Nov. 20, 1928. 1,692,052

W. J. PERKINS

AUTOMATIC FIRE EXTINGUISHING APPARATUS AND SYSTEM

Filed Sept. 2, 1922 3 Sheets-Sheet 1

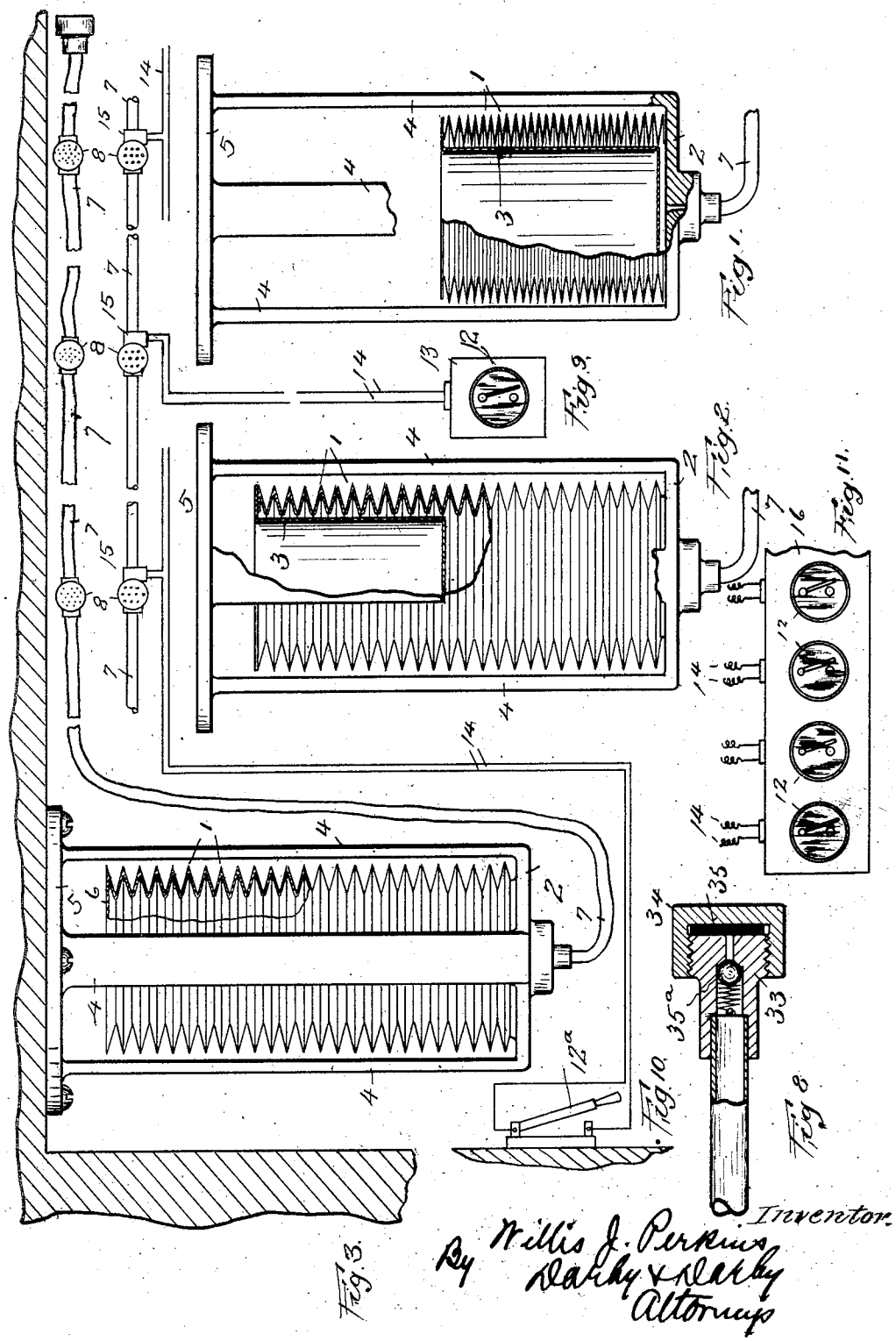


Fig. 1. Fig. 9. Fig. 2. Fig. 11. Fig. 10. Fig 8 Fig. 3.

