforcement. Finally, the report called for the application of codes to old, as well as new, buildings, and highlighted the need for fire inspector training.

The Boston Fire Commissioner also conducted an investigation and issued an independent report on the Cocoanut Grove disaster. That report called the fire of undetermined origin and agreed with the NFPA report that the chimney effect of stairways and draft from ventilators contributed to rapid fire spread. The large flame-over, according to the Commissioner's report, was caused by the partial burning of combustible material, producing highly flammable gases that ignited when combined with oxygen in the foyer and the Main Dining Room.

The Fire Commissioner attributed the high loss of life to many factors, including the extreme overcrowding of the Grove on the night of the fire. The locked door on Piedmont Street and jammed revolving door in the foyer accounted for many deaths. The failure of the lighting

system and the many overturned chairs and tables in the dining room resulted in confusion and delay, causing many additional fatalities. Curtains and decorations concealed unmarked exits, causing more deaths.

All recommendations in Commissioner Reilly's report related to new legislation, contrary to Robert Moulton's suggestions. For example, the Commissioner recommended a better definition for "place of assembly," along with the enactment of more stringent laws for that type of occupancy. A required certificate of safety, issued by the fire department and specifying the maximum number of people to be admitted, was proposed. Other recommendations included prohibiting the use of basement rooms as places of assembly (except under certain conditions), defining aisle space between tables and requiring tables to be affixed to the floor, and requiring lighted exit signs and an emergency lighting system.

After its legal inquiry, the Suffolk County Grand Jury issued criminal indictments against 10 people, including four city employees. For weeks, Boston newspapers provided detailed daily coverage of the trials, including transcripts of testimony and illustrations of the courtroom scenes. The Building Commissioner, the head of the Fire Prevention Bureau, and the fire inspector who had inspected the Cocoanut Grove eight days before the fire were each acquitted of charges against them. Charges against the police night captain, in the Broadway Lounge at the time of the fire on his rounds of nightclubs, were dropped.

Two of those indicted were convicted. The owner, Barnet Welansky, was found guilty of manslaughter and conspiracy to violate the building laws and sentenced to 12 to 15 years. The contractor who built the Broadway Lounge was found guilty of conspiracy to violate the building laws and was sentenced to two years.

The Impact

Forty years after the disaster, the name "Cocoanut Grove" is still associated with fire. To many in fire protection, the fire at the Cocoanut Grove symbolizes the need for strict enforcement of strong fire codes in places of public assembly. △

NFPA SCHEDULES SEMINARS

The NFPA will conduct two *Life Safety Code*® Seminars, as well as one Health Care #101 Seminar.

Life Safety Code Seminars have been scheduled for November 30–December 3 in Honolulu, Hawaii, and December 7–10 in Juneau, Alaska. The Health Care #101 Seminar will be held on December 20–21 at NFPA headquarters in Quincy, Massachusetts.

For additional information, contact: the NFPA, Division for Continuing Education, Batterymarch Park, Quincy, MA 02269 (617-328-9290).

Searching for answers to the **Cocoanut Grove**



Fire of 1942

Doug Beller and
Jennifer Sapochetti

The night of November 28, 1942 was chilly in Boston, but that didn't stop about 1,000 partygoers from jamming into the Cocoanut Grove nightclub on Shawmut Street, many of them celebrating the Holy Cross College football team's victory. By 10 p.m., there were more than 1,000 people in the first-floor Broadway Lounge and basement-level Melody Lounge—about 400 more than the building could legally hold. Less than an hour later, 492 of them would be dead and 166 injured in a fire that started in the Melody Lounge, ostensibly after a busboy lit a match as he tried to replace a light bulb in an artificial palm tree.^{1,2}

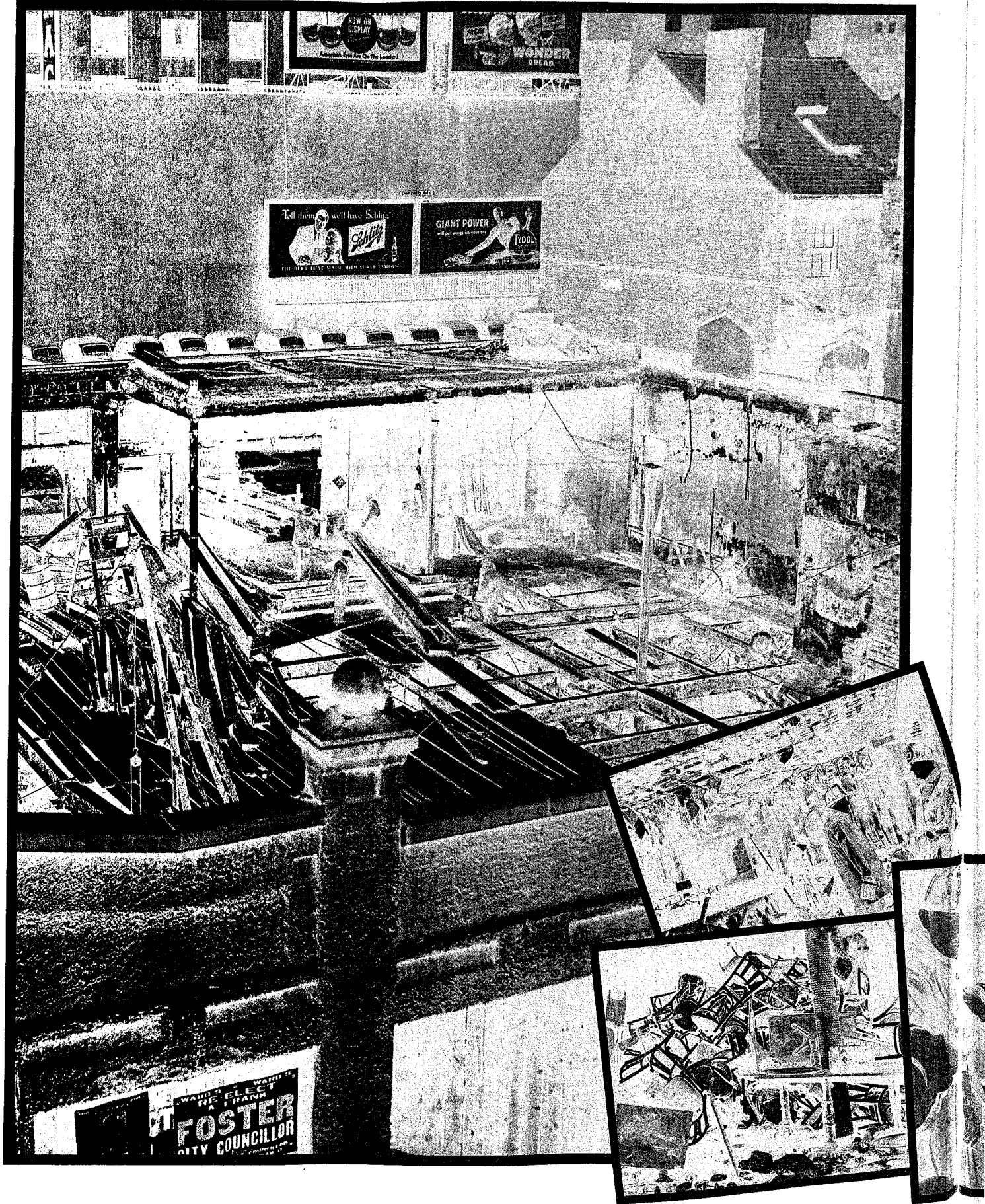
NFPA JOURNAL MAY-JUNE 2000

Photo above: Corbis

84-86, 88, 90, 92



All Photos: Associate Press, except as noted



Fifty-seven years later this fire still elicits passionate discussions about its cause and the speed at which it spread. The official cause of the fire is still listed as "undetermined," although many theories, from alcohol-laden air to residual insecticide vapor, have been proposed to explain both its ignition scenario and the devastation it caused. However, none of these hypotheses have the evidence to support them.

So what did start the notorious Coconut Grove fire? And how can any hypothesis be proven?

