United States Patent

Singer

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[54] **FIRE FIGHTING APPARATUS**

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[52] **U.S. Cl.** **160/1**, 49/8, 160/33, 169/2, 292/35, 292/181

[51] **Int. Cl.** **E05f 15/20**

[58] **Field of Search**.....160/33, 35, 36, 84, 113, 120, 160/1–10; 49/1–8, 24; 169/1, 2; 292/DIG. 18, 181, 177, 35

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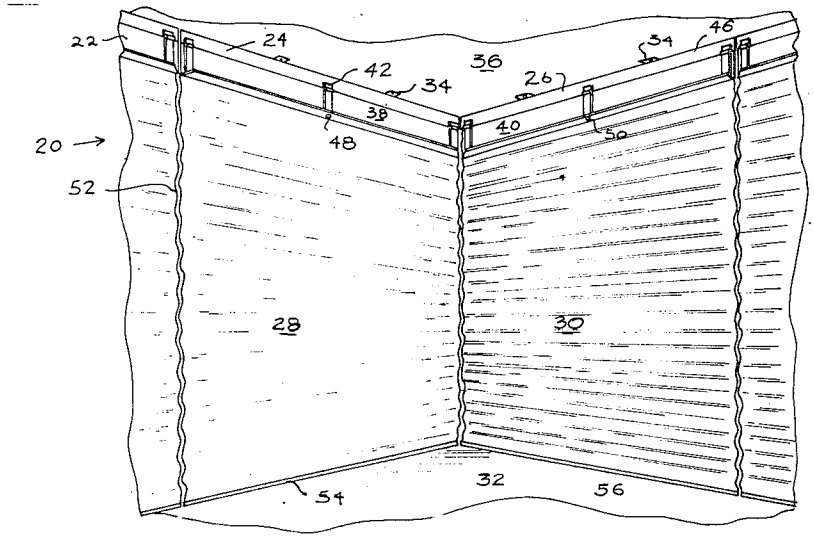
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[57] **ABSTRACT**

A fire fighting apparatus for confining a fire to an immediate area defined by a plurality of fire retardant curtains which are dropped from container cabinets upon actuation of a release mechanism which may be triggered manually or coincidentally with the actuation of a fire extinguishing device associated with the mechanism to be patented. In a preferred form, a plurality of fire retardant curtains are stored in a plurality of modular cabinets which are suspended from a ceiling covering the area to be protected. The release mechanism which allows the curtains to drop from one cabinet is connected to the release mechanism of adjacent cabinets for simultaneous operation of all associated cabinets. In use, operation of an automatically actuated fire extinguishing system, such as discharge of carbon dioxide to the area to be protected, causes a gas pressure drop serving to actuate the trigger mechanism which allows each door lock to move toward a released position to which it is normally biased. In the extended position, the curtains have their edges disposed adjacent one another so as not only to confine the extinguishing gas to a desired area but also to permit workers to escape through the curtains or fire fighting personnel to enter therethrough.