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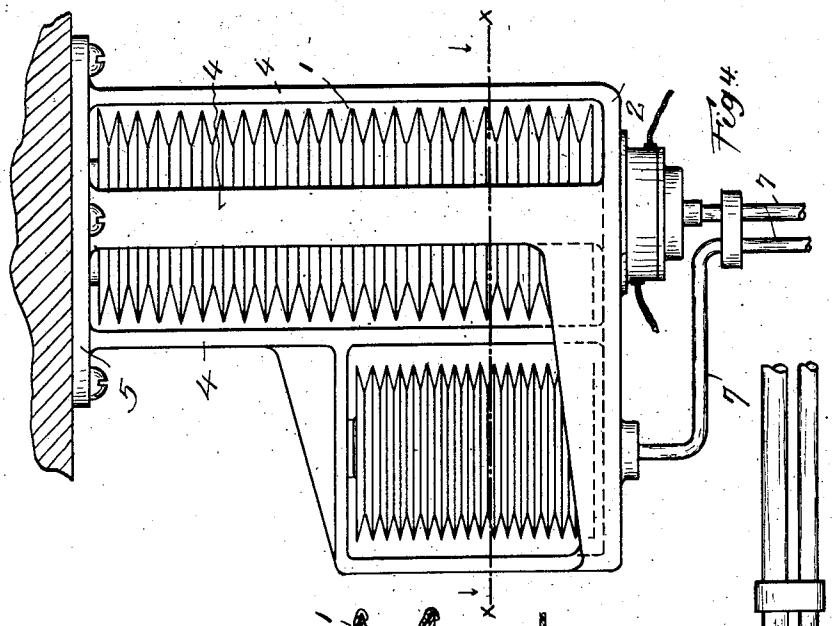


Fig. 4.

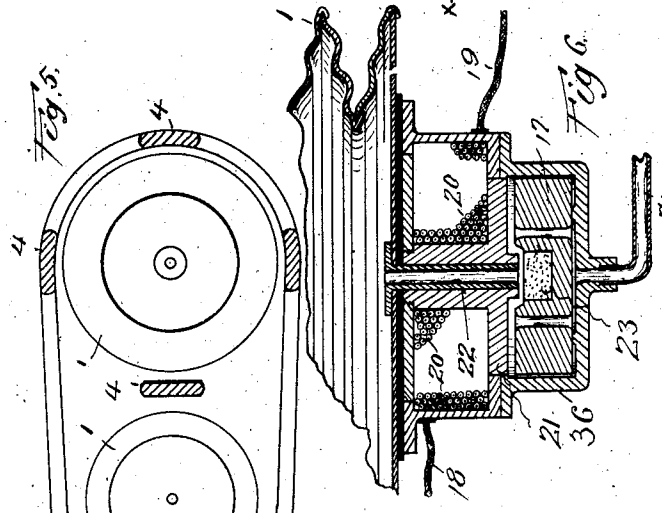


Fig. 6.

Fig. 5.

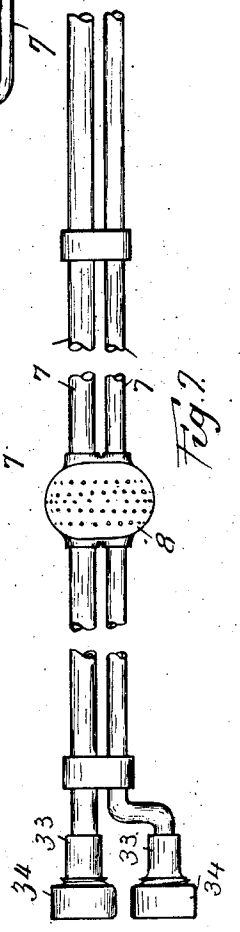


Fig. 7.