The search begins

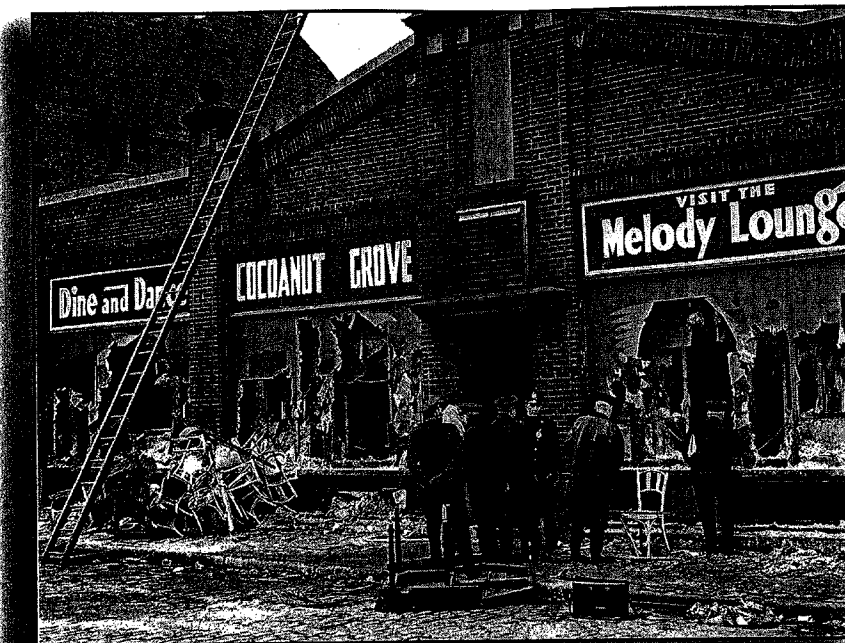
The investigation into the cause and origin of the Coconut Grove fire began in 1996, when NFPA Fire Modeling Specialist Doug Beller began looking for a case study to demonstrate how fire models can be used to develop and verify performance-based fire protection designs. He knew a real fire would be easier for NFPA technical committees and authorities having jurisdiction to relate to than a fire he concocted and would give people an opportunity to compare thoughts. Beller also knew he'd have to use fewer assumptions when constructing the model, given the relatively large amount of information already known about the fire. And he knew that using the Coconut Grove fire as a case study would give people an opportunity to determine how effective some of the many code provisions adopted as a result of the fire would've been had they been in effect in 1942.

Having made the decision to use Coconut Grove as the subject of the case study, Beller began gathering data. Typically, the data is divided into three categories: geometric, physical, and miscellaneous.

Miscellaneous data consists of ambient conditions that existed before the fire began, such as air pressure and the specific heat of the air, and any other data that pertains to controlling the program. For example, one needs to determine how many minutes are to be simulated and at what time interval the calculations will be performed.

Geometric data consists of the dimensions of the room of fire origin and the dimensions and locations of other rooms in the building. Locations and dimensions of vents, such as doors, windows, and ventilation outlets are also provided, as are the locations of the object that burned first and any other flammable items of interest.

In the case of Coconut Grove, the length of the foyer in which the fire traveled is a critical piece of geometric data. However, the foyer had a rounded ceiling, and fire models can't be used to simulate anything but rectilinear, or box-shaped, rooms with flat ceilings. To get around this obstacle, Beller converted the nightclub's rounded ceiling into an equivalent flat ceiling using some assumptions. Assumptions can sometimes prove burdensome because they must be subjected to a sensitivity analysis to determine their effect on the potential operation of the system. Fortunately, there's enough information available today to reconstruct the Coconut Grove nightclub accurately, at least in the computer. Beller held the foyer's length constant while he adjusted the room's height and width to provide the same cross-sectional area. The other rooms in the nightclub needed no adjustment.



The final category of data, physical, is usually the most troublesome, partly because it can be difficult to obtain. This type of data includes the material properties of both the fuels that feed the fire and the building materials involved. How much heat energy does the burning fuel release, for example? How much smoke and other combustion products does it generate? When do additional fuels ignite? Since we know the construction and finish materials used in the Coconut Grove nightclub, representative material properties are readily available. But we don't know what fuel caused the devastation.

Beller didn't know one other important factor: where the fire actually started. In most historic fires, ignition location is known, as is the material that initially burned and its location in relation to other burnable items. The report that the fire was started in the Melody Lounge by a busboy with a match could never be substantiated, and it was just one of many hypotheses of varying degrees of plausibility that were proposed to explain the tragedy.

The search for a culprit

Because the bulk of computer fire model analysis depends on the burning characteristics of the fuel, it's important to identify it accurately. To do this, the researcher must first determine which fuels are plausible, and to do that, he or she must match evidence and eyewitness accounts with what's known about the burning behavior of the fuel.

Beller eliminated some of the hypothetical fuels because they didn't result in products of combustion that would cause the type of trauma seen in victims of the Coconut Grove fire. He considered only the three most plausible hypotheses: pyroxylin, refrigerant gases, and methyl chloride.

Pyroxylin, also known as cellulose nitrate, was used in the manufacturing of artificial leather present in Coconut Grove as wall lining material. Cellulose nitrate is also the basis for motion picture film, and one theory about the fire says that "a number of reels of cellulose

nitrate motion picture film may have been brought into the building on the night of the fire by some employee of one of several nearby film exchanges.² Cellulose nitrate burns rapidly, and a sufficient quantity could explain the fire's behavior.

However, there doesn't appear to have been such a quantity. Furthermore, the fire was seen in the branches of the artificial palm tree near the ceiling at almost the same time it was seen traveling along the wall near the floor.² If cellulose nitrate had been responsible for the rapid fire spread, it would've been near the floor and near the ceiling. Given the fact that it was present either as a wall covering or as reels of motion picture film, it doesn't seem likely that it was near the ceiling. Therefore, something else was to blame.

Having eliminated cellulose nitrate as a possible fuel, Beller turned his attention to the refrigerant gas hypothesis. According to Robert Moulton's 1962 account of the fire, air-cooling units in the Melody Lounge were served by a refrigerating unit behind the false wall, and after the fire, some of its tubing was found broken or melted.² As Moulton notes, however, "none of the commonly used refrigerant gases are flammable, so this would seem to rule out any refrigerant gas as being in any way responsible for the initial flash."

Moulton also notes that, although some refrigerant gases used at the time were toxic, there wasn't any reason to assume that the refrigerating unit's tubing melted or broke to release the gas during the first minutes of the fire. "It thus appears," he said, "that refrigerant gas may be dismissed as a factor in the early stages of the fire when most fatalities occurred."

Or so it appeared in 1962. In 1993, however, David Arnold published an article in *The Boston Globe* that seemed to shed doubt on this conclusion.³ According to Arnold, "Methyl chloride is a flammable gas that was commonly used as a refrigerant during the war years. It replaced freon, almost all of which was allocated to the military." He goes on to say that, "it was common knowledge...that the Cocoanut Grove was cooling beer, food—and people in the summer—with methyl chloride in a system with a capacity of 10 to 15 tons." Apparently, "...investigators at the time thought the Cocoanut Grove was using freon or an older cooling chemical, sulfur dioxide." They didn't know about the methyl chloride, so it wasn't mentioned in their 1943 published report. No one noticed the omission because those who'd serviced the Cocoanut Grove cooling system never saw the report.

They'd all gone to war.

Given that methyl chloride appears to have been on the premises at the time of the fire, Beller investigated its burning characteristics. When he asked Dr. Ed Clougherty, the Boston Fire Department's chemist, whether methyl chloride could've been at fault, Dr. Clougherty replied that, since methyl chloride gas is heavier than air, it couldn't explain the flames near the ceiling of the Melody Lounge.

At this point, the trail appeared to hit a dead end. Researchers considered all the plausible hypotheses, and none seemed to explain the spread of the fire or the resulting evidence. However, this didn't mean that a fire model of the Cocoanut Grove fire couldn't be developed.

Performance-Based Design and NFPA

Performance-based fire protection design differs from traditional prescriptive approaches in several ways. First, instead of a "recipe and list of ingredients" with which to develop a fire protection system, a designer is given goals and objectives to obtain those goals such as "maintain the smoke level above the heads of people evacuating the building."

The designer is left with the burden-of-proof regarding whether the design can achieve the given objective(s). One way of demonstrating this is by performing full- or reduced-scale tests. Another method is using computer fire models to predict the amount of smoke and heat generated from a design fire. A design fire is intended to represent a fire that will significantly challenge a proposed fire protection system design, but not unreasonably so. The computer fire model predicts the times untenable conditions may occur given the design fire and other conditions in the room of fire origin or elsewhere in the building, as well as when various fire protection features may be activated, such as sprinklers, detectors, and so on. If the goal is to maintain life safety in a building, then the predicted time for untenable conditions must be greater than that needed to evacuate the building's population safely.

However, use computer fire models with caution and due diligence in performance-based fire protection design. For this reason, NFPA hired a fire modeling specialist to assist NFPA technical committees that have decided to develop performance-based provisions. Part of developing these provisions involves verification methods to be specified by the technical committee. Current thinking is that computer fire models will be heavily relied upon to perform verification because testing may be prohibitively expensive, experts may have no experience associated with a proposed performance-based design, and there'll most likely be little, if any, historical data. NFPA technical committees are therefore expected to identify those computer fire models and methods that can be used to verify whether or not a proposed performance-based fire protection design may achieve its given objectives.



Types of computer fire models

Computer fire models are available in two basic types: zone and field models. Zone models divide the room of fire origin into two large volumes, one above the other, extending to the wall of the room. The upper volume that is, the layer or zone, is assumed to consist of smoke and other products of combustion. Some fire models allow unburned fuel in the upper layer. The lower zone consists of the cool, ambient air present before the fire starts. Both zones are assumed to be well mixed and have uniform properties. Some fire models allow mixing of the two zones. Zone models provide an adequate level of detail, run fairly quickly, and are relatively easy to learn.