6 Claims, 8 Drawing Figures



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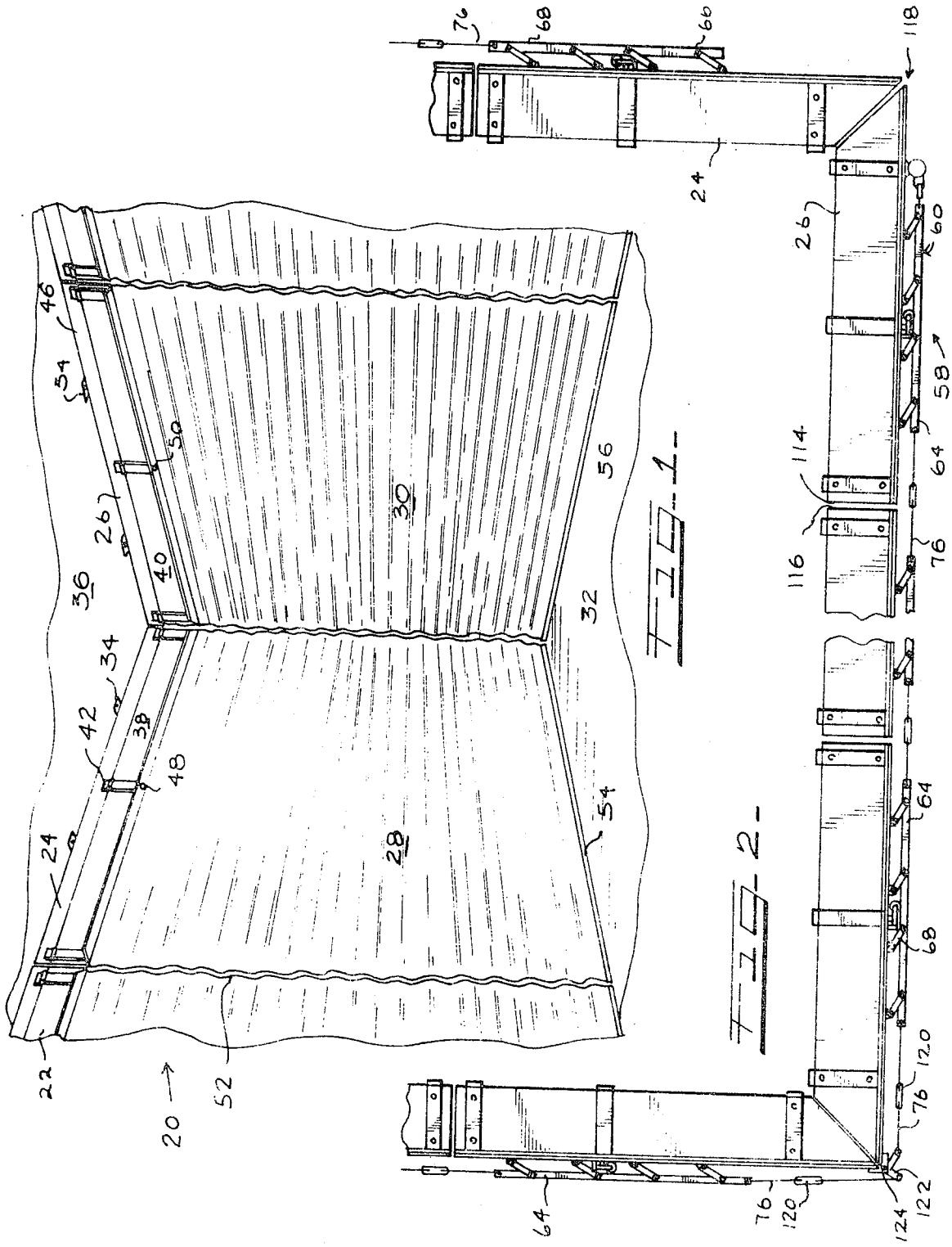
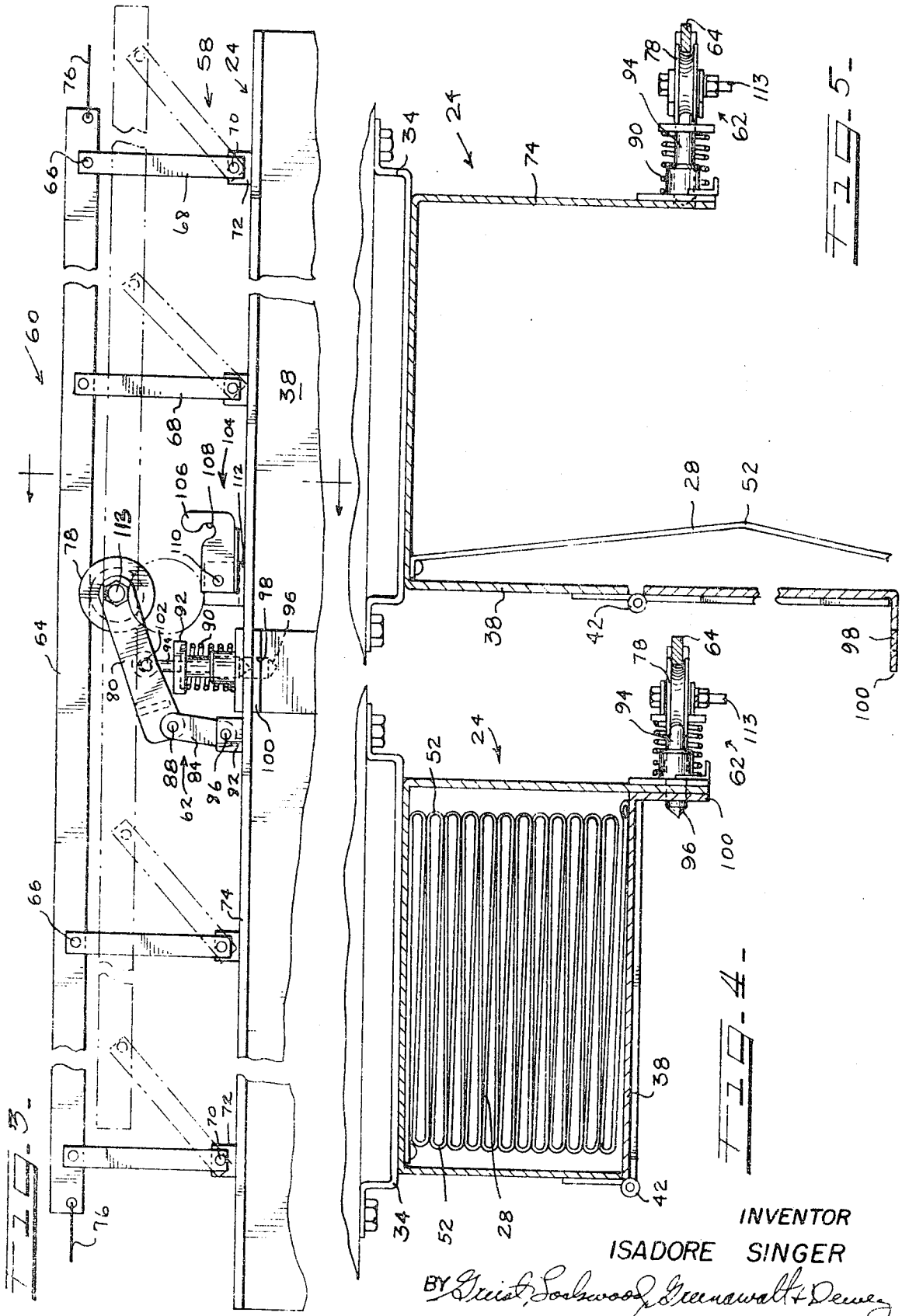