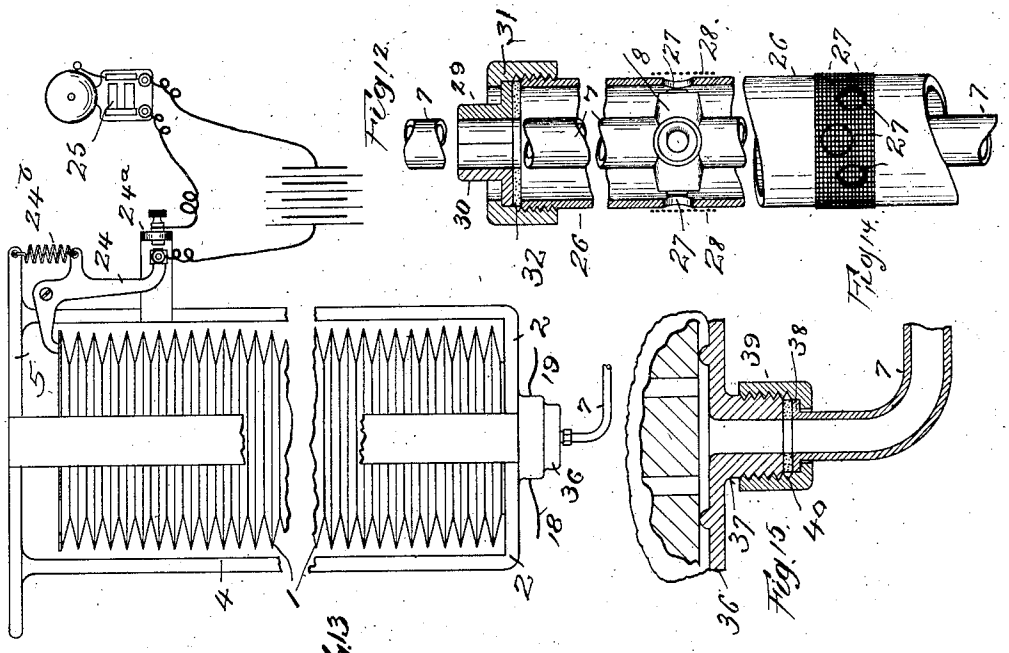
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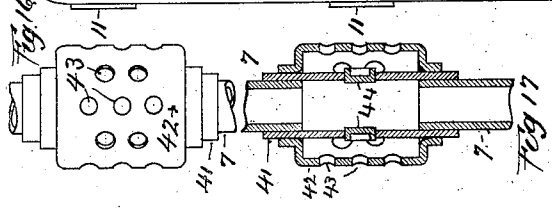
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AUTOMATIC FIRE EXTINGUISHING APPARATUS AND SYSTEM

Filed Sept. 2, 1922 3 Sheets-Sheet 3





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Patented Nov. 20, 1928. 1,692,052

UNITED STATES PATENT OFFICE.

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AUTOMATIC FIRE-EXTINGUISHING APPARATUS AND SYSTEM.

Application filed September 2, 1922. Serial No. 585,898.

The object of this invention is to provide simple and efficient means for maintaining a suitable fire extinguishing or other medium or solution, contained in a sealed receptacle, or tank, under a direct continuous dependable propelling or ejecting pressure, without the use of compressed air or compressed carbonic acid gas, or a spring pressed piston, or any chemical reacting medium.

A further object is to provide simple and efficient means for refilling the container with fire extinguishing or other medium, and simultaneously regenerating or restoring the propelling or ejecting pressure thereon, and resealing all operative parts.

A further object is to provide an automatic alarm signal in connection with a fire extinguishing apparatus or system, or units therefor embodying my invention.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in the construction, combination, location and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings, and to the various views appearing thereon,—

Fig. 1 is a view in elevation, partly in vertical section, showing one form of an expansible force tank, adapted to contain a suitable fire extinguishing medium or other fluid, in accordance with the principles of my invention, and showing the tank in emptied and collapsed condition with the fluid ejecting member at the bottom of the tank.

Fig. 2 is a view similar to Fig. 1, showing the expansible tank in expanded condition, as though filled ready for service, with the ejecting member at the upper end of the tank.

Fig. 3 is a view similar to Fig. 2, showing a modified construction of tank, a flush head being substituted for the ejecting member shown in Figs. 1 and 2, and also showing the complete unit equipment in installed position on a ceiling or other fixed support, with portions of a connected distributing pipe and associated fusible spraying heads.

Fig. 4 Sheet 2 is a view in elevation showing a double arrangement of pressure service tanks, with duplicate distributing pipes and electromagnetic check valve as another form of embodiment of my invention.