Field, or computational fluid dynamic (CFD), models are more sophisticated than zone models in that they divide the room of fire origin into thousands or tens of thousands of small volumes. Each small volume has several equations associated with it. Therefore, CFD models are computationally intensive and take hours to run a single case, in fact, 20 to 30 hours isn't uncommon. Because of smaller volumes, CFD models provide more detailed predictions than zone models, but in addition to taking a lot of time to run, also incur additional staff testing costs. CFD models take more time to learn, prepare the input, and interpret the output than do zone models.

Regardless of which type of fire model is used, both require a solid foundation in engineering sciences and fire dynamics. Without this knowledge, the fire modeler can easily misinterpret the predicted results. Fire modelers and authorities having jurisdiction shouldn't assume that a computer fire model output is correct just because a computer generated it; garbage in, gospel out is the wrong attitude.

Configuring the fire to produce the desired results

While it would've been nice to identify a specific material to explain the rapid fire spread, finding the ignition fuel isn't absolutely necessary when modeling a fire and its effects. One of the attributes of fire models is that they can be configured to provide a desired result. This is especially important for reconstructing fires because the model can be forced to predict an observed condition at a specific point in time.

For example, smoke started leaving the room of origin five minutes after the fire started, a fact that was used in the fire's reconstruction. Since there were so many eyewitness accounts, it was easy to input fuel properties that would allow the model to "predict" what the witnesses actually saw.

This "force to fit" capability is useful in answering "What if...?" questions posed by those developing structures using performance-based designs. For example, what conditions might have resulted if the fuel at Cocoanut Grove had burned less rapidly? To answer this question, a slower burning rate is used, with different effects predicted. Less smoke would've been generated in the same amount of time, therefore conditions would've remained tenable longer, giving more people time to escape.

To do this, Beller established a base case that depicted the fire as it actually occurred, with a burning rate of 100 percent. He then ran three more cases with burning rates of 50, 10, and 5 percent of the base case value. As expected, the three additional cases depict what conditions might result from less "severe" fuels.

Assuming materials are available that correspond to these burn rate values, a designer can specify material that best achieves the objectives of the proposed performance-based design.

After material burning rates were run, the modeling continued by establishing when smoke detectors and sprinklers would've activated, had they been present. The final step involved predicting evacuation time of Cocoanut Grove patrons. This last step is the most imprecise to date and requires additional analysis before providing anything more than a relative measure of how long people would need to evacuate safely.

The end of the story...?

At this point, Beller had a fairly realistic fire model of Cocoanut Grove in terms of time and fire spread, that could demonstrate performance-based design concepts when using limited zone models.

Given these limitations, sophisticated computational fluid dynamics (CFD) models could be applied to the Cocoanut Grove model. Beller asked Doug Carpenter of Combustion Science and Engineering to construct a CFD model of the Cocoanut Grove fire.

Carpenter felt an investigation using NFPA 921, *Fire and Explosion Investigations*, was more appropriate. Beller's staff, including Jennifer Sapochetti, looked into questions Carpenter raised, such as "What fuel when burned in a fire could explain the evidence?"

Investigations: then and now

In 1942, fire investigators relied on instinct and experience, not science, to base their conclusions about the cause and origin of a fire. There are, and may always be, missing links of information necessary to determine what really happened on that cold November night. While this project wasn't intended to determine the cause and origin of the Cocoanut Grove fire, could 57 years of scientific advances shed light on some unanswered questions?

NFPA 921 suggests that basic fire investigation should rely on a systematic approach, like that used in physical sciences, giving attention to all relevant details. A principle of inquiry, the scientific method forms the basis for legitimate scientific and engineering processes, including fire incident investigation. The use of a systematic approach often uncovers new factual data for analysis, which may require reevaluation of previous conclusions.⁴

There are six steps to the scientific method. First, identify the problem or need for investigation. In this case, no official cause has been determined even after all these years. Next, define and investigate the problem. Many articles, books, personal accounts, artifacts, and photographs are available on the Cocoanut Grove fire, though investigators had to rely on the work and word of others due to the passage of time.

With the background in place, the third step is collecting data.

Medical advances in burn treatments

Some of society's most notable advances were conceived in times of tragedy, hardship, and strife. The Cocoanut Grove fire remains one of the United States' most tragic domestic conflagrations. Approximately 492 lives were lost, however, the death toll might have been much higher if it weren't for medical breakthroughs occurring at the time.

Before the fire, the standard way of treating a burn was to "tan" it, which involved scrubbing the burned area clean before applying harsh chemicals, mainly tannic acid, to the burn. The theory was to keep the area clean and free of infection by allowing a hard scab to form, regardless of the terrible pain experienced by patients. Before the fire, Massachusetts General Hospital's Dr. Oliver Cope and others developed an alternative treatment that didn't involve chemicals or scrubbing extremely tender skin. Instead, the burn was covered with a salve of boric petroleum and wrapped in gauze. The patient was also given plasma transfusions to replace lost fluids.

Although this new method had only been used on a couple of patients before the Cocoanut Grove fire, it was a great success. Boston hospitals were overwhelmed with victims, and the new method saved many lives.

In addition to this new surface treatment, the Cocoanut Grove fire also fostered the advancement of respiratory therapy. Before the fire, the extent and dangers of internal burning weren't well known. Many victims suffered burns inside their nasal passages and throats from breathing in super-heated gases, the effects of which were intensified by the presence of other gases such as methyl chloride. As a result many victims died from pulmonary edema even though they didn't suffer external burns.

The number of lives saved over the years as a result of the medical advancements made during and after the Cocoanut Grove fire are unknown. What's known is that significant research was made possible by the tragedy and the treatment of burn victims changed forever.

Everything must be carefully examined with notations of anything that offers a description or condition linked to the fire. In this investigation, several accounts of survivors' stories related how they escaped and survived. Clues were extracted from these descriptions of where the person was in the club, how they became aware of the fire, and how they escaped. One clue was that many survivors recalled a sweet smell to the smoke. Another survivor said he held a wet towel to his mouth as the fire passed through the Melody Lounge, the point of origin. Since many people in that room were overcome by gas and smoke, dying before they could even leave their seat, why was he able to walk away? Clues lead to questions and questions lead to further investigation.

Analyzing such data is the next step in the process. Answering questions raised by the clues led to reviewing medical research documented by the doctors and interns who cared for Cocoanut Grove survivors. Three doctors at Boston City Hospital studied the recovery of patients with internal burn and pulmonary complications and concluded, "The exact cause of the pulmonary lesions in the victims of the Cocoanut Grove fire wasn't determined. At the time of that disaster, the rapid development and severity of the respiratory symptoms, diffuse rales heard in the chests of many of the patients, and the number of deaths resulting from the pulmonary complications within the first few hours all suggested the possibility of a pulmonary irritant such as phosgene."⁵

This was just one of the many medically related links. However, such a link coupled with a report mentioning the use of methyl chloride as a refrigerant, the accounts of sweet smelling gas, and the story of the man who held a wet towel to his face can be pulled together to form a hypothesis, which is the next step in the scientific method.

Several hypotheses should be developed and tested. For example, further investigation has shown that methyl chloride, the assumed refrigerant, releases the toxic gas phosgene when it burns. It's also described as having a sweet smell at certain concentrations and is water soluble.⁶ The effects of phosgene on the human body could cause the symptoms many patients displayed. The solubility of methyl chloride could explain why the man with the wet towel wasn't overcome.

The last step in the scientific method is testing and selecting a hypothesis, which can only be done after carefully testing each hypothesis for validity. The methyl chloride hypothesis used as an example has yet to go through this rigorous process, which is why it remains only one of many speculated theories.

Exactly what occurred the night of November 28, 1942 may never be fully known. But with fire models and the continued use of scientific methods in the investigation process, mysteries such as the Cocoanut Grove fire may finally be put to rest.

Doug Beller is a NFPA fire modeling specialist involved in NFPA's performance-based codes and standards initiative. Jennifer Sapocetti is a fire protection engineer with R.G. Vanderweil Engineers, Boston, Massachusetts.

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FIRE SERVICE

Casey Coburn/Grant

Last Dance at the Coconut Grove

Five who were there remember the night of November 28, 1942.

The Coconut Grove was a nightclub in Boston, Massachusetts, before and during World War II. Today, the Grove still exists, though only as a footnote in history, a single moment carved into the edifice of time.

Just after 10:00 p.m. on the chilly evening of Saturday, November 28, 1942, the Coconut Grove's long history as a fun place to go was about to come to a bitter end. The nightclub was packed beyond capacity with more than 1,000 people when a small fire broke out in an artificial palm tree in the Melody Lounge, located in the basement. The fire quickly spread to the ceiling decorations. Then came the panic.

