

**March 17, 1942.**

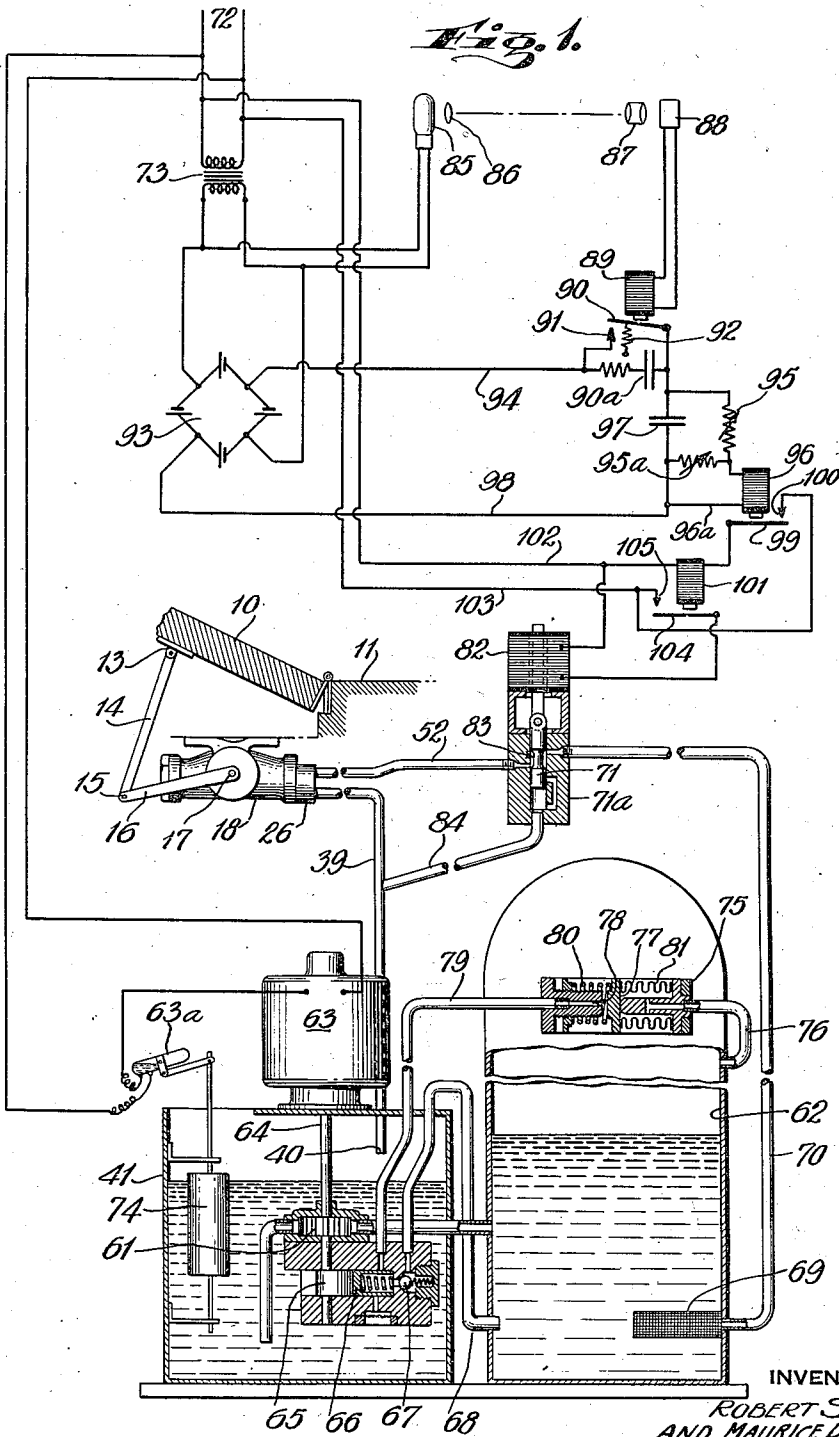
R. S. POTTER ET AL

**2,276,338**

DOOR OPERATOR

Filed Feb. 3, 1938

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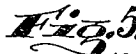


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**2,276,338**

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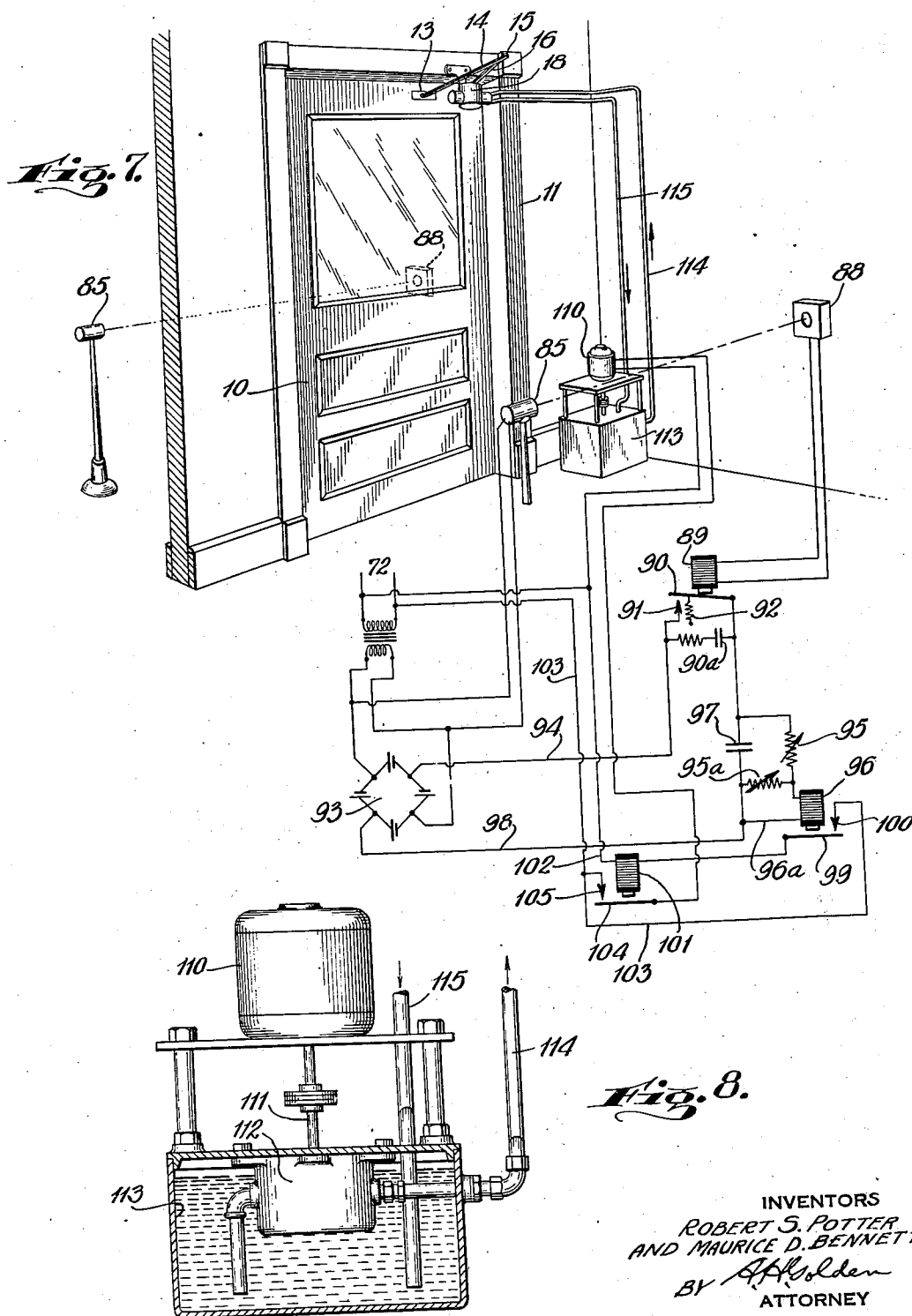