FIG. 1

FIG. 2

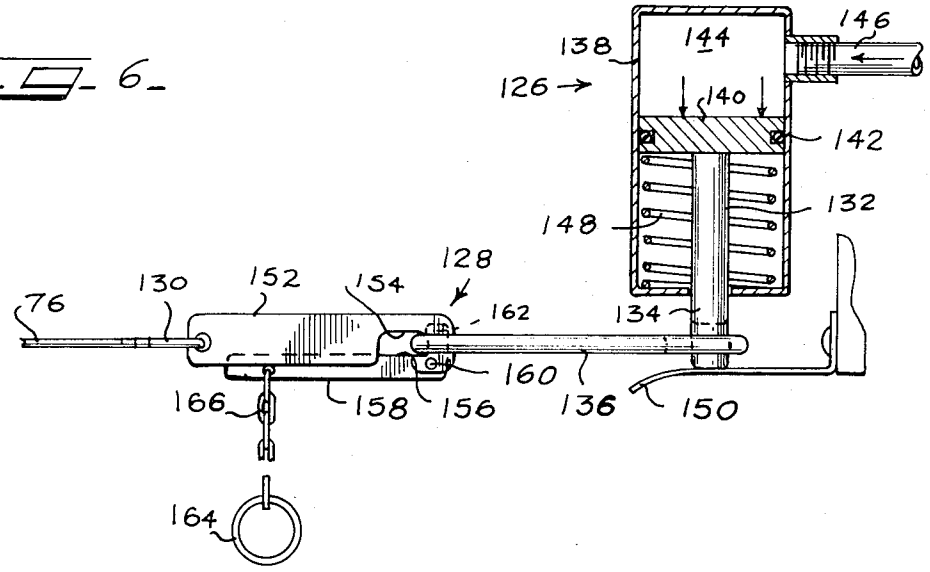
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FIG. 6