In the Boston Fire Department's of-



WORLD PHOTOS

official report, Fire Commissioner William Arthur Reilly estimated that it took only 2 to 4 minutes for the fire to spread across approximately 40 feet of the Melody Lounge to the only public stairway out. In seconds, it had flashed up the stairway, through the first-floor foyer and the main entrance, and into the main dining room. From the first appearance of flame until it spread to the entrance of the first-floor Broadway Lounge almost 225 feet away, Reilly estimated an incredible 5 minutes had passed at most. At this point, all the exits normally open to the public—each of which had something functionally wrong—were useless.

In minutes, the Cocoanut Grove was an inferno from one end to the other. Some patrons escaped untouched but most did not. Rescuers pulled trapped survivors and victims out as quickly as possible, and by midnight, the once-bustling Cocoanut Grove was a blackened, soaking, empty hulk. It all happened so quickly.

The patron

"We went to watch Boston College beat Holy Cross, and instead, it was one of the greatest upsets in college football history," says Hewson Gray of Waltham, Massachusetts.

Hewson Gray and his wife Hilda went to the game at Fenway Park that afternoon with Hilda's sister Josephine Driscoll and her husband Francis. Later that evening, they planned to meet two other couples at the Cocoanut Grove for dinner.

The Boston College (BC) Eagles were better than six-to-one favorites over Holy Cross. They were undefeated with a very tough schedule, in contrast to Holy Cross who had a balance of wins. But the final score was an incredible 55-12 upset.

Despite the debacle, some of the BC contingent carried on with their plans. Among these were the Grays and the Driscolls, who were obligated to meet their friends. Their reservations at the Grove were for late evening. It was about 8:30 p.m. when Gray parked his car on Berkeley Street so the group could cap the night off with dinner and a show at the Cocoanut Grove.

"It was so crowded that you had to turn sideways to get through the tables in the dining room," says Gray, "and apparently, they were having trouble getting us a table, despite our reservation. We had to go all the way across to the far corner of the dining room, over to the other side of the stage. 'O'Brien' was the name on the table that they finally gave us.

"We always wondered where the O'Briens sat; that is, where we should have been," says Gray. "We were lucky." Four O'Briens died in the fire.

It was a few minutes after 10:00 p.m., and the show would soon begin. Gray went to the men's room at the opposite corner of the dining room, just off the lobby at the top of the stairway that led down to the Melody Lounge. Just as he returned to the table, he heard a commotion in the direction from which he had just come. Initially, it sounded as if someone were shouting "Fight!" Patrons seemed to be bumping each other in an attempt to clear out of the lobby.

Then Gray's party saw a sliver of flame flash on the ceiling, and they knew what it was. They all saw it, all eight of them at the table in the far corner. It was a fire.

A waiter rushed across the dance floor and began fumbling with the drapery on

the Shawmut Street wall of the dining room. There was a door behind the drapes, and the waiter was trying to open it. Suddenly the small flame became a fireball, racing toward the center of the dining room, igniting tablecloths and everything else it touched. A wave of humanity started running away from it, toward the party of eight.

The Grays, the Driscolls, and the other two couples jumped to their feet and immediately were pushed toward a service door behind them that led to rooms behind the stage.

As the Grays were swept along, the waiter and others got the Shawmut Street door open, and people from the dining room began flooding out this exit with fire over their heads. Gray and his party, though close to the open door, were swept away from it toward the service door in the corner by terror-filled patrons. And then, just as they entered the service door, the lights went out.

In the darkness, the four couples followed the people in front of them, not sure where they were going. "We took a couple of corners, went up some stairs," says Gray. "There were some more stairs that went down, but we didn't take them. Followed a wall, took some more turns.... It was very confusing...."

Hewson and Hilda Gray and the others were still together, but smoke was starting to build in the little back rooms now jammed with people. They sensed they had come to still another door, but it was locked. Several men teamed up to try to break the door down, but it seemed hopeless. Then it flew open, and there were fire fighters with axes, strikingly cold fresh air, and people running all over the street. This was one of the first doors opened by the fire department, which, fortunately, had happened upon the scene after responding to a nearby car fire.

"Once out of the building, we all stumbled in the night air across Shawmut Street," says Gray, "but then we realized one lady wasn't with us."

As the four men started to fight their way back through the outpouring crowd, she was swept into their midst. All eight people in their group were safe, allowing the four men to return to the service door to help as people stumbled out.

"Now, people were collapsing as they came out, having been exposed to the smoke and flames," says Gray. "They were dropping all around, even some that looked okay, but some had soot around their faces. They were lying everywhere."

In almost no time at all, Shawmut Street had become a seething mass of people. In addition to those coming out of the Grove, fire fighters and police officers were arriving on the scene in growing numbers.

In the commotion, the four men did





what they could to help others out of the club. It was now readily apparent to Gray and the three men with him that many people had not escaped and that the smoke and flames in the building had become unbearable.

The four couples were directed to a nearby hotel that had been set up as a base for the Red Cross.

"As we walked up to the hotel," says Gray, "a cop in the front was talking to a civilian and said to him 'They were all drunk—that's why they died.' We were furious, all of us, and we gave him hell!"

Their hats and coats were lost in the fire. They had lost their car keys, too. Fortunately, the Red Cross arranged for rides, and the Grays were driven home

about an hour after they left the Cocoanut Grove. The next day, Gray went back to pick up his car on Berkeley Street, using a spare set of keys. A number of cars were still there, and he wondered who and where the owners were. Had they survived?

The employee

While Hewson Gray and his party negotiated the fire in the main dining room on the first floor, Daniel Weiss battled for his life downstairs in the basement-level Melody Lounge, the room of fire origin.

Weiss was working the cash register on one side of the bar in the Melody Lounge, directly below the main lobby of the Cocoanut Grove. A single stairway

descended into the lounge, which had a bar in the center. Decorated with a tropical motif of artificial palm trees, greenery, and coconut husks, the dimly lit lounge could accommodate up to about 100 customers. This evening, however, the crowd in the lounge was probably twice that number.

Daniel Weiss was a 24-year-old fourth-year medical student at Boston University, who had worked weekends at the Grove for the past 3 years for the owner, his uncle Barney Welansky.

It was about 10:15 p.m. when a stir in the corner to the right of the stairs caught Weiss's attention. Moments earlier, he had noticed a bar boy talking to the head bartender, John Bradley, about turning a

Medical Advances

In November 1942, the country's medical community was responding to the urgent wartime need to improve certain medical techniques, and Boston found itself directly involved in these efforts.

The research initiatives included the search for improved methods of treating burn victims, and focused on surface and surgical management of burns, as well as fluid and respiratory management.

Surface and surgical management

The accepted method of surface management in 1942 was the "tanning process," which involved the application of a solution of tannic acid. This created a leathery scab over the burn, which shielded against bacteria and the loss of body fluids. However, this time-consuming, cumbersome, and skill-dependent process subjected the patient to agonizing pain when burns were scrubbed before the chemical dyes could be applied.

Dr. Oliver Cope and his colleagues at Massachusetts General Hospital (MGH) devised a new method of surface management known as the "soft" technique. Using this simplified method, the burned surfaces

were swathed in gauze impregnated with boric petroleum.

This innovative method had been implemented at MGH just before the fire and was used on Cocoanut Grove patients who sustained severe burns. The method was virtually an unqualified success for those burn victims without respiratory or other complications.

At Boston City Hospital, the treatment of a young Coast Guardsman named Clifford Johnson made medical history. With third-degree burns over more than 50 percent of his body and second-degree burns over another 25 percent, he was given no chance to live. At that time, it was a medical rarity for anyone to survive third-degree burns over as much as 20 percent of the body. But after almost 12 months under the care of Dr. Newton Browder, Johnson was discharged from Boston City Hospital, a medical phenomenon.

Fluid management

Research on another topic, fluid management for the treatment of shock, was also under way at the time of the Cocoanut Grove fire, and the Boston hospitals were well prepared.

Large quantities of stockpiled

blood and plasma were used on the victims. In the first 24 hours alone, more blood plasma was given to Cocoanut Grove victims than had been used in Hawaii following the attack on Pearl Harbor.

The day after the fire, 1,200 citizens offered to donate blood, and within days, the local Red Cross had collected a much-needed 3,800 units.

Respiratory management

Foremost among the advancements in modern burn treatment that resulted from the Cocoanut Grove fire are those involving respiratory management.

The number of victims who succumbed to respiratory tract injuries was significant. Much to the dismay of the medical staff, the effects of these injuries were often delayed and involved individuals who showed very little outward sign of being in danger.

Postmortem examinations revealed a strange pattern of massive pulmonary edema that developed late and abruptly. This was reminiscent of the effects of poison gases, such as those used in World War I. These findings were also reminiscent of those encountered in the 1929 Cleveland Clinic fire, which



light in the corner back on. Apparently, a patron had unscrewed the bulb to make the corner more romantic for himself and his girlfriend.

After the bar boy had turned the light on and returned to the bar, there was a sudden flurry in the corner. Several people jumped to their feet, backing off and peering up. And there it was: a small flicker of blue light at the top of the palm tree where it met the lowered ceiling.