*Fig. 8.*

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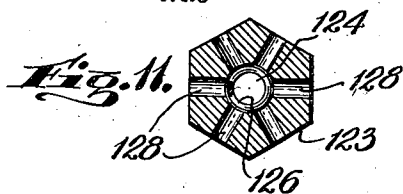
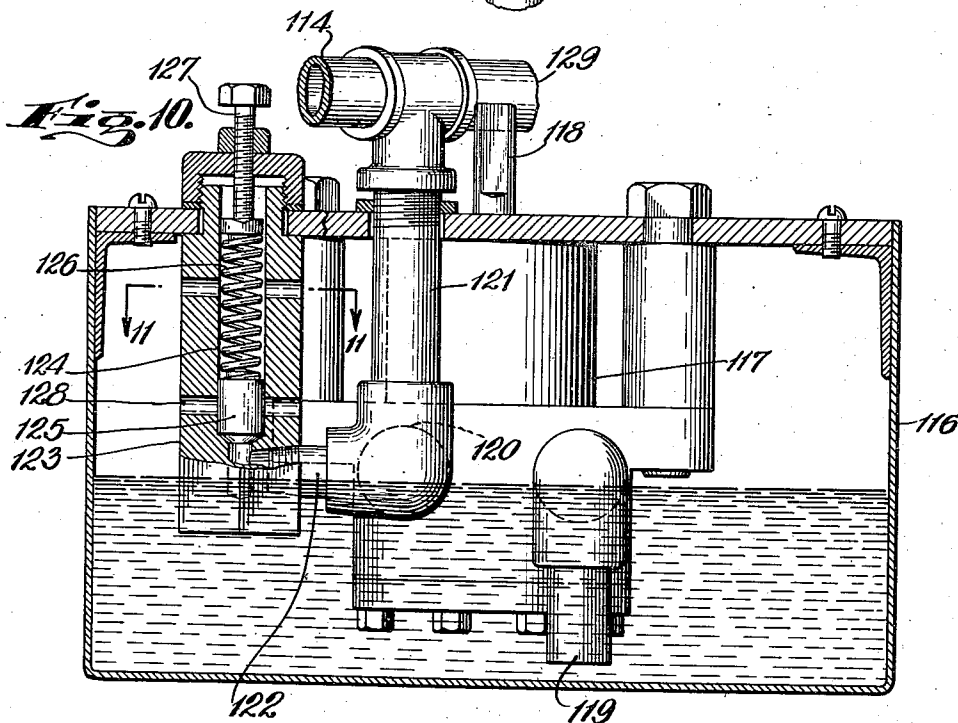
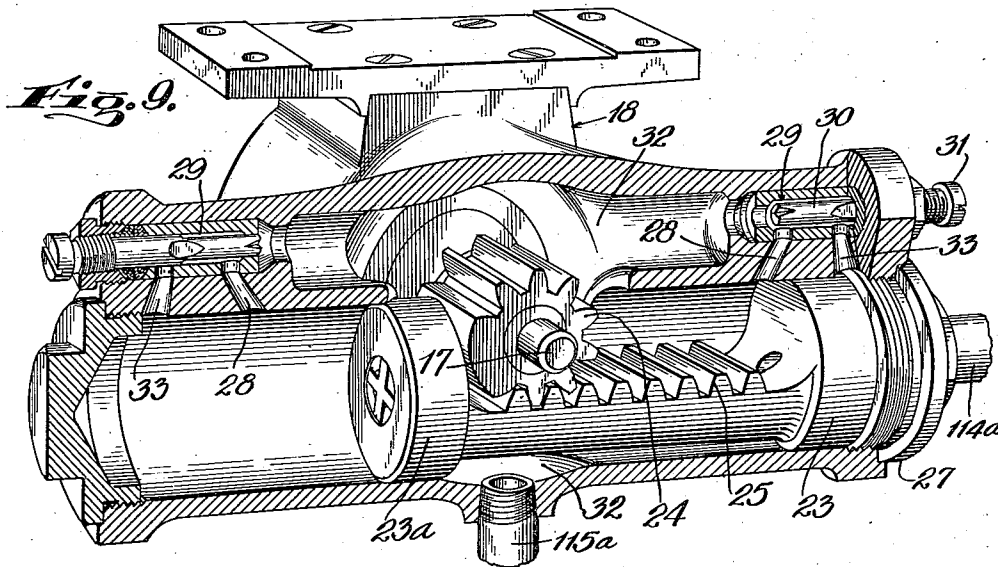
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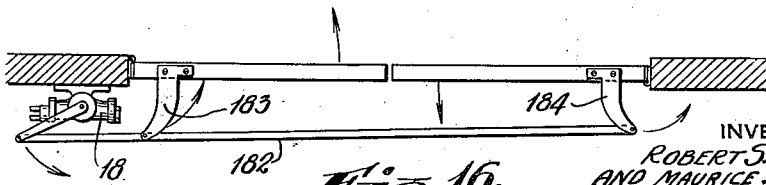
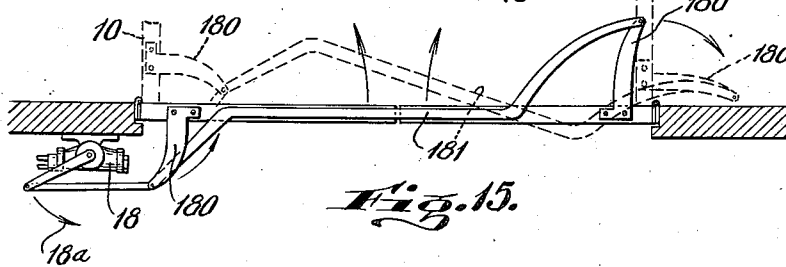
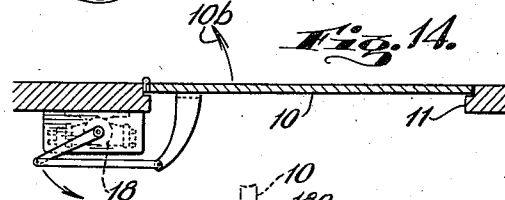
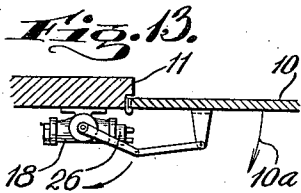
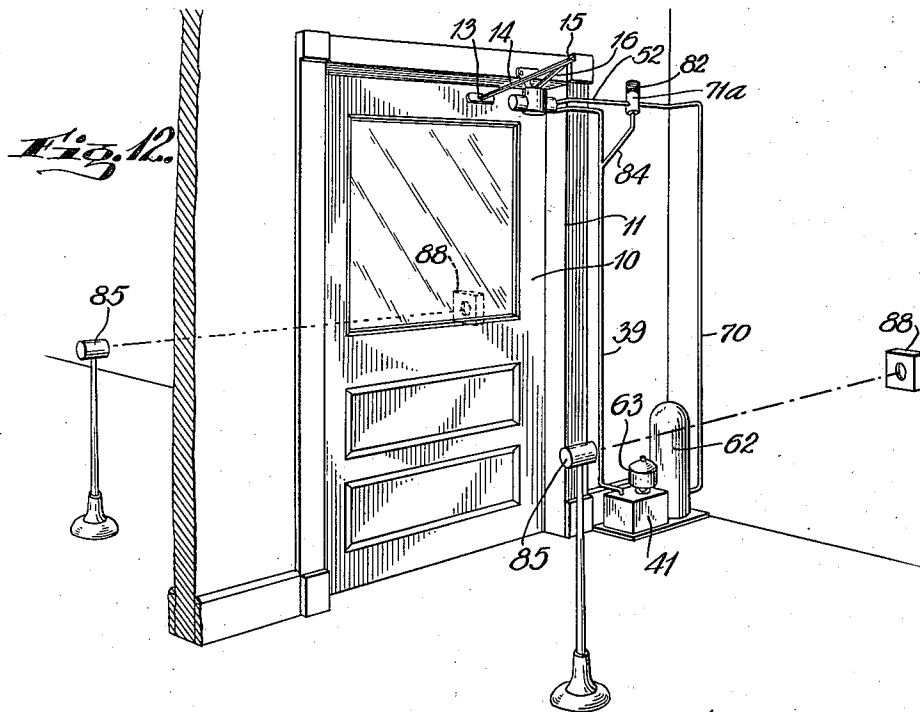
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DOOR OPERATOR

