To all whom it may concern:

Be it known that we, GEORGE I. ROCKWOOD and Hjalmar G. CARLSON, citizens of the United States, both residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Valve for Automatic Sprinkler Systems, &c., of which the following is a specification.

This invention relates to subject matter similar to that set forth in the application for patent on controlling apparatus for alarms for fire extinguisher systems and the like filed on even date herewith, by George I. Rockwood, Serial No. 809,744, and especially to a construction of valve and operating mechanism therefor for use in automatic sprinkler systems and similar places where an alarm has to be given or a signal shown when the pressure in a system of sprinkler water pipes is reduced, as for example, by the operation of a sprinkler head connected therewith, but where it is to be withheld if water is admitted to the alarm system as a result of a water hammer.

The principal objects of this invention are to simplify the construction of such devices and yet to cause the valve parts to be operated directly by the pressure from the alarm device to discharge the water which has accumulated as a result of water hammer, or otherwise, as soon as the water main of the sprinkler system is no longer connected with the valve, also to provide a practicable way of controlling the waste port valve by means of diaphragms, and to provide other improvements as will appear.

Reference is to be had to the accompanying drawings in which—

Figure 1 is a side elevation of a valve constructed in accordance with this invention, showing its connections with a sprinkler system and alarm device; Fig. 2 is a vertical central sectional view of the valve on an enlarged scale; Fig. 3 is a sectional view of a portion thereof on the line 3—3 of Fig. 2, and Fig. 4 is a view similar to Fig. 2 showing a modification.

The drawings show a well known type of sprinkler system involving a main 10 and a pipe 11 for feeding the sprinkler heads 12, the latter being constantly connected with this pipe. This feed is controlled by a check valve 13 which works in a well known way to allow the passage of water into the sprinkler system from the main 10 whenever the pressure in the former decreases materially on account of the opening of one or more of the sprinkler heads. The usual port 14 is shown for connection with an alarm device through a pipe 15 or the like whenever the valve 19 opens. In the form shown this pipe extends to a valve casing 16 which has a waste outlet 17, but the casing normally discharges into a vertical alarm pipe 19. This pipe 19 is provided with a receiving chamber 20 at the top which, when the water rises to the top thereof, discharges the water through a nozzle 21 against a wheel 22. In this case, this operates the alarm when water is fed continuously out of the sprinkler system through the port 14. It will be understood, of course, that any other form of alarm, either electric or otherwise, can be substituted for the one shown, and that the invention can be applied to any other type of sprinkler system, these two features being shown for the purpose of illustrating the operation of this invention.

In the form shown in Figs. 2 and 3, the valve casing 16 is shown as made up of two parts having chambers 23 and 24 between which are a pair of flexible diaphragms 25 and 26 separated by a partition 27 which may be either solid or skeleton. This partition and the edges of the diaphragm are held between the two parts of the casing which are secured at their flanges in any well known way. The two diaphragms are connected to a valve 28, held in position by a nut 29 and collar 30 secured on the valve.

In this way the valve moves with the diaphragms. The valve is provided with a central perforation 28 and with a conical end 31 constituting a waste port valve proper. In the center of one of the members which forms the casing 16 is a bushing 32 which has a passage therethrough and is in registration with the end of the open connection 19. This bushing has a skeleton frame-work 33 which holds an auxiliary ball valve 34. The passage 28 is provided with a drain outlet 35 opening into the chamber 24 from which the waste outlet 17 extends. In this way it will be seen that the chamber 23 under the diaphragms receives the water directly from the sprinkler.
system through the inlet pipe 15; that the second chamber 24 above the diaphragms is in direct and free communication with the discharge outlet 17, and that there is a small chamber 36 at the top which is normally kept out of communication with the chamber 24 by the waste port valve 28 which is held up by a slight permanent set, which is given the flexible diaphragms, except when there is an excess of pressure in the chamber 36. A removable plug 37 is shown for permitting access to the interior of the casing and draining the water therefrom. The partition 27 is provided with radial grooves 37 on both sides, which extend out between the flanges of the casing. These permit any water that may be caught between the diaphragms to drain out. The partition also, of course, limits the motion of the diaphragms in both directions. Packing 38 is shown on both sides of the partition.