"Get water quick! There's a fire!" someone shouted.

Weiss guarded his register, as was expected of him, while several employees attacked the flames with water from a pitcher and a siphon bottle of seltzer. A bar boy swiped at the fire with a towel,

killed 125. The Cleveland fire involved x-ray film, which released phosgene gas into the ventilation system. In the Coconut Grove fire, investigators suspected that a deadly poisonous gas might have been released from the pyrolysis of the interior finish.

In any event, it was apparent that many of the hospitalized victims had inhaled a toxic substance. They developed post-traumatic pulmonary injury and required constant observation.

Infection

Another medical milestone specifically related to the Coconut Grove fire was the use of penicillin on general patients. In 1942, penicillin was new, expensive, and scarce. Nonetheless, Coconut Grove survivors at Massachusetts General Hospital became the first recorded general patients to receive the new drug on December 2, 1942. Much later, however, when more was known about penicillin, it was determined that the drug had been administered in dosages that were much too small to do them any real good.



Following the blaze, Boston fire fighters inspect the bar of the blackened and gutted Coconut Grove.

but the flames continued across the ceiling decorations. Another employee returned from the kitchen with an extinguisher, but it was ineffective. By now, the music had stopped. However, many patrons seemed unaware of the growing problem and few had made any effort to leave.

Bradley and a busboy struggled to pull the now-blazing palm tree off the wall. With a mighty yank and a shower of sparks, the tree finally came down. The fire, now well-involved in the ceiling fabric, suddenly flashed across the ceiling with terrifying speed.

The crowd rose in panic. Shouts and screams accompanied a mass rush to the stairs, the only obvious exit. Fortunately, Bradley had flung open the camouflaged service door, and he shepherded a small group into the kitchen. Most of the patrons were unaware of the kitchen exit, however, and scrambled toward the stairway, which now had become a chimney. A few made it out before flames raced up the stairs, but most did not. A wall of bodies quickly blocked the only visible way out, trapping patrons in the inferno.

During the panic, Weiss hesitated, staying at his post despite his terror. Cashiers were entrusted with safeguarding the money during disturbances. But this was different. Weiss watched in horror as people were burned alive on the stairs or fell victim to the smoke and fumes.

Weiss knew he had to get out. Just as he sprang for the gate beneath the bar, the lights went out. Dropping to his hands and knees, he scrambled to the bar gate and pushed, but it was blocked. He stayed low. Nevertheless, it was becoming difficult to breathe. Still crouching, he reached into a sink and soaked a bar towel in dishwater, placed the cloth over his mouth and nose, and lay face down.

"The closer I was to the floor, the easier it was to breathe," he says.

Suddenly, Weiss realized that the screams and cries had subsided into

moaning and scratching, followed by an eerie, forbidding silence. Even the fire seemed to be gone. What was happening?

Desperate, Weiss took a deep breath, rose, and lunged over the counter. But instead of the floor, he landed on shapeless forms and stumbled. Bodies!

Scrambling in horror, still holding his breath, Weiss fumbled through the service door into the smokeless passageway to the kitchen. As far as he could tell, he was the last person to leave the Melody Lounge alive.

Feeling his way, Weiss made it into the spacious basement kitchen. He was astonished to find several dozen people huddled there. It was unclear to him why they were making no effort to leave. He took the initiative and headed for the stairs that served the main dining room.

"I got halfway up the stairs, and then it hit me like an inferno," he says. "The heat upstairs was unbearable."

Before retreating, he heard people screaming, furniture crashing, and the crescendo of the fire itself.

Remembering the service stairs beyond the furnace room on the other side of the kitchen, Weiss convinced the fearful group to follow him. These stairs led to service rooms behind the stage in the main dining room, then directly out to Shawmut Street. However, as they came through a basement storage room, they opened the door to the furnace room and were hit by the warm air and soft light of the club's boiler plant. A woman screamed, "He's leading us into the fire!" The group broke ranks in a panic, retreating to the kitchen.

In the kitchen once again, Weiss pleaded with the group, but no one would follow him. Weiss could only promise to send help.

As he came to the top of the service stairs, he found himself among the gasping, wheezing, struggling survivors stumbling out of the upstairs part of the club. On Shawmut Street, people were running



The injured, the dead, and the dying lie in the street outside the nightclub, while civilians and medical personnel attempt to administer emergency aid.

everywhere: fire fighters, police officers, servicemen, civilians. There was shouting, screaming, and sirens. Singed survivors stumbled around in a daze, and bodies lay about the street like rag dolls.

Once outside, Weiss shouted that others were trapped in the basement. Many fire fighters were now entering the building, and Weiss could not go back into the club. He drifted about on Shawmut Street in a daze, before he thought to call his parents.

Weiss's frantic parents were greatly relieved to receive his phone call and immediately rushed to meet him. His father insisted he go to the hospital.

The following day, Weiss was escorted through police lines to help secure the money in the Grove's cash registers. The building was gutted, everything black and broken and sad. Upended furniture was scattered everywhere. Below, the Melody Lounge was eerie and waterlogged.

As he looked around, however, Weiss noticed that the fire damage in many places was limited to the upper portions of the building. In the Melody Lounge, much of the bar appeared to be untouched. Even in the main dining room, fire damage seemed to be confined to the upper reaches.

The Coconut Grove was now a part of history.

The fire fighter

George "Red" Graney had been with the Boston Fire Department for 5 years at the time of the fire. He was assigned to Engine Company 35, at Broadway and Warrenton streets, near the Coconut Grove.

At 10:15 p.m., an alarm box sounded at Stuart and Carver streets in the South End. Apparatus responded and found an automobile on fire. The men on Engine 35 immediately went to work to extinguish the small blaze.

Graney and fellow fire fighter Arnie

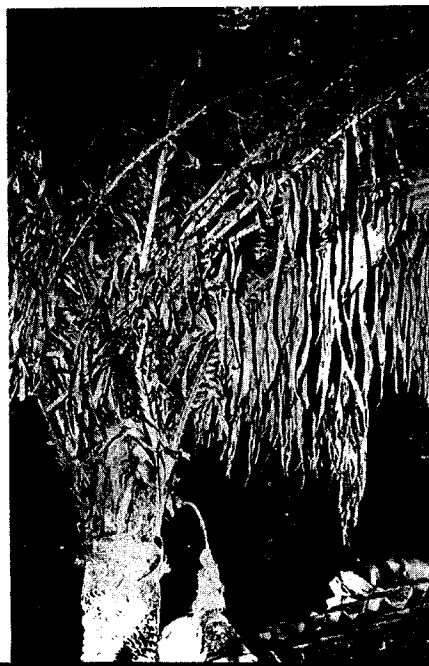
Snell were loading the hose back on the reel when a fire fighter exclaimed, "Hey look, there's another one around the corner!"

They immediately drove over to the Broadway Street side of the Coconut Grove and parked right in front of the door.

There were people everywhere, and smoke was pouring out the Broadway Street door. District Fire Chief Daniel Crowley, who had also responded to the car fire, ordered a third alarm, skipping the second alarm altogether. Boston Fire Alarm Headquarters received the alarm at 10:23 p.m. One minute later, Crowley ordered a fourth alarm for what would eventually be a five-alarm fire.

The fire department had gained a significant time advantage by coming upon the scene with their equipment. Because

The fire broke out in an artificial palm tree in the Melody Lounge, which was located in the Coconut Grove's basement.



of the swiftness of the Grove fire, however, much of this advantage was lost. By the time fire fighters were able to approach the club, it was ablaze from the Melody Lounge all the way out to the Broadway exit.

Part of the Broadway Street wall of the nightclub was made of glass bricks, which soon began to fail. Some of the fire fighters working frantically around the Broadway Street door could see bodies piled up inside the club, and they desperately wanted to get into the building to pull them out.

Graney now dragged his charged, high-pressure hose toward the corner of Shawmut Street and Broadway to the door of the Broadway Lounge. He pressed in, accompanied by other fire fighters trying to reach the limp, unburned bodies lying just inside the doorway. As the men dragged these bodies out, Graney noticed smudges around their noses and lips.

The fire fighters now moved forward into the entrance, and Graney found himself looking down at a young woman who was pinned to the floor by bodies. When she saw Graney, she yelled, "Please get me out, my father will be worried!" Just then, the fire flashed over Graney's head, and he had to back out, yelling to the girl to hang on. Calling for another hose line, he pressed inward again, allowing others to pull the girl to safety.

Making his way into the building, he encountered a mountain of bodies.

"It was incredible," Graney says. "I couldn't go forward or to the right because of the bodies. I couldn't even get in with the hose."

The fire fighters knocked the blaze down quickly and entered the main dining room. Had the building been unoccupied, the fire would have been extinguished even more quickly. But rescue was paramount.