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6 Sheets-Sheet 5



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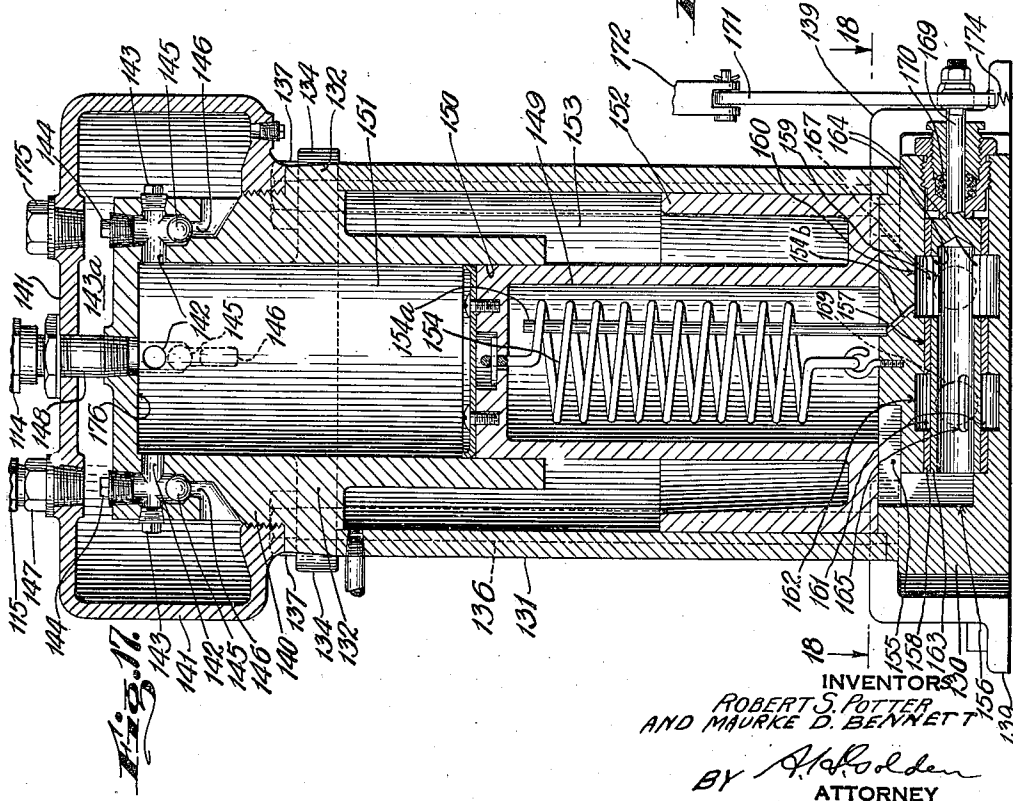
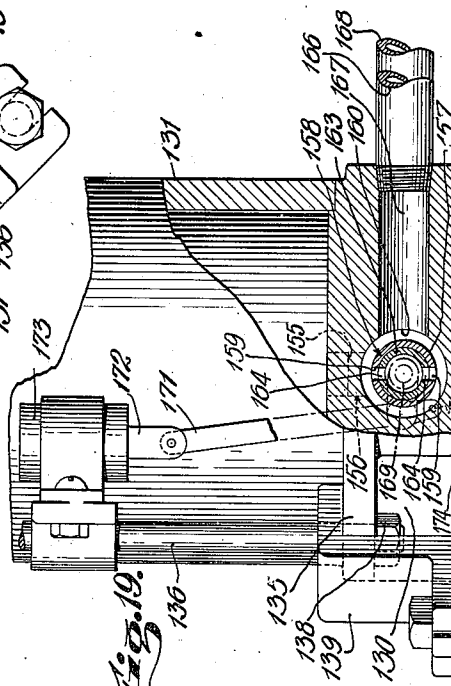
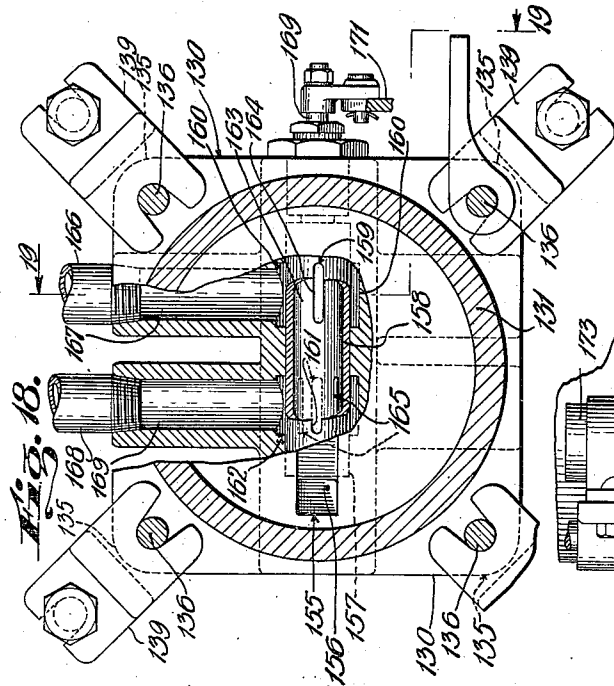
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DOOR OPERATOR

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## UNITED STATES PATENT OFFICE

2,276,338

## DOOR OPERATOR

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Application February 3, 1938, Serial No. 188,512

13 Claims. (Cl. 268—66)

This invention relates to apparatus for opening and closing doors automatically. More particularly, our invention relates to door opening and closing apparatus of a type which may be controlled by a photo-electric cell.

Door operating apparatus of the type referred to by us is broadly not new, and door operators controlled by photo-electric cells have been developed by a number of inventors. Our invention contributes to the art a door operator of relatively simple character, in which we are able to use devices now available in the art, and devices which have been tested by use over a period of many years.

One feature of basic importance inherent in our invention is the feature whereby our door operator will allow the door to be opened manually, and closed automatically as by a standard commercial door closer, should the mechanisms fail for any reason, or should it be desirable that the door operator be not used to open the door automatically.

More in detail, our door operator utilizes a door closer of a type well known in the art, which acts as a door closer to permit the opening of the door manually, and thereafter closes the door, preferably under the control of a fluid dashpot. This same door closer, when combined as proposed by us with other means to form a new operating combination, functions as a door opener and also as a cushioning door closer, while not affecting the operation as a normal door closer. We are thus able, through use of our new combination, to obtain the operation normally expected from a door closer, while at the same time obtaining an automatic door opening operation when we wish it.