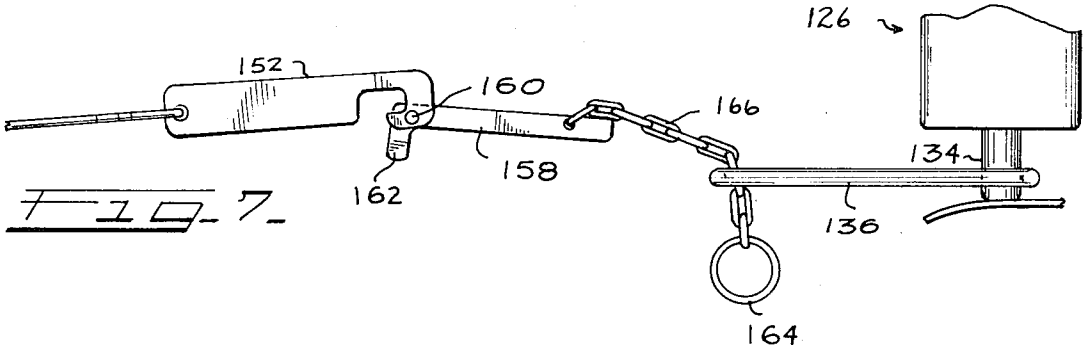


FIG. 7

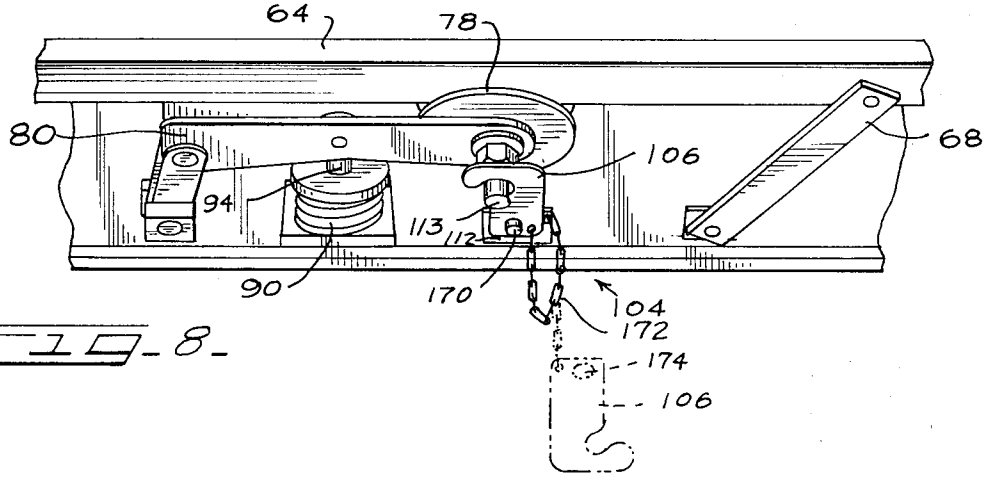


FIG. 8

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FIRE FIGHTING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to fire fighting equipment, and particularly to a fire fighting apparatus adapted to be installed in a desired location adjacent equipment presenting a fire hazard so that, in the event of fire, fire retardant curtains contained within the apparatus will simultaneously drop down in a predetermined pattern to surround the equipment and confine the flames and/or the gases used to extinguish them.

It is common today, in many industrial installations, particularly installations of equipment which uses or is associated with inflammable material such as volatile solvents and the like, to provide permanently associated fire extinguishing apparatus for this equipment. Such apparatus commonly consists of supply lines or pipes directing a fire extinguishing material, such as carbon dioxide or the like, to discharge nozzles disposed adjacent the equipments. Such systems also include a detector of a known type, so that, in the event of fire, the apparatus is quickly actuated and a spray of the carbon dioxide or the like is directed into the general area of the equipment. Systems such as these are very helpful in extinguishing or containing fires; however, there is still room for improvement in fire fighting devices as a whole for reasons which will now be discussed.

Referring to a typical situation, a principal problem in fire fighting is not only that of directing the extinguish material toward the location where the fire started, but also to prevent the spread of flames, and to reduce the likelihood of explosion. In open areas, assuming that a volatile, inflammable solvent is burning, the spread of flames may be very rapid because the increased heat created by the fire further volatilizes and spreads the vapors into areas which are remote from the origin of the fire. Since flame propagation may take place wherever favorable conditions for combustion are present, it is not uncommon for an extinguishing system to extinguish a localized portion of a fire but, in the process, displace a major portion of the unburned vapors and the flame itself to another area where burning continues.

As a consequence of this, it is common to confine equipment presenting serious fire hazards within areas which are isolated from the surroundings by permanent walls, heavy curtains and the like. A solution of this type is not always highly desirable, however, since it generally reduces accessibility to the equipment and creates difficulties and added expense in providing ventilation and the like.

In addition, some equipment, by reason of its physical shape, is not suited to confinement within small areas. Examples of such equipment are continuous process equipment, such as paper or film printing or coating equipment, which is often laid out in a straight line of substantial length.

In view of the general state of prior art fire protection systems, as exemplified by the equipment described above, and in view of the advantages of confining equipment presenting combustion hazards to relatively small areas, it is an object of the present invention to provide an improved fire fighting apparatus.