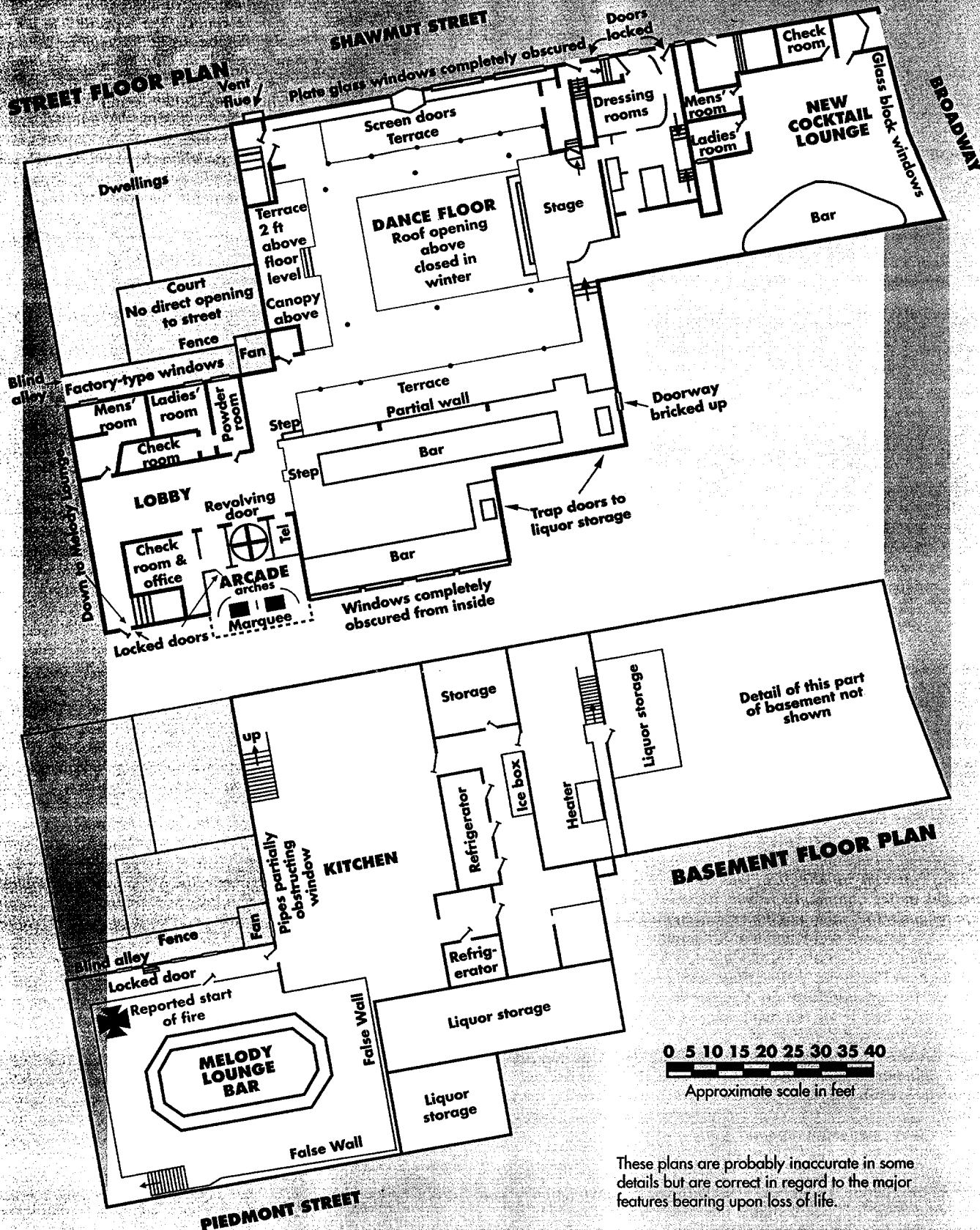
Though no fire fighters were included on the list of the deceased, several of those first on the scene succumbed to smoke and flames during rescue efforts. One of these was Charley Kinney of Rescue 1, who, after pulling more than a dozen people out the Shawmut Street dining room door, finally went down. Later, in the hospital, it was noticed that he had claw marks on his legs—tragic testimony to the desperate final moments of so many.

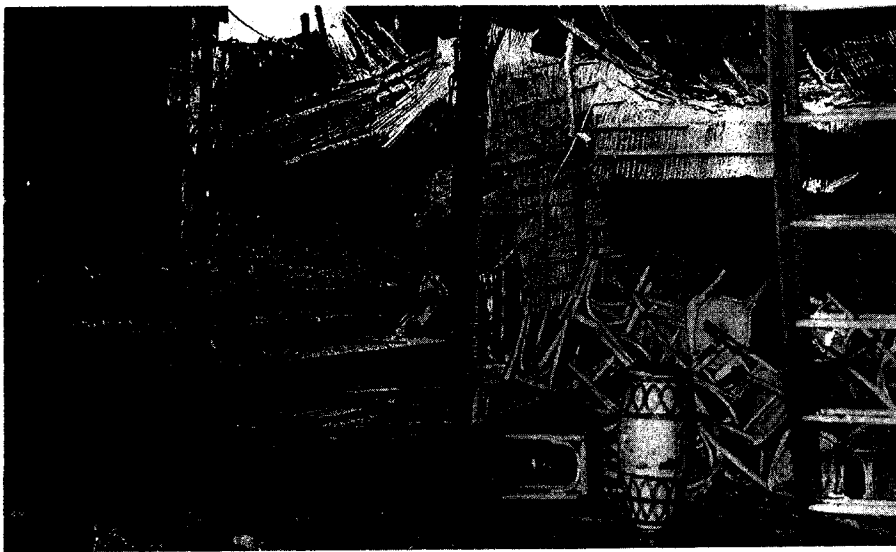
With the flames subdued, Graney found himself carrying bodies out of the main dining room.

"The tables weren't all burned, and in some places, people, though dead, were only singed, still in chairs and drooped over their tables," he notes. "Elsewhere, bodies were so badly burned you couldn't tell the men from the women."

Graney and Engine Company 35 were

The Coconut Grove Floor Plan





NFPA PHOTO

Upended furniture was scattered everywhere in the gutted, waterlogged Grove. The building's roof had collapsed, and walls and plate-glass windows had been smashed.

released from the scene at about 4:30 Sunday morning.

"At the time, we had no idea how many had been killed," says Graney, "and we guessed that maybe 200 people had been lost."

The serviceman

John Collins had been on the Boston Fire Department for about a year when Pearl Harbor was attacked. Like many, he immediately enlisted.

Because of his background in fire fighting, Collins was assigned to the U.S. Navy's Boston-based fire fighting program, one of five Navy fire fighting schools in the country. The Boston school was staffed by 10 fire fighters, half from the New York City Fire Department and half from the Boston Fire Department. This group was led by Lt. Comdr. Peter Hogstrom, originally from the New York City Fire Department.

It was just another Saturday night for John Collins, who was on standby. As the evening came to a close, his superior officer suddenly came in and shouted for everyone to get their turnout gear: They were being called to a bad fire downtown.

They arrived as the fire was being brought under control. However, a massive rescue effort was under way, and the Navy fire fighters were needed. As they approached the Cocoanut Grove's revolving door on Piedmont Street, they saw a row of bodies laid out on the street, bodies that had been removed from the revolving door itself. Inside, more bodies were piled seven and eight high. In all, some 200 people had been trapped behind the revolving door in the main lobby.

The Navy men split up and immediately started to work. Collins began removing bodies through the main entrance on Piedmont Street, where the revolving door had been. Just a few feet away, other fire fighters broke down an-

other door, revealing more bodies piled chest-high against the door.

This door, at the top of the stairs from the Melody Lounge into the lobby, was equipped with panic hardware, but it had been bolted shut.

"Some bodies were very badly burned, but some were not. It was very, very strange," says Collins. "But more than anything else, the stench of burned flesh was terrible. It was overwhelming.

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"There, sitting at a table, was a very pretty girl. She was sitting with her eyes open and her hand on a cocktail glass, as if waiting for someone. I wondered why she was just sitting there..."

.....

"Of all the vivid impressions made upon me that evening," says Collins, "perhaps the most unforgettable was when we first went down into the Melody Lounge. There, sitting at a table, was a very pretty girl. She was sitting with her eyes open and her hand on a cocktail glass, as if waiting for someone. As I first looked at her, I wondered why she was just sitting there, thinking she was okay. But, of course, she was dead."

Like most of the people in Boston at that time, Collins followed the inquiries into the fire very closely. The day after the disaster, the Boston Fire Department convened a public hearing. Chaired by Fire Commissioner Reilly, the hearing was intended mainly to clarify the fire department's involvement. The final fire department report would not appear for more than a year.

One of the first witnesses Commis-

sioner Reilly called was Lt. Frank Linney, one of his own inspectors. Linney had inspected the Cocoanut Grove approximately a week before the fire and had turned in a routine report, terming the Grove's safety conditions as "good." The one-page report was reprinted in its entirety on the front pages of the local newspapers.