One form of our invention utilizes a door closer of the general type disclosed in the Potter Patent No. 1,926,554, dated September 12, 1933, and also in the Norton Patent No. 1,152,339. As a matter of fact, the actual door operators we have built and tested utilize a door closer such as is manufactured today by the Norton Door Closer Co., of Chicago, Illinois. This door closer, now identified, is connected to a suitable source of fluid pressure. The application of fluid pressure to the door closer checking piston, reverses the action of the door closer and makes it function as a door opener, so long as the pressure applied is sufficient to force the checking piston to open the door, while allowing for dissipation of the fluid pressure through the valve mechanism which forms an essential part of the door closer.

Another form of our invention uses a door closer of the type just disclosed, except that the usual valve mechanism is not utilized, and new independent valve mechanism is substituted. This new valve mechanism assists in the application of fluid pressure to the door closer piston whereby the door closer may act as a door opener, by preventing the dissipation of fluid pressure during the period of the opening of the door. This new valve mechanism does allow the door closer to function normally as a door closer when desired, just as in the case of the regular commercial door closer we first described generally.

Further features of our invention which we shall describe and claim below, but which require no general description here, include means for controlling the application of pressure, for generating fluid pressure in several convenient ways, and for opening more than a single door. While we intend to describe certain preferred forms which our invention may assume, we do wish it understood that we do not wish to be limited in our patent monopoly except as may be required by the state of the art.

We shall now describe the drawings wherein several preferred forms of our invention are illustrated. In the drawings, Fig. 1 is a diagrammatic representation of one form of our invention in which the pressure source is a form using oil and air. Fig. 2 is a vertical cross section through the door closer shown in the modification of Fig. 1. Fig. 3 is a view along lines 3—3 of Fig. 2, while Fig. 4 is a view along lines 4—4 of Fig. 2. Fig. 5 shows the right hand end of the door closer of Fig. 2 with one of the valve parts in a different position. Fig. 6 is an isometric view of one of the valve parts used in Fig. 2. Fig. 7 illustrates another form of our invention applied to a door. Fig. 8 is a section through the fluid pressure source of Fig. 7. Fig. 9 illustrates a door closer similar to that shown in Fig. 2, but with the valve mechanism the same as that present in a commercial door closer such as manufactured by the Norton Door Closer Co. supra. Fig. 10 is a vertical section through a fluid pressure source similar to that shown in Fig. 8. Fig. 11 is a cross section along lines 11—11 of Fig. 10. Fig. 12 illustrates the construction of Fig. 1 applied to a door. Figs. 13, 14, 15 and 16 show the application of our invention to different types of door installations. Fig. 17 illustrates an alternate form of fluid pressure source. Fig. 18 is a section along lines 18—18 of Fig. 17, while Fig. 19 is a partial section along lines 19—19 of Fig. 18.

Referring to Figs. 1-6 and 12 of the drawings, there is shown one form of our invention. In Fig. 12 there is shown a door 10 mounted in a door frame 11 for swinging movement from the position of Fig. 12 to the position of Fig. 1. At 13, there is secured to the door a closer arm 14 pivoted at 15 to a second closer arm 16, which in turn is secured to the central shaft 17 of the door closer 18 (shown in Fig. 2).

The closer arm 16 carries a pawl 18a (Fig. 3) which fits into the teeth of a ratchet 19, which ratchet is secured to a sleeve 20, which is in turn secured to a spring winding sleeve 21 for winding the door closer spring 22 when the door is opened, all as is well known in the art. Opening movement of the door rotates arm 16 and shaft 17, and also the ratchet 19, so as to wind the spring 22. At the same time, the shaft 17 through coaction of its pinion 24 with the rack bar 25 forming part of the piston 23, moves the piston 23 to the left. Before describing now the action of the special valve mechanism mounted in the valve carrying head 26 of the door closer of Figs. 2-6, we shall refer to the standard door closer of Fig. 9.

In Fig. 9, we show a door closer which is exactly the same as that of Fig. 2, except for the valve mechanism and the pressure head 27 of the cylinder in which the checking piston 23 slides. In the door closer of Fig. 9, with the piston at the extreme left and the spring wound up, once the door is released to allow free action of the spring, the piston moves to its position illustrated in Fig. 9, and in so moving, first forces the fluid through a passage 28, and a further passage 29 as controlled by a valve stem 30 having an adjusting head 31. From passage 29 the fluid moves to a central chamber 32 on the other side of the piston 23.

The final closing movement of the piston 23 closes off the valve passage 28 so that all the fluid must flow through the valve passage 33. Through proper construction of the valve stem 30, as is well understood by those skilled in the art, the door will close at one speed until it reaches almost its final closing position, whereupon it will close at another speed.

The door closer in Fig. 9 is shown with two identical piston heads 23 and 23a and two identical valve assemblies, because the said door closer is reversible. By merely taking out the spring 22 and turning it over so that it will rotate in a reverse direction, the door closer will function to close a door which swings outwardly, as is best shown in Fig. 13. This is all well understood by those skilled in the art, and since it forms no part of our invention, need not be described in more detail here.

For the purposes of the invention utilized in Figs. 1-6, the head 27 of the standard door closer of Fig. 9 is removed, and a different head 26 is applied, as is shown in Figs. 2, 4 and 5. In addition, the valve passage in which the valve stem 30 operates in Fig. 9 is blocked off by a plug 34, while a sleeve 35 is inserted to block off the passage 28. Preferably, also, the opposite passage 29 adapted to cooperate with the piston head 23a on reversal of the door closer, is blocked off by a similar plug 34. Otherwise, the door closer retains the same form as shown in Fig. 9.

The valve head 26 is formed with a passage 36 leading to a threaded opening 37, into which is inserted a nipple 38, which connects to a pipe 39 emptying at 40 into an oil reservoir 41 on the low pressure side of a fluid pressure source. A

second bore 42 is formed in the valve head 26 and has secured therein a sleeve 43, best illustrated in Fig. 6. Sleeve 43 has three longitudinal slots 46 formed therein, and has also a series of pierced openings 47 functioning as will be described presently.

Within the sleeve 43, which sleeve is maintained fixed in the bore 42 of valve head 26, there is an inner sleeve member 48 which is in turn fixed relatively to the sleeve 43. A movable valve piston 49 is also mounted within the sleeve 43, and is normally maintained in its position of Fig. 2 by a spring 50 bottoming against sleeve 48. The passage 42 communicates with a nipple 51 similar to nipple 38, the nipple 51 being the pressure nipple and forming means whereby the pressure side of the fluid pressure source is connected through a pipe 52 with the valve head 26, and therefore, the door closer 18.

The valve head 26 contains a further bore 53, which is threaded at 54 for cooperation with the headed end 55 of a valve stem 56 which lies in bore 53. A further bore 57 is formed in the valve head, as is best illustrated in Fig. 2, this bore connecting with a circular groove 58 on the outer periphery of the valve head 26. As best seen in Fig. 4, this circular groove 58 leads in turn to the bore 33 and passage 29 described as present in the standard door closer of Fig. 9 to which valve head 26 is applied.

We shall now describe the action of the door closer in Fig. 2 when it functions as a normal door closer. It will be well to indicate that its action as a normal door closer is substantially the same as that indicated with regard to the form of closer shown in Fig. 9, except that instead of the controlling valve being the valve stem 30, it is, in the case of Fig. 2, the valve stem 56. When the door is opened, the spring 22 is wound up and the piston 23 is moved to the left from the position of Figs. 2 and 4. The fluid in the chamber 32 and behind the piston heads 23 and 23a will readily be dissipated through passages 28 and 29 on the left side of Fig. 4, and also through the unseating of the ball valve 23b in piston head 23.