Another object is to provide fire fighting apparatus or equipment which is adapted to surround the immediate area of a fire immediately upon the break out of such fire, while at the same time providing a construction which does not interfere with the layout of or access to the equipment to be protected.

A still further object is to provide fire fighting equipment which may be instantaneously actuated in response to the triggering of an associated fire extinguishing system and which may also be actuated manually.

A still further object is the provision of a fire fighting system which can be readily arranged in almost any desired configuration so that it is easily adapted to be used to protect a variety of equipment.

A further object is the provision of an apparatus adapted to store fire retardant curtains in an out-of-the-way location during non-use thereof, while keeping such curtains available to drop from the storage area and surround a predetermined area upon outbreak of a fire or detection of an actually or potentially hazardous condition.

Another object is the provision of a system of the above type wherein the unlocking mechanisms for each of a number of curtain-containing cabinets are constructed are arranged for simultaneous actuation to discharge the curtains contained in the cabinets upon triggering of a single detector or actuator.

Another object of the invention is the provision of such a device which, while adapted to surround completely a given area, permits easy movement of persons into and out of the area between individual curtains when all the curtains are in position of use.

A still further object is the provision of such an apparatus which is adapted to discharge a plurality of curtains simultaneously, but which may be reloaded for subsequent use one module or cabinet at a time.

A further object of the invention is the provision, in a fire fighting system of the type described, of a temporary lock mechanism used to facilitate reloading of individual curtain-containing cabinets after use of the apparatus.

A still further object is the provision of an apparatus having the above enumerated features and characteristics and which is further characterized by ease of manufacture and installation, as well as economy of manufacture and simplicity and reliability in operation.

The present invention accomplishes these objects, and other inherent objects and advantages thereof, by providing a fire fighting apparatus having a plurality of cabinets, each adapted to store a fire retardant curtain therein, means associated with each cabinet for permitting discharge of the curtain from the cabinet and means for actuating the discharge means of the several cabinets simultaneously in response to a predetermined signal or condition. The exact manner in which the invention accomplishes these objects, and other inherent objects and advantages thereof, will become more apparent when reference is made to the following detailed description of the preferred embodiments of the invention and to the accompanying drawings, wherein like reference numerals indicate corresponding parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the fire fighting apparatus of the invention, showing the curtains of the ap-

paratus in the lowered positions thereof defining an area to which the fire may be confined;

FIG. 2 is a plan view, with portions broken away, showing the bottom of the fire fighting apparatus;

FIG. 3 is a fragmentary enlarged plan view of the actuating portion of the fire fighting apparatus of the invention;

FIG. 4 is a vertical sectional view of one of the cabinets of the invention, showing a curtain in place therein;

FIG. 5 is a sectional view similar to that of FIG. 4 and showing the curtain support door in an open position;

FIG. 6 is an enlarged view of the triggering mechanism partly in elevation and partly in section and showing the same in the closed position and ready for automatic release;

FIG. 7 is a view similar to FIG. 6, but showing the manner in which the trigger mechanism is actuated by manual control; and,

FIG. 8 is a perspective view showing one embodiment of the temporary lock mechanism used to facilitate reloading of the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

Although the present invention will be described with reference to an apparatus designed for use in association with an existing fire extinguishing system and wherein five retardant plastic curtains are disposed within metal storage cabinets, it will be understood that the principles of the invention may be embodied in other structures having other components and elements adapted to perform the same function. Likewise, it will be understood that, depending on the structure of the building containing the apparatus to be protected, it is not necessary that the cabinets and associated curtains be arranged in a rectangular fashion, inasmuch as any desired arrangement thereof may be easily made by reason of the modular construction of the device, and further in view of the fact that existing walls, partitions or curtains may form one or more of the means for totally surrounding the apparatus to be protected in order to retain the fire fighting gases and vapors therein and to prevent the spread of flame and flammable materials.

In addition, although the apparatus is described with reference to an associated carbon dioxide type fire extinguishing system, it will be appreciated that the apparatus of the invention is equally useful with other forms of fire fighting apparatus, including those in which other gas, liquid or foam type of extinguishing agents are used, either singly or in combination.