Fig. 5 Sheet 2 is a sectional plan view on line X—X, of Fig. 4, looking in the direction of the arrows.

Fig. 6 is an enlarged view in sectional elevation showing a portion of the expansible tank construction in expanded condition, and a form of electromagnet controlling valve for stopping and starting the flow of the fluid contents of said tank.

Fig. 7 Sheet 2 is a fragmentary plan view of twin distributing pipes having a suitable associated mixing and spraying head, and terminal attachments for refilling the tank and restoring the ejecting pressure.

Fig. 8 Sheet 1 is a broken view partly in longitudinal sectional elevation of the distributing pipe terminal refilling end connection.

Fig. 9 Sheet 1 is a diagrammatic view of a portion of a distributing pipe system and spraying head therefor, and one form of electrical arrangement and switch for actuating and controlling or releasing the spraying head.

Fig. 10 Sheet 1 is a view similar to Fig. 9, showing another form of electrical arrangement and switch embraced within the scope of my invention.

Fig. 11 Sheet 1 is a view in diagram of a portion of a switch board having a series of glass protected electrical switches grouped thereon for use in carrying out my invention.

Fig. 12 Sheet 3 is a view in elevation of an expansible pressure force tank or container showing the application thereto of a conveniently located automatic alarm.

Fig. 13 Sheet 3 is a broken view in elevation, partly in vertical section, of a larger type of expansible pressure tank or receptacle, having a supplemental dead weight propellant or ejecting force associated therewith and embraced within the scope of my invention.

Fig. 14 Sheet 3 is a broken view in elevation with parts in longitudinal section of means for protecting a distributing pipe and its associated fusible elements.

Fig. 15 Sheet 3 is a broken view in longitudinal section of a form of detachable connection between the tank and a distributing pipe.

Fig. 16 Sheet 3 is a plan view of a portion of distributing pipe showing the application thereto of a protected replaceable, non-crushable spraying element adapted to be buried in

a mass of material or merchandise to be protected against fire in accordance with my invention.

Fig. 17 Sheet 3 is a central longitudinal sectional view of the construction shown in Fig. 16.

The same part is designated by the same reference numeral wherever it occurs throughout the several views.

A system for protection against fire which is thoroughly dependable and always ready for use, and which is capable of installation wherever desired, requires the use of a non-injurious chemical, such as carbon tetrachloride, its compounds or derivatives, or their equivalents, or a mixture of soda and water, with salt added to prevent freezing, if necessary. The efficient utilization of such a system, both automatically and through manual control, ofttimes requires the location of distributing pipes and spraying elements at other points than on the ceilings of the rooms of the area to be protected. The utilization of such a system to its best advantage requires complete equipments of separate units of various fluid capacity, sizes and radius of pipe distribution, in proportion to the areas to be protected. In the use of such a system it is also advantageous to employ an automatic alarm or signal for each equipment unit. In some cases it may sometimes be desirable to secure the mixing at a spraying head of two or more chemicals which when combined constitute the fire extinguishing mixture or medium. It is also important to provide sprinkler or spraying heads which are releasable through the fusing of suitable elements employed in connection therewith, and which are controlled automatically, electrically or otherwise, as by the heat developed or temperature rise in the area in which the system or equipment is installed, or by means of electric switch controlled circuits. It is also important to maintain the fire extinguishing medium under a constant dependable pressure force which, when released, causes the medium to be discharged at the desired point.

It is among the special purposes of my present invention to provide an apparatus, equipment or system which attains the foregoing radical and vitally important and beneficial results, and others not specifically stated, in a simple, practical and commercial form.

In carrying out my invention, I propose to employ a constant dependable, preferably all metal, container or tank, which is expansible under interior pressure, and is of greater or less fluid capacity, depending on the area to be served, and to combine therewith one or more distributing pipes, of a length and diameter and equipped with the desired number of spraying heads, having fusible releasing elements, according to the area to be served. I also propose to provide suitable means, such as electrical switches, or otherwise, for releasing by fusing any desired spraying head. I also propose to employ, in some cases, a switch controlled electro-magnetically operated means, such as a valve, to control at will the stopping and starting of the flow of the extinguishing or other medium.