When the door is released so that it may close under the influence of the spring 22, the ball valve 23b will first be seated, allowing piston 23 to force the liquid against the valve head 26. The liquid so forced will move through the three slots 46 of the sleeve 43 of Fig. 6, and thence down through the holes 47 in said sleeve 43, through the bore 57, best illustrated in Fig. 2, past the end of the valve stem 56. From bore 57, the fluid enters the circular groove 58 formed on the outer periphery of the valve head 26. It will empty from this circular groove 58 into the passage 33, and thence through the passage 29 and the bore of sleeve 35 into the chamber 32. Naturally, the position of the valve stem 56 will control the speed with which the fluid will move through the several passages indicated, and will thus control the speed of the closing of the door.

We believe that we have now presented the manner in which the door closer will function as a normal door closer when applied to a door as in Figs. 1 and 12.

As has already been indicated, the door closer of Figs. 2 and 4 is connected to a suitable pressure source through the valve nipple 51, and is connected to the low pressure side of that pressure source through the nipple 38. It will be well now to explain just what happens when fluid under pressure is transmitted through the nipple

51 and back to the pressure source through nipple 38, it being understood that preferably, the fluid will be of the type now used in door closers.

If, in the position of Fig. 2, fluid is transmitted under pressure through nipple 51, it will first act on the valve 49 and against the pressure of spring 50 to move that valve from the position of Fig. 2 to the position of Fig. 5. It will be well to note that with the valve piston 49 in the position of Fig. 5, openings 47 of the valve sleeve 43 are blocked off, while notched openings 46a are exposed. Therefore, the fluid under pressure will move through the notched openings 46a of the valve sleeve 43, thence through the three slots 46 and against the piston head 23. The ball valve 23b will be seated by the pressure, so that the full fluid pressure will be transmitted against the piston head 23. It will force piston 23 to the left from the positions of Figs. 2 and 4, and motion will be transmitted from the rack 25 through the pinion 24, to the closer shaft 17, to the arm 16, thence to the door 10, so as to cause that door to move from the closed position of Fig. 12 to the position of Fig. 1, and beyond that to full open position. The fluid in back of piston heads 23 and 23a will move through the passage 29 and the bore of sleeve 35 past the blocked passage 28, thence down passage 33, circular groove 58 (Fig. 4) into vertical bore 57 (Fig. 2), and through bore 36 and nipple 38 to the low pressure side of the fluid pressure source.

As will be noted in Fig. 4, the cylinder in which the piston head 23 operates has an opening at 59 so that when the piston is moved to a position exposing the said opening 59, the excess pressure presented against the piston head 23 will be dissipated through the opening 59, the several passages as described above and through nipple 38 to the low pressure side of the fluid pressure source. The reservoir 32a and all the internal passages of the door closer are of course maintained full at all times, as will be appreciated.

With the valve mechanism in the position of Fig. 5, should pressure against the piston head 23 be relieved, the door will close under the influence of the wound up spring 22, with the fluid controlling the speed of closing, as will now be indicated. First, the withdrawal of the pressure against the valve piston 49 will cause that piston to move from the position of Fig. 5 back to the position of Fig. 2. This will uncover the openings 47 leading from the three grooves 46 of the valve sleeve 43 of Fig. 6, as is apparent in Fig. 2, and will cover notched openings 46a. The piston head 23 now forces the fluid through the internal passages of the door closer, that is, through grooves 46, through the openings 47, through the passage 57, thence past valve stem 56, through the circular groove 58 and into the chambers 32 and 32a of the closer. This flow of liquid during closing is identical with the flow previously described as taking place when the door is opened manually and then allowed to close.

It will be well to explain at this time that each piston 23 is grooved at 23c, a small bore 60 running from the said groove 23c into the chamber adjacent the ball 23b. The groove 23c and the bore 60 function to permit the escape of air which may otherwise be trapped by the piston.

We shall now describe the means whereby pressure is properly applied to the nipple 51 for utilization against the piston 23 in the manner already set forth. One form of pressure source

is illustrated in Fig. 1 and has already been referred to. A reservoir 41 contains the fluid which is the usual oil used in the door closer art. This oil is adapted to be pumped through a gear pump 61 into a pressure chamber 62 through the operation of a motor 63. The shaft 64 of the gear pump 61 extends downwardly so as to operate a cam 65, which in turn operates against a piston 66 for forcing air past a ball valve 67 through pipe 68 into the pressure chamber 62, it being understood that the pressure of air in the chamber 62 against the body of oil therein will force that oil through the filter 69, the pipe 70, and an electrically controlled piston 71 into the pipe 52 leading to the nipple 51.

The motor 63 is connected to a source of alternating current 72 through a mercury switch 63a controlled by a float 74, so that whenever the oil level in the reservoir 41 rises beyond a predetermined amount, the motor 63 will be started and the gear pump 61 will force oil into the pressure chamber 62.

For controlling the pressure of the oil in the pressure chamber 62, we utilize a form of valve 75, shown here only diagrammatically since it may assume any one of many forms. This valve 75 communicates through pipe 76 with the air in the pressure chamber 62, it being the function of the air pressure to operate through bellows 81 against a piston 77 which may seat against an air admitting passage 78 forming the terminal end of pipe 79 which leads to the air pumping piston 66. When the pressure in the chamber 62 reaches a predetermined limit which may be controlled by the setting of the spring 80, the air will act through pipe 76, bellows 81, and against the pressure of spring 80 to force the piston 77 to close the passage 78 of the pipe 79, thus cutting off the flow of air to the air pumping piston 66.

When, however, the pressure in the chamber 62 drops below a predetermined amount, the piston 77 will move away from its seat against passage 78, and air will move through the pipe 79, to be forced by the piston 66 into the chamber 62. We thus have at all times a predetermined amount of oil within the chamber 62 maintained under predetermined pressure and adapted for admittance into the door closer when permitted to do so by the electrically controlled piston 71. In the position of Fig. 1, the electrically controlled piston 71 is in a position to allow the flow of fluid through the pipe 52 into the door closer.

When, however, the piston 71 is allowed to drop, as when the circuit is broken through the electro-magnetic relay 82, the grooved portion 83 of the piston 71 will move below the openings to pipes 70 and 52, so as to shut off the admission of fluid under pressure to the closer. When this is done, the closer will be allowed to move the door to closed position through the action of door closer spring 22, as has already been described. The purpose of pipe 84 from the housing 71a of piston 71 is to permit the bleeding of the said valve housing 71a, as will be apparent to those skilled in the art.

It is now apparent that the door 10 is moved to open position whenever the electro-magnetic relay 82 is energized to move the piston 71 to its position of Fig. 1. It is further apparent that the de-energization of the electro-magnetic relay 82 will allow the piston 71 to drop so as to permit the door closer to close the door.

It is now necessary to describe the means whereby the circuit through the electro-magnetic

relay 82 is closed and opened. We shall describe such means briefly, since the means shown by us in this application are not our joint invention. Our invention contemplates the energization and de-energization of the electro-magnetic relay 82 by many means that are well known in this art, and which are employed for the particular purpose. For example, we have in mind such means as are shown in the patents to Fitzgerald, No. 1,972,682, and Crago, No. 1,929,273.

Referring now to Figs. 1 and 12, the alternating current from its source at 72 enters transformer 73, from which it issues as low voltage. A light source 85 receives this low voltage current and illuminates, through suitable lenses 86 and 87, a photo voltaic cell 88 which, so long as the light shines thereon, generates current which maintains energized the relay 89, maintaining the armature 90 away from contact 91 against the force of spring 92. It will be obvious that when a person approaching door 10 intercepts the light beam from source 85, the photo voltaic cell 88 will fail to generate electric current, and the spring 92 will move the armature 90 to close the circuit at 90, 91. This will, through means to be described presently, cause the energization of the armature 82, and the consequent opening of the door 10.