The operation is very simple. Normally the parts are in the position shown in Fig. 2. Whenever water under pressure enters the chamber 23 through the pipe 15, some of it, of course, will drain out through the passage 33 into the outlet, but as this passage is relatively small the pressure of the water on the diaphragm 25 will hold it stationary, in the position shown in Fig. 2 so as to keep closed the connection between the pipe 19 and the chamber 24. The valve 34 in this case is held by the current of water up from the end of the waste port valve 28. Most of the water then will flow past this valve 34 and out into the pipe 19. If these conditions remain the same for a considerable period the water will rise in the pipe 19 and in the chamber 20 until it operates the alarm. It will continue to operate the alarm until the conditions change.

By the use of two diaphragms the valve 28 is properly supported and accurately held in position. The partition 27 limits the motion of the diaphragms alternately and by the drainage is prevented from hindering their free motion.

Whenever the valve 13 closes, no matter what the cause, the first effect is to cause the ball valve 34 to drop, because almost immediately the pressure in the chamber 36 will exceed that in the chamber 23 on account of the drainage of a part of the water from the latter through the passage 35. When this occurs the entire pressure in the pipe 19 is directed against the valve 28, or rather so much of it as is located inside the bushing 92. The head of water in the pipe 19 thus exerts pressure on the water in the chamber 23, thus forcing leakage through the port 35. Thus this valve and the diaphragm are allowed to drop. This allows free passage of the water from the pipe 19 into the discharge chamber 24. After which the set of the diaphragms and the head of water forcing in the valve 28 will cause the valve face 31 to move up to its seat and reestablish the direct connection between the port 14 and the alarm mechanism. It is obvious that this head of water can be depended upon alone for securing this result, when the distance between the diaphragms and the port 35 is made great enough. Ordinarily, however, we prefer to rely mainly on the set of the diaphragms. If the entrance of water into the chamber 23 was caused by water hammer this operation will also take effect if a material amount of water has been forced into the pipe 19. If a succession of water hammers occurs the discharge of water will take effect between each two successive hammers and prevent the accumulation of enough water in the chamber 20 to operate the alarm. The operation of the valve therefore is not dependent upon any varying differential filling of the chamber 20, nor does the opening of the valve 13 itself cause the operation of the valve 28. Because ordinarily, after the pipe 19 is emptied, this valve will be closed in the position shown in Fig. 2 by the set of the diaphragms or the pressure of water under the same, or both, and the position of these parts does not change when the valve 13 opens.

Thus it will be seen that the receiving chamber is connected with a waste port valve, which is closed at all times except during the emptying period so that no change in its position takes place upon the opening of the channel check valve and the entrance of water to the chamber, and, subsequently, to the alarm mechanism, and which opens only upon the reversal of the flow of water from passing up, to passing down, the pipe 19. As the waste port valve 28 is normally closed water cannot waste through it while the receiving chamber is filling, except, of course, the small amount passing through the port 35.

As the normal position of the parts is such that the entrance of water operates the alarm without moving the parts, except the ball valve 34, it will be seen that they are not likely to get into a position in which they will be prevented from operating the alarm under the proper conditions.

In the form shown in Fig. 4 a similar situation exists, but the device is shown in a different position and there is only one diaphragm 45 forming the boundary of the pressure chamber 46. A waste port valve 48 is connected with the diaphragm 45 and it engages a bushing 49 opposite the open connection 19 in the chamber 50. The diaphragm is prevented from operating too far, and the valve 48 is guided, by a skeleton frame 47. An auxiliary ball valve 51 is shown operating horizontally, but otherwise like the valve 34. On the left side of the
diaphragm 45 is a waste chamber 52 communicating with the waste outlet 17. In this case the diaphragm need not have a permanent set as the water entrapped below the central passage through the waste port valve will hold the same normally closed. The operation of this form of the device need not be described, in view of the fact that it is so similar to that of the form shown in Fig. 2.

Although we have illustrated and described only two forms of the invention, we are aware of the fact that the principle can be carried out with many other modifications without departing from the scope of the invention as expressed in the claims, and that it can be connected with other forms of alarms and sprinkler systems also. Therefore, we do not wish to be limited in these respects, but

What we do claim is:

1. The combination with a valve casing having a diaphragm therein, of a normally closed pipe for supplying water to the casing on one side of the diaphragm, a waste outlet from the casing on the other side of said diaphragm, a valve in the casing held normally closed by the diaphragm for normally preventing the maximum discharge of waste water from the first named side of the diaphragm in the casing into said waste outlet but movable with the diaphragm and having means for allowing the water to flow freely from the first named side of the diaphragm in the casing to the alarm device, an alarm device connected with the casing on the other side of the diaphragm, from the first named side, and means whereby only when the pressure from the alarm device exceeds that on the first named side of the diaphragm, said valve will be opened to allow water to be discharged freely from the alarm device.