In carrying out my invention, in one form of embodiment thereof, I employ one or more circular bellows wafers 1, preferably of spring metal, and each of limited spring movement, which wafers are superposed, the one upon another, and hermetically joined together at their adjacent edges by crimping, soldering, brazing, or electric welding, or by any other suitable construction or formation, to form a pressure tank or container to receive the fire extinguishing medium, and which is distended or expanded against the resistance of its own inherent spring tension by forcing the medium thereinto under pressure, whereby the contained medium is maintained under a constant ejecting pressure which is produced by the expansible tank or container itself. At one end the built up series of wafers is hermetically attached to the plate 2, which constitutes the base of a supporting frame, while the opposite end of the series is fastened to one end of a hollow fluid ejecting member 3, which member 3 depends into the tank preferably to such depth, as to force out practically all of the contents of the tank, when said bellows wafer structure is in collapsed position, as shown in Fig. 1.

The fluid medium contained in the tank, is mainly below the ejecting member 3, when the tank is expanded and filled and in operative condition, as shown in Fig. 2. Each bellows wafer of the tank has an inherent fluid ejecting force or tension in direct proportion to the thickness and spring tension of the metal used, and to the number and depth and form of the series of grooves between the inner and outer edges of its component elements.

The collapsible tank is supported in any suitable framework, which in the form shown consists of a series of vertical members 4, supporting member 5, and base 2. This frame, in the form shown, constitutes a visible gauge by which an observer noting the relative positions of the end of the tank, and the support 5 of the supporting frame, can tell at a glance whether or not the unit equipment is in normal expanded filled and tensioned or ejecting condition, or is in more or less emptied or non-serviceable condition.

It may sometimes be advisable on account of the volatile character or low boiling point of some desirable type of fire extinguishing chemicals which may be used, to leave a safety expansion space between the end of the expansible tank, and the adjacent supporting frame member 5, as shown in Figs. 2 and 3.

In the modified arrangement shown in Fig.

3, the ejecting member 3 shown in Figs. 1 and 2 is omitted, and the end wall 6 of the collapsible tank effects the expulsion of the medium when the tank is permitted to collapse. In this case the tank is only partially emptied of fluid when in collapsed condition. However, it is evident that if the fluid contents, discharged under the force of the collapsing tank is not sufficient to extinguish the fire which caused the automatic release of the contents of the tank, then the heat generated from the fire would thereafter transform the remaining liquid in the tank into a more or less gaseous condition with corresponding ejecting force, thereby discharging or ejecting practically all, if not all, the liquid in the collapsed tank.

Some kinds of chemical fire extinguishing mediums, such, for example, as the so-called "foamite", and possibly others, require the mixing of two or more chemicals at the instant of discharge. In some cases the proportions of such chemicals are equal parts, and in other cases a different proportion is required. Where equal parts are required, two expansible tanks of the same fluid capacity are required. Where unequal parts of chemicals are employed expansible tanks of corresponding relative capacities are required. A dual mixing system is shown in Fig. 4 wherein it is assumed that more of one chemical than of the other is to be used, and consequently two expansible tanks of relatively different capacities are indicated.

When a filled and expanded tank is permitted to collapse, that is, when the inherent contractive force of the wafers composing a tank is brought into operation for the ejection of the fire extinguishing medium, such medium is ejected from the tank through the distributing pipe or pipes 7, which are in communication with the interior of the tank or tanks. In installing the distributing pipes where two tanks are employed, one for each of two different chemicals, it is desirable that the two pipes be installed in close parallel relation to each other.

In accordance with my invention the fire extinguishing medium is expelled from the system in the accomplishment of its extinguishing function through suitably disposed sprinkling or spraying heads 8 associated with the distributing pipe or pipes 7. Each of these heads is provided with one or more fusible members which serve to retain the medium in the tank or tanks and associated pipe or pipes, but which, when fused, permit the pressure under which the medium maintained to become effective to cause the medium to be ejected or discharged through said heads. Where the system includes two tanks and two lines of distributing pipes, in the case where two chemicals are used, the sprinkling or spraying heads 8 are common to both pipes, as shown in Fig. 7. The proportionate size of the distributing pipe or pipes 7, and of the openings therefrom into the sprinkling head, determines the proportionate quantities of the intermixing chemicals being ejected under the same constant ejecting pressure, the chemicals being mixed at the instant of discharge through the common head.