A dry disk copper oxide rectifier 93 is shown diagrammatically in Fig. 1, and is connected to the low voltage side of the alternating current transformer 73. Upon the closing of the contacts of the circuit of 90, 91, current will flow from the conductor 94, through the resistor 95 and relay 96 as one path, and through the resistor 95a into condenser 97 as another path, back to the rectifier 93 through the conductor 98. It will be appreciated that the function of condenser 97, which is in a circuit parallel to the circuit through contacts 91, 92, is to prevent any arcing at 90, 91 when the circuit there is broken.

The closing of the circuit through relay 96 moves the armature 99 into a position to close a circuit at 100 through relay 101, which relay receives its current direct from the high tension A. C. supply 72, through conductors 102 and 103. The closing of the circuit through the relay 101 causes the armature 104 to close a circuit 105 through the relay 82, which moves the valve 71 into position so that the door may be opened.

It will be appreciated that as soon as the person who has intercepted the beam between the source of light 85 and the photo voltaic cell 88 passes beyond a certain point, the relay 89 will be re-energized, and the circuit will be broken at 90, 91. Unless some means were provided, this would cause the breaking of the circuits at 99, 100, 104, 105, the de-energization of the electro-magnetic relay 82, and the immediate closing of the door. This operation would be undesirable because the door would close too swiftly under ordinary conditions. Some time period must be allowed for a person to intercept the light beam, and then pass through the open door.

It is the purpose of our condenser 97 and the resistors 95 and 95a to prolong the period during which the relay 96 will be energized after the relay 89 becomes re-energized due to the reestablishment of the light beam. It will be understood that at the time the circuit is broken at 90, 91, there will be a charge on the condenser 97. This charge 97 will pass through the resistor 95, the relay and conductor 96a, conductor 98, and back to the rectifier 93, so long as the charge on the

condenser 97 remains. By adjusting the resistor 95, the flow of current is controlled.

The purpose of the additional resistor 95a is to assist in the control of the time period during which the electric charge on condenser 97 will be dissipated. Thus, if the resistor 95a is set so that the resistance therethrough is quite low, the current will be short circuited around relay 96 to the conductor 98. On the other hand, if the resistance through conductor 95a is set relatively high, then the major portion of the current charge on condenser 97 will flow through the relay 96 to conductor 98. By adjusting the two resistors 95 and 95a, the time interval during which effective current will flow through the relay 96 may be definitely prolonged to a predetermined period.

Because of this construction, even though the person who has shut off the light beam has passed beyond the light beam, the electro-magnetic relay 96 will still remain energized, functioning through contacts 99, 100, relay 101, contacts 104, and 105, to maintain the electro-magnetic relay 82 energized for a predetermined period. This will maintain the door open until the person who originally intercepted the light beam has passed therethrough.

In the modification just described, pressure is applied to the door closer for utilizing it as a door opener, from a constant source of pressure, a valve governing the flow of fluid under pressure from the pressure source to the door closer. We shall now describe a modification of our invention in which the same door closer is used as previously described, also the same electrical control. However, instead of having the door closer fluid constantly under pressure and available for application, we utilize quick acting power means for generating pressure for the interval that the door is to be opened and kept open. The fluid pressure source to which we allude is shown best in Figs. 7, 8 and 10, while a modification thereof is shown in Figs. 17, 18 and 19.

Referring now first to Figs. 7, 8 and 10, it will be noted that the arrangement of the door and the door closer, and the electric control circuit is exactly like that of Figs. 1 and 12. The control relay 101 in the alternating current circuit, is, however, adapted to close the circuit of an electric motor 110, rather than the circuit of a valve controlling relay 82, as is the case in the modification of Figs. 1 and 12. The motor 110, as is best seen from Fig. 8, drives a pump shaft 111 for actuating a standard form of pump 112 to pump liquid under pressure from the storage chamber 113 through pipe 114 to the door closer 18, for actuating that closer in the same manner as is actuated the closer of Figs. 1-6, inclusive, the closer being the same in construction. The pipe 115 running from the closer back to the pump, is the same as the pipe 39 of the modification of Figs. 1-12.

It will now be well to describe one complete operation of the invention of Figs. 7 and 8 before proceeding further. When a person intercepts the light beam between light source 85 and photo voltaic cell 88, the photo voltaic cell ceases to generate an electric current, and the relay 89 is de-energized at once. This allows the spring 92 to move armature 90 into a position to close a circuit with contact 91. The circuit so closed is from the dry disk rectifier 93 through conductor 94, contacts 90, 91, thence through the resistor 95, relay 96, conductors 96a and 98 to the other side of the rectifier 93. A branch of the current will flow from the rectifier 93 through

the parallel circuit including the condenser 97, and back to the rectifier through the common conductor 98.

Energization of the relay 96 will pull the armature 99 into engagement with contact 100, so as to close a circuit through relay 101, as follows: From the A. C. source 72 through conductors 102, relay 101, contacts 99, 100 and conductor 103, back to the A. C. source. The excitation of relay 101 will close the circuit at 104, 105 through the electric motor 110, as is obvious. The motor 110 will immediately force liquid under pressure through pipe 114 to the door closer, and against piston 23 of the door closer, thus forcing the door open.

As soon as the person who has intercepted the light beam from the voltaic cell 88 passes beyond the light beam, the voltaic cell once again generates electric current and energizes the relay 89. This opens the circuit at 90, 91 and stops the flow of electricity from the rectifier 93 through the relay 96. However, the condenser 97 has been charged, and will send current through the relay 96, through the resistor 95, as is quite obvious. The resistor 95a, if set to a very high resistance, will compel most of the current to flow through the relay 96, and will prolong the duration of the period after the re-establishment of the light beam, during which period relays 96, 101, and therefore the motor 110, remain energized. If the resistor 95a is set to a very small resistance, the electric charge of the condenser 97 will be short circuited relatively to the relay 96, and the relay will be de-energized only a very short interval after the re-establishment of the light beam.

When finally the charge on the condenser 97 is consumed, the relay 96 will be de-energized and the circuit at 99, 100 will be broken, de-energizing the relay 101, thus opening the circuit 104, 105, de-energizing the motor 110. Pressure in the door closer 18 against piston 23 will drop, and the spring 22 will close the door in a manner previously described.

In Fig. 10, we show a pressure generating apparatus operating along the same lines as that of Fig. 8, and usable in the combination of Fig. 7. We should now like to describe the construction of Fig. 10.

In Fig. 10, there is shown a storage chamber 116 in which is mounted a pump 117 having a driving shaft 118, which is driven by a motor such as motor 110 of the modification of Figs. 7 and 8. The pump when driven accepts fluid through its intake pipe 119, and moves it outwardly under pressure through its port 120. The liquid under pressure moves from the port 120 upwardly through the pipe 121 to the pipe 114 which leads to the door closer, this pipe 114 being the same one as illustrated in Figs. 7 and 8.

The fluid under pressure is also forced through a nipple 122 into a pressure control valve 123. This pressure control valve 123 has a central bore 124 in which is housed a piston 125, which is maintained in a downward position, in which it obstructs the flow of fluid from the nipple 122 by means of a spring 126 which is adjustable to vary the pressure thereof by a bolt 127, in a manner which is quite obvious.

So long as the pressure generated by the pump 117 is lower than is necessary to lift the piston 125 against the pressure of spring 126, all of the fluid pumped will move upwardly through pipe 121 to pipe 114, to the door closer. Should the pressure generated by the pump rise to a point

sufficient to overcome the force of the spring 126, the piston 125 will be raised, exposing a series of transverse passages 128, best shown in Fig. 11. Pressure will be dissipated through the transverse passages 128 to an extent sufficient to bring the pressure down to the desired level to which the spring 126 has been set. For determining the pressures, there is connected to the pipe 115 a further extension 129 to which may be attached a gauge, as will be quite clear to those skilled in the art.