Referring now to one preferred form of apparatus in greater detail, FIG. 1 shows a fire fighting apparatus generally designated 20 to comprise a plurality of individual cabinets 22, 24, 26, etc., each having operatively associated therewith a suspended, fire retardant curtain 28, 30 which is adapted, in an extended position thereof, to close off the area between an associated cabinet 24, 26 and the floor 32 of the structure in which the unit is housed. Conventional fasteners 34 are utilized to suspend the cabinets 22, 24, 26 from the ceiling 36 or other elevated portion of the structure. As may also be seen by reference to FIG. 1, the curtains 28, 30 are released by opening of curtain-supporting doors 38, 40 which are supported for movement between opened and closed positions by hinges 42 attached to the doors 38, 40 and to the side walls 44, 46 of the cabinets 24, 26. As will become more clearly apparent as the description proceeds, these curtain supporting doors are adapted to be released when unlocking means (FIG. 3) which are provided for cooperation with slots 48, 50 in the doors are actuated. Convenient storage of the curtains 28, 30 is accomplished by providing the same with a plurality of permanent but relatively resilient accordion pleats 52. The bottom margins 54, 56 of the curtains 28, 30 are preferably weighted, as by incorporation therein of a length of chain, a heavy rod or the like. The use of the chain for this purpose is advantageous in that it enables the bottom edge of the curtain to overlie and closely surround any irregular surface which may be disposed therebeneath. The stiff lower surface provided by a rod or the like would be acceptable in some cases, however.

Referring now to FIGS. 2 and 3, the principal elements of the mechanism 58 for operating the apparatus are shown. The elements of this mechanism 58 include an operating rod assembly 60 and an unlocking mechanism 62 for operative association therewith. As shown in FIG. 2, the cabinet 24 has associated therewith an operating rod 64 connected at flexible joints 66 to a pair of links 68 movably mounted, as at 70, to brackets 72 associated with a side wall 74 disposed opposite the other side wall 44 of the cabinet 24. Extensions 76 on either end of the rod 64 are provided for association with an adjacent rod or for association with a bell crank or a portion of the actuator mechanism, as will be set forth in further detail herein. Accordingly, it can be seen that mounting of the rod 64 permits it to move between positions which are respectively closer to and farther spaced apart from the side wall 74.

Referring now to the unlocking mechanism 62, this unit is shown to include a roller 78 mounted at the end of an arm 80 for movement between positions closer and more distantly spaced apart from the side wall 74 respectively.

A bracket 82 supports an intermediate link 84 at pivot point 86, while a pivoted connection 88 is provided for connection of the link 84 to the arm 80. A spring unit 90 exerts a strong outward force on a collar 92 associated with a rod 94, the nose portion 96 of which extends through an opening 98 in the flange 100 of the door 38. The rod 94 is joined at a pivot point 92 to a central portion of the arm 80.

An additional feature of the invention resides in the provision of a temporary lock assembly 104 which includes a locking element 106 having a slot 108 therein and movably mounted as at 110 to a bracket 112 fastened to the side wall 74. In use, the slot 108 may be lockingly engaged with a stub 113 extending outwardly from the center of the roller 78, so as to keep the roller 78 and the parts associated therewith, including the arm 80 and the nose 96 of the rod 94 in the position shown in phantom lines in FIG. 3, and shown enlarged in FIG. 4.

It will also be understood that, after one use of the invention, the cabinets 24, 26, etc., will be desired to be reloaded individually for convenience, and therefore,

as each curtain 28, 30, etc., is folded and moved into a position so as to be supported by its associated door 38, 40, etc., the nose 96 of the rod 94 will be engaged with the opening 98, thereby retaining the individual door in the closed position. Since the temporary lock 106 will prevent outward movement of the roller 78 until after each individual cabinet has been reloaded, and since the rod 64 supplies the force to keep the rod 94 in position with its end 96 engaged with the door 38 after all cabinets are loaded and locked, the temporary lock 106 may thereafter be moved to the open position shown in FIG. 3. In this way, the unit is ready to repeat its operating cycle at any time after reloading. Another embodiment of this feature will be referred to herein.

Referring now to FIG. 2, it will be appreciated that the plurality of cabinets 24, 26, etc., may be arranged in any desired pattern, with respective end portions thereof 114, 116 abutting one another or joined at a mitered corner 118. The illustrated configuration is that of a rectangle, with one leg thereof not shown and the other legs shown with portions thereof broken away. It will be understood that any reasonable number of units may be used and that the shape of the area to be protected can be defined by arranging the cabinets in any form desired. It is also apparent that the area in question may be enclosed in part by permanent walls or partitions and that the remainder may be adapted to be enclosed by curtains falling into the position of use when the device is actuated. Accordingly, the cabinets 24, 26 need not surround the entire defined area if such area is otherwise surrounded by fire retardant structure.