In many installations it may be desirable to install a pressure tank of a large size so as to contain in a single tank unit a sufficient volume of fire extinguishing medium to protect an entire building, such tanks being placed either in the attic, or in the basement of the building or in any other desired location. The ejecting force inherent in the tank is ordinarily sufficient to efficiently discharge the medium wherever the tank may be located. With a larger tank it is deemed advisable, however, in some cases, in order to reduce the thickness, weight and spring tension pressure of the metal used therein in building it up, and thereby reduce the cost of the tank, to make provisions whereby a supplemental pressure may be employed to augment the inherent spring pressure of the expansible structure of the tank. In Fig. 13 I have shown such an additional or auxiliary pressure obtained by means of a dead weight 10 mounted in a receptacle 9, which is mounted on the top of tank.

Since the weight 10 rises and falls according to the expanding or contracting movements of the tank, suitable means for guiding the weight 10 are desirable. For this purpose it is preferable that the vertical bars 4—4 serve as guides for the lugs 11—11, which are attached to the weight carrying receptacle 9. See Fig. 13.

In the case of such a larger tank, as above described, and as shown in Fig. 13, it is desirable to employ a series of distributing pipes 7, which are extended therefrom in various directions, and of suitable lengths to fully cover the fire area to be protected with the required or desired number of spaced apart spraying heads.

The distributing pipe or pipes 7 may be connected to the tank or tanks in any suitable or convenient manner. In some cases, however, it is desirable that the distributing pipe 7 be detachably connected to the tank. This may be accomplished in various ways. A simple detachable connection for said pipe is shown in Fig. 15, wherein a screw threaded boss 37, is provided on the valve cover 36, or it may be provided on the tank bottom 2. Formed on or attached to the end of the pipe 7 is a flange 38, a pipe encircling interiorly threaded nut sleeve 39, clamps the elements together with the intervening sealing gasket 40 sealing all parts.

As above described, the extinguishing medium is retained in the tank and distributing system, and under the pressure imposed there-

on by the spring tension of the expanded tank, whether alone or reinforced by the auxiliary weight. The retention of the medium, under pressure, is effected by means of fusible elements, preferably located in or associated with sprinkling or spraying heads suitably located and distributed throughout the area to be protected. The fusing of the fusible element, in order to release the medium and allow it to be ejected, may be accomplished in various ways. This may be done automatically by the abnormal rise of temperature produced by a fire in the vicinity thereof. Or it may be accomplished through manual control by associating with the fusible elements an electric resistance coil or element, indicated at 15, the circuit of which is under the control of a suitable conveniently located switch. In Fig. 9 I have shown a switch 12 enclosed within a protecting casing 13, for controlling the circuit wires 14, of the electric fusing element 15. In Fig. 10 an ordinary form knife edge switch 12^a is shown. Any suitable source (not shown) of electrical energy, which is dependable may be connected into the circuit thus provided. By means of such an arrangement it will be seen that in case of an incipient fire being discovered in proximity to a spraying head 8, the fusing of the fusible element of such head, through the switch means described, may be instantly effected, and the fire extinguished before the heat therefrom could possibly fuse such a fusible element.

In some cases it may be desirable, in place of the described individual fusing switches being scattered throughout a building, or over a large area, to group them, as shown, at a common switchboard 16, Fig. 11, which may be located at any desirable point for convenience and dependability in service.

It is desirable and important, in spraying any high efficiency fire extinguishing medium to provide a manual control of same so that the spraying thereof may be instantly stopped and started at the will of the attendant, thereby conserving the use of said medium and relatively safe guarding all persons exposed to the gases thereby released, and also permitting the convenient and safe replacement of a fused head by a perfect one. In Fig. 6 is shown a preferred form of a fluid controlling valve for this purpose. This consists of the built in and absolutely leak proof electrically controlled valve 17. This valve is controlled by means of an electro-magnet, the coil 20 of which is wound upon the core or field piece 21, the terminals 18, 19 of said coil leading to the switchboard 16, and there controlled by a switch 12, or 12^a.