Despite several past commendations for heroism, Linney found himself mired in every fire inspector's worst nightmare. During the hearing, he was pressed to elaborate on his written report, one section of which stated that the Grove had "no inflammable decorations." Linney indicated that he had taken some of the fabric and tried to light it with a match, which was the normal procedure for field-testing at the time. The fallacy of these test methods was shown later, but this did not help Linney during the hearing.

Although Reilly's hearings were meant to do nothing more than bring information to the public and did not result in any legal proceedings, they did point the finger of blame in many directions, even at the mayor.

Another hearing in Boston did lead to legal action, however. Almost a month after the fire, a grand jury convened by the state attorney general and the county district attorney's office indicted 10 individuals, including Boston Building Commissioner James Mooney. Among the 10 was Lt. Frank Linney, inspector for the Boston Fire Department, who was charged with being an accessory after the fact to manslaughter and willful neglect of duty.

Linney went to trial in October 1943. Defending him was an attorney by the name of Lewis, one of the top criminal lawyers in Boston at that time.

Lewis was able to demonstrate that Linney had never intentionally meant to do anyone harm and had only followed standard, though terribly inept, inspection procedures. After hearing the testimony, the jury deliberated for 3½ hours before they delivered a verdict of not guilty.

The painful experience of Frank Linney served as a lesson for everyone involved in fire inspections. One evening years later, John Collins would recall this lesson as he walked to Boston's Ladder 26, where he worked.

He was passing Symphony Hall, when he noticed that a performance was about to begin. He went into the building, more for curiosity's sake than anything else, gaining access as a fire department representative.

"It was a big show, and I was shocked to see that they had put chairs in the aisles, blocking some of the exit paths,"

says Collins. "I wasn't sure what to do. I could have walked out and pretended that I had never seen any of it."

But he didn't. Instead, he contacted the management and told them that they could not start the show until they had corrected the problem. As he expected, they were furious. But they had no choice, and the show was delayed while some of the patrons were removed from the audience.

"I thought of the Cocoanut Grove, and I thought of Frank Linney, and I couldn't bring that upon myself," says Collins. "What he went through should never happen again."

The doctor

Dr. Francis D. Moore was an assistant resident on duty at Massachusetts General Hospital (MGH) in Boston.

"That evening, Charlie Burbank and I were in charge of the emergency room," says Moore.

Throughout the evening, the hospital had been very quiet. Until 10:35 p.m., that is. At that time, the first Cocoanut Grove victims began arriving at MGH.

"I was upstairs and came down after hearing the sirens," notes Moore.

This was the beginning of an unimaginable onslaught of patients. Yet as bad as things were at MGH, the situation was even worse at Boston City Hospital. For every victim sent to MGH, four arrived at Boston City Hospital.

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During the hearing following the fire, the fire inspector was pressed to elaborate on his written report. . . which stated that the Grove had "no inflammable decorations."

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Not long after the first patients arrived at MGH, Dr. Oliver Cope showed up. Cope headed a National Research Council project at the hospital, investigating the treatment of burns, and he walked into a crisis that would put his new techniques to the test (see sidebar on page 76).

As the staff mobilized, the emergency room was cleared of all other patients.

When it became evident that even this would not provide enough space for the victims who continued to pour in, the entire sixth floor of one building was converted into a Cocoanut Grove ward.

"The first few hours were spent stabilizing the victims and clearing the dead," says Moore.

As the casualties continued to pile up, one thing increasingly confounded the medical staff. An inordinate number of people seemed to be dying from something other than burns. Some appeared to have died instantly, without burns, at the scene of the fire, while others succumbed after they had reached safety or while en route to the hospital. Most baffling were those who had come into the hospital, apparently with only minor injuries, then collapsed and died with little warning.

Typifying this phenomenon was a 23-year-old Navy ensign, who was one of the first to arrive at MGH. He walked into the emergency room under his own power, with badly burned hands and some burns on his face and neck. Aside from his flushed appearance and some agitation, however, he seemed fit enough to wait while doctors treated the more desperate victims that poured in. Although he was

Emergency Disaster Preparedness

It was 1942, and the United States was at war. The weekend before the Cocoanut Grove fire, a mock "blitz by the German Luftwaffe" was conducted to test the response of some 30,000 Boston civil defense workers. Authorities could not have guessed that a week later, the lessons learned from it would be put to the ultimate test.

By good fortune, the Boston Fire Department happened upon the Cocoanut Grove fire after responding to a car fire, a circumstance that may have saved as many as 100 lives. In all, the five alarms sounded for this fire brought 25 engine companies, 5 ladder companies, 1 water tower, 1 rescue company, and a variety of other emergency apparatus.

The police department provided ambulance service, maintained law and order in the vicinity, roped off streets, and provided routes for emergency vehicles to transport casualties. Other agencies that responded to the scene or shifted into operation included the United States Army, Navy, and Coast Guard; Civil Defense; the Red Cross; and the Salvation Army.

In retrospect, the only real emergency response problem was the

failure to disperse the victims more evenly among the area's hospitals. The anticipated injury-to-death ratio for a disaster typically is three to five injured for every death. In this disaster, the numbers were reversed. Boston City Hospital, received the lion's share of the victims. The line of vehicles outside the hospital waiting to unload patients stretched out of sight, while victims already inside the hospital, living and dead, lined the corridors of the admitting area.

Eventually, word of this situation reached the fire scene, and the overflow was diverted to Massachusetts General Hospital, the other of the two medical institutions that received most of the victims.

Boston City Hospital

In little more than 1 hour, Boston City Hospital had received more than 300 casualties. This means that one Grove victim was received *every 11 seconds* over a period of 1 hour and 15 minutes—one of the highest admittance rates ever recorded.

By the end of December 1942, mortality rate among the Grove victims at Boston City Hospital was close to 30 percent, or 36 of the original 132 survivors. A number of

these deaths were wholly or partially attributable to "full-thickness," or third-degree, burns.

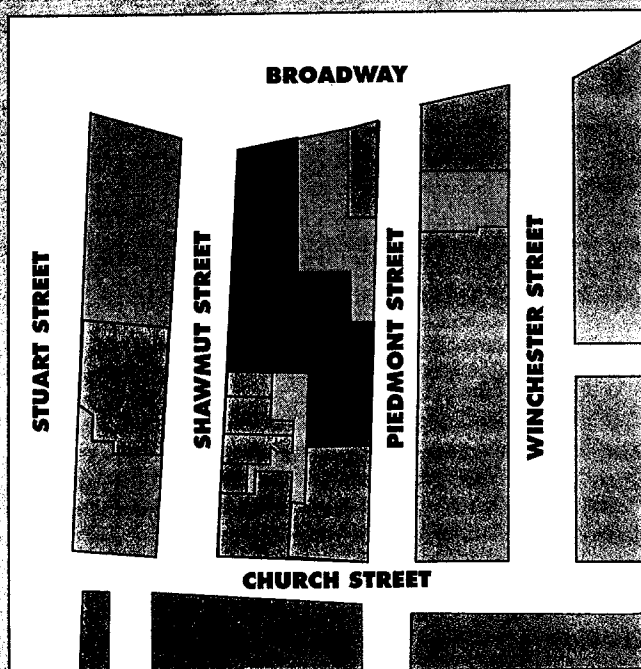
By February 1943, the fire's official death toll was 488. Three survivors remained in critical condition at Boston City Hospital. In May 1943, the last casualty died at Boston City after struggling for 5 months with grave burns and severe internal injuries.

Massachusetts General Hospital

Of the 114 Grove victims delivered to MGH within 2 hours of the fire, only 39 were still alive to be treated. Ten of the 39 survivors had significant burns. The other 29 had slight or no external burns, but some of these suffered severe lung damage and hypoxia. Thirty-two were in stable or good condition, and seven were in critical condition, including movie star Buck Jones, who later died.

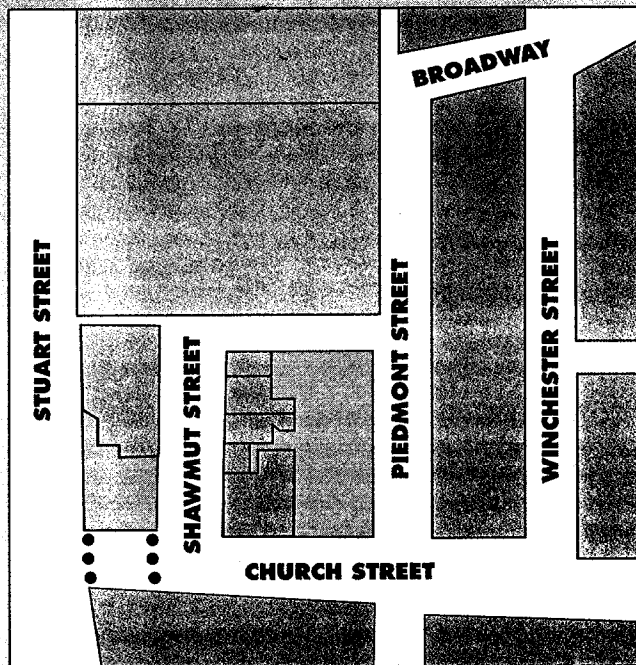
MGH lost 7 patients in the first 3 days, bringing its mortality rate to about 18 percent by December 1942. By the end of January 1943, nine of the original Grove survivors remained at the hospital. In April 1943, the last survivor was discharged.