Referring again to FIG. 2, it will be shown that the extensions 76 of each rod 64 are operatively associated with one another by means of turnbuckles 120. The extensions 76 are also operatively connected to each other by a bell crank 122 which is pivotally attached, as at 124, to the corner portion of one of the cabinets. In this manner, a continuous connection between all cabinets and their associated operating rod assemblies is assured. The provision of the turnbuckles 120 or their equivalent provides means for adjusting the assembly to compensate for dimensional variations in manufacturing and installation.

Referring now to FIGS. 6 and 7, actuation of the device is illustrated. As shown in FIG. 6, an actuator assembly 126 and a connector assembly 128 are provided for operative association with one end portion 130 of one of the rod extensions 76. The actuator, in a typical embodiment, includes a rod 132 having a nose portion 134 which extends into the interior of a large link 136. The actuator 126 also includes a cylinder assembly 138 containing a piston 140 to which the rod 132 is fixedly attached, and sealing means in the form of an O-ring or the like. Gas pressure within the volume 144 above the piston 140 is maintained continuously, since a tube 146 is connected to the gas supply. As shown in FIG. 6, gas pressure urges the piston 140 downwardly, whereas the spring 148 urges the piston upwardly. Consequently, as long as the pressure of the gas, which is preferably the carbon dioxide gas used in the extinguishing system, supplies a force great enough to overcome that of the spring, the tip 134 of the rod 132 will keep the link 136 from being released. A leaf spring 150 keeps the link 136 from falling vertically and thus unintentionally triggering the system.

The cumulative force of all the springs 90 forming parts of the unlocking mechanism 62 urge the extensions 76 of the rod 64 to the left as shown in FIG. 6. Therefore, when the CO_2 system which is intended to extinguish the fire is actuated, pressure in the area 144 drops instantaneously, permitting the piston 140 to be moved upwardly by the spring 148, thereby moving the nose 134 of the rod 132 to the upward position shown in phantom lines in FIG. 6. Accordingly, when the CO_2 or other like extinguishing system is actuated automatically, the actuator 126 operates simultaneously and each unlocking mechanism 62 instantaneously releases its associated curtain-supporting door 38, 40, etc., so that the curtains can drop to the floor and surround the defined area. As will be appreciated, this action not only prevents the spread of flame and flammable, volatile material through the air but also confines the CO_2 or other extinguishing gas to the immediate area defined by the fire fighting apparatus of the invention. Accordingly, the fire fighting gas or the like cannot diffuse away from the immediate area and any given amount thereof is much more effective to extinguish the fire.

Referring again to FIG. 6, it will be seen that the connector assembly 128 includes an upper portion 152 having a slot 154 therein and that the bottom of the slot 154 is closed off in use by an upper surface 156 of the leg 158 which is mounted, as at 160, for pivotal movement. Consequently, a force applied to the left as shown in FIG. 6, on the toe portion 162 urges the leg 158 into the upward position shown, and as long as tension is present to create this force, the link 136 may not drop vertically or otherwise escape confinement from the connector assembly 128.

Referring now both to FIGS. 6 and 7, and having in mind that an object of the invention is to provide manual actuation as well as automatic triggering of the apparatus, the need for providing the link 164 and the chain 166 will be appreciated. In the use of the manual actuator, a downward pull on the chain 166 will move the leg 158 downwardly, causing the foot 166 to move the portion of the link 136 associated therewith into a position beneath the pivot point 160, whereupon the force applied to the connector assembly 128 will open it to the position shown in FIG. 7. As a result, the upper portion 152 of the connector assembly 128 can move to the left, releasing the doors, while the leg 158 and the chain 166 associated therewith move through the link 136. Thus, the apparatus of the invention may be triggered manually with the same effect as though operated in response to operation of the fire extinguishing system, although the exact operational sequence of the two release mechanisms is slightly different.

Referring now to FIG. 8, another form of the temporary lock arrangement 104 is shown. As can be seen by reference to FIG. 8, the rod 64, the roller 78, the spring 90, rod 94 and other principal elements of this form of apparatus are the same as those shown in FIG. 3. However, in this embodiment, the temporary lock 106 is removably received over a stub 170 which extends outwardly from the bracket 112, and a chain 172 is provided for tethering the removable temporary lock 106 to the bracket 112. According to this form of the invention, an additional safety feature is provided, as will now be set forth. Use of the form of assembly 104 shown in FIG. 8 is made in the same manner as that of

its counterpart, that is, the lock **106** is positioned so that the slot **108** therein engages the stub shaft **112**, while the lock **106** is held in place with the opening **174** therein engaged by the shaft **170**. After all curtains have been stored, when the rod **64** is in contact with the roller **78**, and all associated parts are in the locked position, the lock **106** is removed and allowed to hang downwardly in the position shown in phantom lines in FIG. **8**. In this manner, a simple visual check of each cabinet **22**, **24**, etc. will show that all temporary locks are in the removed position and that unintentional or accidental failure to function will not be occasioned by reason of one or more of the locks remaining in place.