For simplicity, the pipe 115 of Fig. 8 is not shown in Figs. 10 and 11, but such a pipe will naturally be installed. It should now be quite clear that the construction of Fig. 10 will be effective to force fluid under a predetermined pressure into the door closer, and that this predetermined pressure may be readily changed.

In some places where installation of our door operator is desired, there will be available water under pressure. We have therefore devised a water pressure operated mechanism for generating oil pressure for operating our door opening mechanism, this mechanism being of a construction which will operate quite satisfactorily where the source of water pressure is merely the usual domestic water faucet. Referring to Figs. 17, 18 and 19, we shall describe this modification of our invention.

On a base 130, there is supported a cylinder 131 on which is placed a second cylinder 132 having a series of ears 134. Ears 135 corresponding to ears 134 are formed on the base 130. Rods 136 pass through the ears 134 and 135 and are threaded for upper and lower nuts 137, 138, thereby holding the cylinders 131 and 132 assembled to base 130. The base 130 is then secured to a suitable main base through a series of lugs 139 shaped as is shown in Figs. 18 and 19.

The upper end of the cylinder 132 is screw threaded at 140 so that there may be mounted thereon a cap 141 defining a storage chamber 143a. Cylinder 132 has a series of four passages 142 formed as illustrated, and each plugged at 143 and 144. Ball valves 145 are dropped into obstructing relation to a series of lower passages 146, for a purpose to be described presently. A nipple 147 is screw threaded into the upper portion of cap 141, this nipple leading to the low pressure side of the door closer through pipe 115, which is the same pipe as shown in Figs. 7 and 8.

Both the cap 141 and the upper surface of the cylinder 132 are drilled for a further nipple 148, which connects to the pipe 114, this leading to the pressure side of the door closer 18, as in Fig. 7. A double piston 149 is mounted so that its upper piston 150 operates in the chamber 151 of the cylinder 132, while its lower piston 152 operates in the internal cylinder 153 of the cylinder 131. A spring 154 is connected at one end to the piston 150, and at its other end to the base 130, so as to urge the double piston 149 into its position of Fig. 17, and with the face of the piston 152 against the base 130.

The base 130 is cut away at 155, the portion 155 connecting through passage 156 with a bore 157 in the base. In this bore 157 there is maintained a stationary sleeve 158. This sleeve is slotted as at 159 at points spaced 180° on its periphery, and opposite a counterbore 160 formed in the bore 157. It has a second pair of slots 161 also spaced 180° on its periphery, and corresponding to a second counterbore 162 formed in the bore 157.

A sleeve valve 163 is mounted for rotation within the sleeve 158. This sleeve valve has a pair of slots 164 which are adapted to be aligned in one position of the sleeve, opposite the slots 159 in sleeve 158. A second pair of slots 165 are formed in our sleeve valve 163 for cooperation with the slots 161 of sleeve 158. The orientation of the slots 165 relatively to the slots 164 is such, that when the sleeve valve is in one rotated position; that is, the position of Fig. 17, the slots 164 will be aligned with the slots 159, so that there will be a through passage from the counterbore 160 through the central chamber of the valve 163, through passage 156, and the cut away portion 155. In a second rotated position of the valve 163, the slots 164 will move to close off the passage through slots 159 in the stationary sleeve, and the slots 165 will be aligned with the slots 161 of the stationary sleeve, and with the counterbore 162 so that there will be communication between the counterbore 162 through the sleeve valve 163, passage 156, and cut away portion 155.

Leading into the counterbore 160 is a passage 167 connected to a water pressure nipple 166, so that when the sleeve valve is positioned as in Fig. 17, water under pressure is admitted against piston 152 of the double piston 149 to force that piston upwardly. A second nipple 168 is connected through passage 169 to the second counterbore 162 in the base 130. The nipple 168 leads to the low pressure or exhaust side of the water pressure system, so that when the sleeve valve 163 is rotated from its position of Fig. 17 to a position wherein the slots 165 are aligned with slots 161 and counterbore 162, the water pressure will be allowed to exhaust from the system and the double piston 149 will drop.

It is best now to indicate that the arrangement of the slots 164 and 165 is such that slots 164 will shut off the water pressure just in advance of the positioning of slots 165 to permit the exhaust of the water under pressure. For rotating the sleeve valve 163, we utilize a rod 169 formed integral with sleeve 163 and passing through a packing member 170, and connected to a lever 171, which in turn is pivoted to the armature 172 of an electromagnet 173. The electromagnet 173 functions just exactly as does the electromagnet 82 of Fig. 1; that is, when it is energized, it forces the sleeve valve 163 into a position wherein water pressure will be applied to move the double piston 149 upwardly under the pressure of the water; whereas when the said relay is de-energized, it allows the spring 174 to move the valve to a position allowing the exhaust of the water under pressure, all of which will be quite clear.

The cylindrical chamber 151 of the cylinder 132 is maintained filled with oil, and the reservoir 143a defined by the cap 141 is maintained filled with oil of the type used in door closers, the filler cap 175 being adapted for removal so that oil may be added whenever necessary. Since the oil level in the reservoir 143a defined by the cap 141 is maintained always higher than the surface 176 of the cylinder 151, should there be some loss of oil during the operation of my mechanism, the flow from the reservoir, in a manner to be described presently, will serve to make up this loss.

When the double piston 149 is forced upwardly through the action of relay 173, the piston portion 150 will naturally force oil through the nipple 148, through the high pressure pipe 114 into the door closer of Figs. 2 and 4, as has already

been described, causing the door to open. The ball valves 145 are of course seated at this time to prevent any flow of oil under pressure through the passages 146. Oil will flow from the door closer as previously described through pipe 115, and into the storage chamber 143a.

When the relay 173 is de-energized and water pressure on the piston portion 152 of the double piston 149 is relieved, the door closer spring 22 will function to close the door. It will of course be assisted by spring 154. There being no pressure in the cylinder 151, the ball valves 145 will unseat, and oil will flow upwardly through the passages 146 into the cylinder 151 in sufficient quantity to fully fill that cylinder so as to condition it for the next operation of the double piston 149. It will be well to indicate at this time that the pipe 154a and passage 154b leading to counterbore 160 are merely to permit escape of air trapped by the double piston 149. We believe that the operation of this portion of our invention will now appear quite clear to those skilled in the art.

It will be recalled at this time that the door closer of Figs. 2 and 4 has a novel valve head 26, which has been substituted therein for the standard commercial valve head 27, such as is shown in the door closer of Fig. 9. A further modification of our invention dispenses with the valve head 26, and utilizes the commercial door closer shown in Fig. 9 together with a source of adequate pressure, such as that of Fig. 10. For the purposes of our invention, it may be considered that the head 27 of the door closer of Fig. 9 is drilled and tapped for a nipple connection 114a, whereby to connect the door closer with the pressure pipe 114 of the pump of Fig. 10. The lower portion of chamber 32 is drilled and tapped for a nipple 115a, whereby fluid forced into the door closer may be exhausted and allowed to drain into the storage chamber 116 through a suitable connection which is not shown in Fig. 10.

When pressure is applied to the piston head 23 through the pipes 114 and 114a by the energization of the motor which drives the pump 117 of Fig. 10, the piston 23 will be forced to the left in a direction to actuate the pinion 24, carried by shaft 17, through its rack 25, thus reversing the normal operation of the door closer 18 and forcing the opening of the door.