A pipe 22 extending through core 21 constitutes a passageway for the fluid in tank, to pass from the tank when released. There is preferably an open space provided between the valve 17 and the adjacent end of the magnet core, and passageways are provided through the valve 17, and around the same, said passages and space communicating with the distributing pipe 7, or with a series of said pipes, if a series are connected with the valve casing 36. A central sealing element 23, preferably of cork, in direct alinement with the tank connecting pipe 22, is seated firmly in the valve member 17. At the instant of the electric current, from any dependable source, being switched into the electro-magnet, the valve 17 with the sealing cork or member 23 is magnetically drawn forcibly against the end of the pipe 22, and held thereagainst firmly as long as the control switch remains closed, thereby cutting off all outlet of fire extinguishing liquid from the tank. The opening of the switch allows the valve 17 with its related sealing cork or member 23 through its own weight, and the pressure force in the tank, to drop away from the end of the connecting tube 22, reestablishing thereby the free pressure fluid flowing relation between said pressure tank 1, and distributing pipe 7.

It is evident that the efficiency of a fire extinguishing apparatus of the nature above described, and built up in separate equipment units, would be greatly increased if, when it is performing its normal fire extinguishing function, it sounded an alarm or signal, thereby attracting the attention of nearby persons or arousing endangered persons from sleep. With this object in view, I have utilized the fact that any discharge of the medium from the expansible tank results in its collapsing proportionately; therefore, in accordance with my invention, I employ this collapsing movement to actuation of alarms. In one form this is accomplished by placing a pivoted electrical switch lever 24, see Fig. 12, in engagement at one end with the end of the tank. When the tank is in full expanded position it opens and holds open said electric switch lever from the contact 24^a, which is in the circuit of an alarm device 25. Conversely, when through any loss of fluid contents from said tank by fire service, or otherwise, the head of the tank is lowered whereupon the spring 24^b connected to switch lever 24 causes the same to close automatically against contact 24^a, thereby closing the signal circuit and sounding the alarm 25 until same is switched off or the expansible tank conditions are replaced to normal condition. If desired a spring actuated bell may in like manner be operated.

It is desirable under some conditions to protect the fluid distributing pipe from injury caused by strains due to the pressure thereon of the material which it is designed to protect, for instance, when embedded in coal in a ship's bunker, or piled up in large quantities on land, or dock. It is a well known fact that some grades of coal are inclined to spon-

taneous combustion, and fires so created are generally at depths in the interior of the pile or mass of the coal, rendering ordinary fire extinguishing methods futile. In Fig. 14 a distributing pipe 7 with any suitably formed fusible spraying or discharging head 8, is shown inside of a protecting pipe 26, which pipe is perforated by a series of openings 27 therethrough. Bands of wire screening 28 therearound, provide free admission of heat to the fusible element 8, while excluding foreign substances such as particles of coal, etc., and permits free exit of the ejected fire extinguishing medium through the meshes thereof.

Protecting or guard pipe 26 may be buried horizontally in a pile of coal or other inflammable material at any desired depth, or may penetrate such pile of material vertically, thereby locating the fusible elements 8 in the vicinity of the origin of the fire or directly at the point of ignition. In either event, the automatic releasing through abnormal heat on the fusible element, and the resulting automatic discharge of the fire extinguishing fluid takes place under the most efficient fire extinguishing conditions.

For the purpose of preventing the protecting or guard pipe 26 from forming a vent or chimney in case of a fire, and for the further purpose of facilitating the assembling and withdrawal or replacement of the distributing pipe 7, therefrom, and replacing same, the outlet end of pipe 26 is preferably sealed by means of a split gland 29 and 30, in connection with the screw threaded binding cap nut 31, and sealing gasket 32, all being firmly secured to the end of guard pipe 26.

By the arrangement described, after the fire is extinguished, the pipe 7 with its fusible element 8, can be withdrawn from the protecting guard pipe 26, and the fused element of head 8, replaced with a perfect element. The tube 7 is then replaced within guard pipe 26, and the expansible tank refilled, and the fire extinguishing equipment unit is then again all set for its required duty.

It is evident where single unit equipments are employed, each unit being associated with a single protecting or guard pipe 26, with its related fire area and individual electric alarm, that the exact heat area in a large field or mass of coal would, by such alarm means, be instantly indicated, thereby determining which one of the various distributing pipes in the area was to be withdrawn and restored to proper functioning conditions.