The Cocoanut Grove Fire Location, Boston, Mass.



1942

- COCOANUT GROVE 1942
- OTHER BUILDINGS 1942
- ▨ STREET LEVEL PARKING, COURTYARD OR ALLEYS



1991

- HOWARD JOHNSONS MOTOR LODGE (24 FLOORS) 1991
- OTHER BUILDINGS 1991
- ▨ STREET LEVEL PARKING, COURTYARD OR ALLEYS

NOTE: Originally Shawmut extended to Broadway. Today, Shawmut curves into Piedmont.
Casey Grant, NFPA

told to lie down and stay calm, he was soon pacing back and forth, waving his hands in pain. Suddenly, he fell to the floor, hardly breathing. Further examination revealed that his nostrils were deeply burned. His throat swelled, and his upper respiratory passages became obstructed. Hours later, he died.

As the crisis continued, one doctor was assigned to each patient. Moore roved, taking an overview of the emergency room, as was his responsibility. By 3:00 on Sunday morning, all patients were bedded down. However, the patients dominated everything for the next several days, and there was very little rest for anyone.

Fifty years later

In June 1945, about 2 months before the vacant Cocoanut Grove was torn down, the police made a startling discovery. Someone had forced his way into the fenced-in, boarded-up hulk that was once the Cocoanut Grove and had broken down a portion of the basement wall under the Melody Lounge stairs, exposing a hidden Mosler safe. It was cleanly

drilled out—and empty. Someone had known exactly what he was doing, but who did it and what was taken remain a mystery to this day.

The fire at the Cocoanut Grove was a tragedy of immense proportions, and a

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One thing confounded the medical staff: An inordinate number of people seemed to be dying from something other than burns.

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few lingering questions about the final death toll remain unanswered. News reports finally settled on 492 dead, but doubts persist.

Fire Commissioner Reilly's report of the dead and injured indicates that 490 people died and 166 were injured. Despite its claim to cancel and supersede all other tallies, however, the commission-

er's list did not include the name of Eleanor B. Powerell, who succumbed at Boston City Hospital. Nor did it include patients treated immediately and released, or those admitted to military hospitals. And then there were victims like Francis Gatturna, who recovered from his own injuries but was readmitted to the hospital several weeks later, despondent over the loss of his wife, and threw himself through a closed window on the sixth floor.

The precise location of the Cocoanut Grove is difficult to find today. The streets have been altered to accommodate a high-rise hotel complex over most of the Grove's main dining room and the Broadway Street Lounge. Standing at the exact location of the Grove's revolving door and the stairway to the Melody Lounge, one sees a movie theater, with a long bank of exit doors—testimony to the effect the fire at the Cocoanut Grove had on building codes nationwide.

The shortcomings of the building regulations in effect at the time of the fire were painfully obvious. Perhaps the most searing discussion of this subject ap-

peared on the front page of the international newspaper, the *Christian Science Monitor*, on the Monday following the fire. The article quoted Robert S. Moulton, the NFPA's technical secretary and the secretary of the NFPA Committee on Safety to Life, as saying that Boston building laws were in a "chaotic condition," subject to "incompetent enforcement, political influence, and careless management."

"The Cocoanut Grove nightclub tragedy," he declared, "is clearly due to gross violation of several fundamental principles of firesafety, which have been demonstrated by years of experience in other fires, and which should be known to everybody."

Expanding upon his charge, Moulton said, "The most glaring feature of this tragedy was the lack of proper exits. Revolving doors have long been considered by the National Fire Protection Association Committee on Safety to Life as a menace under fire and panic conditions. Even though a revolving door may be a so-called collapsible type, it can readily serve as a death trap."

Moulton further pointed out that the NFPA had developed a *Building Exits Code* that considered nightclubs "essentially a place of public assembly, in the same class as a theater, but having greater possibilities of fire."

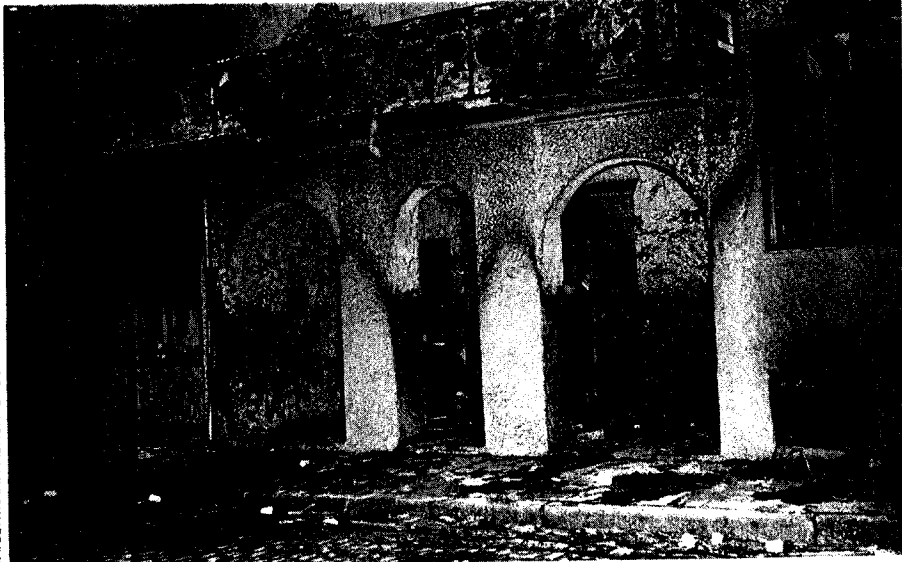
In the year following the Cocoanut Grove fire, building codes from coast to coast were revamped. The most notable advances were made in the area of exits, combustible materials, emergency lighting, and automatic sprinklers.

The definition of places of public assembly was also expanded. Before the fire at the Cocoanut Grove, many jurisdictions did not consider restaurants and nightclubs to be places of public assembly. After the fire, however, this changed.

Today, it's recognized that all portions of a building used for public assembly should have two separate and remote means of egress, and the necessary number of reliable exits should be available for the expected occupancy. Exits should function only with approved panic hardware and should swing in the direction of the flow. Revolving doors are unacceptable by themselves as exits and must be flanked by standard exit doors.

Furthermore, no combustible materials should be used for decorations in places of public assembly, and materials used for interior finishes should conform to nationally recognized test methods. Shortly after the fire, the Boston Fire Department went so far as to establish the position of chemist, whose duties would include testing the flammability of decorations in places of public assembly throughout the city.

Emergency lights should be installed



Fire fighters view the Cocoanut Grove's revolving door where some 200 people died as they tried to escape from the burning nightclub.

permanently to allow egress from the building. They should be reliable and independent from the regular lighting system.

Even though the lack of automatic sprinklers in the Cocoanut Grove was overshadowed by such flagrant inadequacies as the lack of proper exits, sprinklers would have changed the outcome of this fire dramatically. They were thus recognized as an alternative to be used in

In Boston, at least, there will never be another Cocoanut Grove nightclub fire. Immediately following the tragedy, the Boston Licensing Board ruled that no place of entertainment could ever again use the name Cocoanut Grove. Of course, such rulings cannot put an end to fires of this magnitude. We can only hope that we've learned from our mistakes, even those that are 50 years old.

Casey Grant is the NFPA's chief systems and applications engineer, responsible for managing the General Engineering Department.

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 assembly also was
 expanded.**

difficult regulatory situations, such as those often found in existing restaurants or nightclubs located below-grade.

There is no memorial or any official sign of remembrance at the site of the Cocoanut Grove. But those who perished have another sort of testimonial to show that they did not suffer in vain: The changes the Grove wrought in fire regulations and emergency procedures would have taken years to effect otherwise. Similarly, the sheer enormity of the work done in the hospitals allowed significant strides forward in the field of medicine.

Author's Note

Other than reports, short articles, and eyewitness testimony, I am aware of only two comprehensive books on the fire at the Cocoanut Grove. One is *Holocaust!* by Paul Benzaquin, originally published by Henry Holt & Co. in 1959. This was reprinted as *Fire in Boston's Cocoanut Grove* by Boston Branden Press in 1967. The other book is *Cocoanut Grove* by Edward Keyes, published by Atheneum Press in 1984. I highly recommend both of these books, along with the NFPA report on the fire by Robert S. Moulton and the Boston Fire Department report by Commissioner William Reilly, to anyone who wants an exhaustive review of this subject.

Despite the relentless march of time, many of those involved in the fire at the Cocoanut Grove 49 years ago are still around to recall the event. The people I interviewed for this article sometimes referred to earlier testimony and interviews. Any similarity to other published material on this subject is based on the interviewees' own reflections on this material.