Referring now to another feature of the invention, it will be noted that by providing a plurality of individual cabinets and individual curtains rather than a single cabinet for each side of the area to be enclosed or defined, not only is production simplified and made more economical, but the provision of separate but closely adjacently disposed curtains makes it easy for persons to pass between the curtains if desired, without compromising the effectiveness of the curtains. In other words, a person trapped within the curtained area is able to escape therefrom at any one of a number of places, and would normally be able to push one curtain aside temporarily in the event that the person were not able to escape at a point where the edges of two adjacent curtains met. Furthermore, this feature provides the same advantages for firemen or the like who may desire to enter the curtained off area to help extinguish the fire.

Referring now to the preferred construction of the apparatus of the invention, although no particular materials are necessarily required for constructing the apparatus, it is preferred that the cabinets be made of metal, such as steel, and that the hinge assemblies be made of stainless steel, so that the likelihood of rust or corrosion rendering them inoperable is minimized. This is because the units might be called upon to perform even after a period of several years or more of non-use. Preferably, the curtain material is of a vinyl coated nylon or other tough, fire retardant material which can be obtained at reasonable cost and which is easy to store by reason of folding compactly into the cabinets. The remainder of the elements may be made of steel, with moving parts preferably being made from stainless steel or brass. The triggering mechanism may be made of any suitable construction, an illustrative construction thereof only having been shown in view of the fact that the details of the operation thereof do not form an essential part of the present invention.

In certain instances, the nature of the material presenting the fire hazard will dictate the material from which the curtains should be made. For example, an asbestos or treated asbestos curtain may be preferred for use where the hazard is one involving high burning temperatures or persistent and intense flames. Still other materials now available or hereafter developed may be used as the curtain material as may be indicated by the nature of the hazard.

It will thus be seen that the present invention provides a novel fire fighting apparatus having a number of novel advantages and characteristics including those pointed out herein and others which are inherent in the invention.

I claim:

1. A fire fighting apparatus comprising, in combination, a plurality of individual cabinets disposed adjacent one another so as to define at least partially the periphery of an area to which a fire may be confined, each of said cabinets comprising a pair of side walls and a bottom door extending between said side walls at the lower margins thereof, said door being adapted to move between an open and a closed position, a curtain disposed within each cabinet, each curtain having one end portion thereof fixed to a portion of its associated cabinet and the other end thereof free from said cabinet, said curtain being adapted to be folded into a relatively small volume so as to be able to be disposed within said cabinet and to be supported therein by said door when said door is in said closed position, a latching mechanism for holding said door in said closed position and for releasing said door to allow it to move to said open position thereof, said latching mechanism including a latch unit having a nose portion adapted to engage said door in one position of said latch unit and to be disengaged from said door in another position of said latch unit, spring means urging said latch unit under a predetermined force to said disengaged position, a link system having one portion thereof fixed in relation to said cabinet, another portion thereof adapted to engage a movable retainer assembly, and a still further portion attached to said latch unit, a movable retainer assembly including mounting links and a retainer bar, said retainer bar having end portions adapted for operative attachment to a corresponding bar on an adjacent cabinet, one of said bars being operable in response to a single triggering signal, whereby, said triggering signal will cause movement of said retainer bars, movement of said link system, and permit latch movement to cause said doors of said cabinets to be opened simultaneously.

2. An apparatus as defined in claim **1** wherein said release mechanism is positioned, in the locked position thereof, so as to require for triggering thereof only a relatively small force in relation to said predetermined force exerted by said spring means.

3. An apparatus as defined in claim **1** in which said latching mechanism is operable in response to the actuation of a fire extinguishing system operatively associated with said apparatus.

4. An apparatus as defined in claim **1** in which said latching system is manually actuable.

5. An apparatus as defined in claim **1** which includes temporary locks for maintaining said individual latches in position to support said doors, said locks being adapted to be removed after said individual latches are in said supporting positions.

6. An apparatus as defined in claim **1** wherein said curtains are comprised of a fire retardant, synthetic plastic material.

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