A frequent cause of fire is spontaneous combustion in bales of cotton on board ships at sea, or in storage in warehouses on land. The protected distributing pipe 7 of the character above set forth enables lines of such distributing pipes with their fusible elements 8, to be laid between tiers of cotton bales, in storage or in transit, with full automatic fire protection thereby secured.

For this purpose, however, I prefer to employ the construction shown in Figs. 16 and 17, which consists of a short pipe section 41 fitting over and soldered, brazed, or otherwise secured to the spaced apart ends of pipe 7. Soldered or brazed to pipe 41 is the enlarged casing 42 having ther through a series of vent holes 43. One or more fusible elements 44 are formed in or attached to pipe 41. The unit so assembled can conveniently be removed from ends of distributing pipe 7 when fused, and replaced by a perfect assembled unit.

The refilling of the expansible tank and simultaneous restoration of the ejecting force, may be secured in various ways. One simple arrangement is shown which consists in attaching a suitable hand or power operated force pump to the screw threaded terminal 33, see Fig. 8. As the fire extinguishing fluid, of any name or nature or compound, is pumped into the collapsed tank, said tank is gradually refilled and expanded against inherent spring resistance of the series of bellows wafers, and with the larger tanks against the added dead weight until such tank is fully expanded and fully refilled. After the removal of the pump, a screw thread sealing cap 34 with suitable sealing gasket 35 makes the terminal connection absolutely tight, as against the escape of the contained fluid under the ejecting pressure which is inherent in said tank. The spring pressed valve 35^a retains the fluid against the ejecting pressure exerted thereon, while the pump is being removed and gasket 35 and screw cap 34 are being replaced. The larger tank shown in Fig. 13 may be filled in like manner through any preferred one of the several connecting distributing pipes. All of these features stated and many others which are apparent make the invention one of great simplicity and practical value and importance.

While I have referred to the use of my invention in connection with fire extinguishing apparatus I do not propose to confine myself to such, as an apparatus or system embodying my invention is well suited for many other uses.

The invention is defined in the appended claims. Many minor changes in mechanical structure are possible, and it is to be understood that such changes coming within the scope of the claims are comprehended by the invention which, while complete in every operative sense as disclosed, is to be considered as diagrammatic of the invention rather than as limiting it to specific constructions other than as defined by said claims.

Having now set forth the objects and nature of my invention and various arrangements embodying the principles thereof, what I

claim as new and useful and of my own invention, and desire to secure by Letters Patent, is:

1. In a fire extinguishing apparatus, a series of flexible annular metallic bellows wafers hermetically connected together and closure means for the two terminal members of the series to form an expansible, elastic tank to enclose a fire extinguishing medium and when filled with same to exert a constant integral spring ejecting pressure on said medium, said tank having an outlet.

2. In a fire extinguishing apparatus, an expansible self collapsing tank enclosing a fire extinguishing medium, said tank operating to exert an inherent ejecting pressure on said medium, and a distributing pipe communicating with said tank and having a fusible element associated therewith, in combination with an alarm or signal device, and a pivotally mounted, spring pressed lever engaging said tank and normally restrained thereby from movement, but adapted on collapse of said tank to cause operation of said alarm or signal device.

3. In a fire extinguishing apparatus, an expansible and integral spring collapsible tank enclosing a fire extinguishing medium, said tank operating to exert an inherent ejecting pressure on said medium, and a distributing pipe communicating with said tank, and having a fusible element associated therewith, in combination with an electrically operated alarm or signal device, and means for closing the circuit of said alarm or signal device, said means being normally restrained from actuation by said expanded tank.

4. In a fire extinguishing apparatus, an expansible self collapsing tank containing a fire extinguishing medium, said tank operating to exert an inherent ejecting pressure on said medium, and a distributing pipe communicating with said tank and having a fusible element associated therewith, in combination with a closure plug for said pipe, said plug having a valve controlled passage, and constructed to receive the end of a pump, whereby said tank may be refilled.

In testimony whereof I have hereunto set my hand on this 26th day of August, A. D. 1922.

WILLIS J. PERKINS.