2. In a device of the character described, the combination of a casing having three chambers therein, a diaphragm separating the first and second of said chambers, a valve movable with said diaphragm for normally disconnecting the second chamber from the other two, said valve having a passage for connecting the first and third chambers, an open connection from the third chamber to an alarm system, and an auxiliary valve in position to close said passage when the pressure in the third chamber exceeds the pressure in the first chamber, whereby said auxiliary valve and main valve will be pushed back to permit the third chamber to discharge into the waste chamber.

4. In a device of the character described, the combination of a casing having three chambers therein, the first chamber having an inlet, a diaphragm separating the first and second of said chambers, a valve movable with said diaphragm for disconnecting the second chamber from the other two, said valve having a passage for connecting the first and third chambers, and a connection from the third chamber to an alarm system, said valve normally closing said connection, and including means in position to close said passage in the valve when the pressure in the third chamber exceeds the pressure in the first chamber, whereby said means and main valve will be pushed back to permit the third chamber to discharge into the second chamber.

5. In a device of the character described, the combination of a casing having three chambers therein, the first chamber having an inlet, a diaphragm separating the first and second of said chambers, a valve movable with said diaphragm for disconnecting the second chamber from the other two, said valve having a passage for connecting the first and third chambers and a drain port, and an open connection from the third chamber to an alarm system, said valve including an auxiliary ball valve in position to close said passage in the valve when the pressure in the third chamber exceeds the pressure in the first chamber, the diaphragm having a set in a direction to cause the valve normally to close.

6. In a device of the character described, the combination of a two-part casing, a diaphragm, a valve supported by said diaphragm, said valve having a passage there through and a drain port, means for admitting water into the casing at one side of said diaphragm, a waste outlet from the casing at the other side of said diaphragm, an open connection from the casing to an alarm system, said diaphragm having a permanent set whereby said valve closes communication between said open connection and the waste outlet chamber except when there is excess pressure on the valve from the alarm system.

7. In a device of the character described, the combination of a two-part casing, a diaphragm, a valve supported at the center of said diaphragm, said valve having a longitudinal passage, means for admitting water into the casing at one side of said diaphragm, a waste outlet from the casing at the other side of said diaphragm, an open connection from the casing to an alarm system.
system, and means whereby said valve closes communication between said open connection and the waste outlet chamber except when there is excess pressure on the valve from the alarm system.

8. The combination with a valve casing, and a normally closed supply pipe therefor, said casing having three chambers therein, one for receiving the water from said supply pipe, a waste outlet connected with the second chamber, and an open connection to an alarm system connected with the third chamber, of a diaphragm separating the first and second chambers, a valve in said casing normally closing the free connection between the second and third chambers, but movable with said diaphragm, said diaphragm constituting means whereby when the water enters the first named chamber the valve will be held stationary in its normal closed position, means for allowing the passage of water from the first chamber to the third chamber, and means whereby when the pressure in the third chamber exceeds that in the first chamber said valve will be opened only until the third chamber has discharged into the chamber which is connected to the waste pipe outlet.

9. In a device of the character described, the combination of a two-part casing, a partition secured between the two parts of the casing and extending into the interior thereof, a diaphragm on each side of said partition, said diaphragms being movable toward and from the partition, a valve supported by said diaphragms, said valve having a passage therethrough and a drain port, means for admitting water into the casing at one side of said diaphragms, a waste outlet from the casing at the other side of said diaphragms, an open connection from the casing to an alarm system, and means whereby said valve closes communication between said open connection and the waste outlet chamber except when there is excess pressure on the valve from said open connection.

10. In a device of the character described, the combination of a casing, a partition extending into the interior thereof and having grooves extending to the exterior of the casing for draining purposes, a diaphragm on each side of said partition, said diaphragms being movable toward and from the partition, a valve supported by said diaphragms, said valve having a passage therethrough and a drain port, means for admitting water into the casing at one side of said diaphragms, a waste outlet from the casing at the other side of said diaphragms, and an open connection from the casing to an alarm system.

In testimony whereof we have hereunto set our hands, in the presence of two subscribing witnesses.

GEORGE I. ROCKWOOD.
Hjalmar G. Carlson.

Witnesses:
C. Forrest Wesson,
Catharine I. Hartnett.