The pressure generated by the pump must, however, be of a sufficient degree so that pressure will be maintained against piston 23 while oil under pressure is first dissipated through passage 33, and past valve stem 30, and later is dissipated through passage 28 and past the end of the valve stem 30. The oil so dissipated runs through the exhaust pipe 115a and back to the storage tank 116. We have found that by using a pressure of 125 pounds per square inch, together with a standard closer such as manufactured by the Norton Door Closer Company, we are able to obtain the action desired, and a full, complete and efficient opening of a door through the forcing back of the piston 23, despite the dissipation of the pressure through the regular valve mechanism of the closer. Naturally, the door closer 18 will, when pressure is not applied thereto, and when the door to which it is applied is manually operated, function in the normal manner of a door closer.

It will be noted in Fig. 9 that the valve stem 29 at the left end of this closer is in position to control the speed of the flow of fluid through the passages 28 and 33. By substantially closing

flow through passage 33, the final opening movement of the mechanism is snubbed or checked, contributing a very desirable result, as will be appreciated.

In Figs. 13 to 16, we show various applications of our door openers. In Fig. 13, the door closer 18 moves the door 10 in the direction of the arrow 10a. In Fig. 14, the door closer 18 moves the door 10 in the direction of the arrow 10b. In Fig. 15, we show a pair of doors operated by a single closer 18. Each door carries a link 180, the corresponding ends of the links 180 being connected by a bar 181. When the door closer operates to move its arms in the direction of the arrow 18a, the links 180 and common link 181 will move to the dotted line position of Fig. 15, and each of the doors 10 will be opened to their dotted line positions, as shown. In Fig. 16, we show a second pair of doors 10 operated by a door closer 18 through a common link 182, and individual links 183 and 184, all as will be readily understood by those skilled in the art.

We now claim:

1. In a combination of the class described, a door closer having a door closing spring, a fluid pressure chamber, a piston movable in said chamber, means movable upon manual opening movement of the door to wind said spring and move said piston from the high pressure end of said fluid pressure chamber toward the low pressure end thereof, the said spring thereafter closing said door as said piston moves towards the high pressure end of said fluid pressure chamber, fluid passage means between the low pressure end of said chamber and the high pressure end thereof constructed so that as said piston moves toward the low pressure end fluid will flow freely from said low pressure end to said high pressure end, a control valve positioned in a passage of said fluid passage means for slowing down the flow of fluid from the high pressure end of said chamber to the low pressure end to control the piston movement incidental to the closing action of said door closer, a source of fluid pressure, a pipe connecting the pressure side of said source to the high pressure end of said chamber, a pipe connecting the intake side of said source to the low pressure end of said chamber, means initiating the application of fluid under pressure from said source to the high pressure end of said chamber and against said piston to reverse the action of said door closer by forcing said piston toward the low pressure end of said chamber, the fluid from the low pressure end of said chamber passing through said pipe towards the intake side of said source, the stoppage of fluid application from said source allowing the door closer spring to close the door, whereupon the piston forces the fluid from the high pressure end of said chamber to the low pressure end through said fluid passage means in by-passing relation to said source and past the said control valve, whereby to control the door closing speed in the same manner as when the door is manually opened and subsequently released for closing.

2. In a combination of the class described, a door closer having a door closing spring, a fluid pressure chamber, a piston movable in said chamber, means movable upon manual opening movement of the door to wind said spring and move said piston from the high pressure end of said fluid pressure chamber toward the low pressure end thereof, the said spring thereafter closing said door as said piston moves towards the high

pressure end of said fluid pressure chamber, fluid passage means between the low pressure end of said chamber and the high pressure end thereof constructed so that as said piston moves towards the low pressure end fluid will flow freely from said low pressure end to said high pressure end, a control valve positioned in a passage of said fluid passage means for slowing down the flow of fluid from the high pressure end of said chamber to the low pressure end to control the piston movement incidental to the closing action of said door closer, a source of fluid pressure, a pipe connecting the pressure side of said source to the high pressure end of said chamber, a pipe connecting the intake side of said source to the low pressure end of said chamber, means initiating the application of fluid under pressure from said source to the high pressure end of said chamber and against said piston to reverse the action of said door closer by forcing said piston toward the low pressure end of said chamber against the pressure of the door closer spring, while allowing dissipation of fluid through said control valve to the low pressure end of said chamber, the fluid from the low pressure end of said chamber passing through said pipe towards the intake side of said source, the stoppage of fluid application from said source allowing the door closer spring to close the door, whereupon the piston forces the fluid from the high pressure end of said chamber to the low pressure end through said fluid passage means in bypassing relation to said source and past the said control valve, whereby to control the door closing speed in the same manner as when the door is manually opened and subsequently released for closing.

3. In a combination of the class described, a door closer having a door closing spring, a fluid pressure chamber, a piston movable in said chamber, means in engagement with said piston and spring and movable upon manual opening movement of the door to wind said spring and move said piston from the high pressure end of said fluid pressure chamber toward the low pressure end thereof, the said spring thereafter closing said door as said piston moves towards the high pressure end of said fluid pressure chamber, fluid passage means between the low pressure end of said chamber and the high pressure end thereof constructed so that as said piston moves towards the low pressure end fluid will flow freely from said low pressure end to said high pressure end, a control valve positioned in a passage of said fluid passage means for slowing down the flow of fluid from the high pressure end of said chamber to the low pressure end to control the piston movement incidental to the closing action of said door closer, a source of fluid pressure, a pipe connecting the pressure side of said source to the high pressure end of said chamber, a pipe connecting the intake side of said source to the low pressure end of said chamber, means initiating the application of fluid under pressure from said source to the high pressure end of said chamber and against said piston to reverse the action of said door closer by forcing said piston toward the low pressure end of said chamber, means for stopping the flow of fluid past said control valve during the application of said fluid under pressure against said piston, whereby to prevent dissipation of said fluid under pressure through said valve, the fluid from the low pressure end of said chamber passing through said pipe towards the intake side of said source, the stoppage of fluid application from said source allowing

the door closer spring to close the door, whereupon the piston forces the fluid from the high pressure end of said chamber to the low pressure end and through said fluid passage means in bypassing relation to said source and past the said control valve, whereby to control the door closing speed in the same manner as when the door is manually opened and subsequently released for closing.

4. In a combination of the class described, a door closer having a door closing spring, a fluid pressure chamber, a piston movable in said chamber, means in engagement with said piston and spring and movable upon manual opening movement of the door to wind said spring and move said piston from the high pressure end of said fluid pressure chamber toward the low pressure end thereof, the said spring thereafter closing said door as said piston moves towards the high pressure end of said fluid pressure chamber, fluid passage means between the low pressure end of said chamber and the high pressure end thereof constructed so that as said piston moves towards the low pressure end fluid will flow freely from said low pressure end to said high pressure end, a control valve positioned in a passage of said fluid passage means for slowing down the flow of fluid from the high pressure end of said chamber to the low pressure end to control the piston movement incidental to the closing action of said door closer, a source of fluid pressure, a pipe connecting the pressure side of said source to the high pressure end of said chamber, a pipe connecting the intake side of said source to the low pressure end of said chamber, means initiating the application of fluid under pressure from said source to the high pressure end of said chamber and against said piston to reverse the action of said door closer by forcing said piston toward the low pressure end of said chamber, a pressure actuated device actuated by the application of said fluid for shutting off the flow of fluid past said control valve during the application of said fluid under pressure against said piston, whereby to prevent the dissipation of said fluid under pressure through said valve, the fluid from the low pressure end of said chamber passing through said pipe towards the intake side of said source, the stoppage of fluid application from said source allowing the door closer spring to close the door as said pressure actuated device moves to allow once again the flow of fluid past said control valve, whereupon the piston forces the fluid from the high pressure end of said chamber to the low pressure end through said fluid passage means in by-passing relation to said source and past the said control valve, whereby to control the door closing speed in the same manner as when the door is manually opened and subsequently released for closing.

5. In a combination of the class described, a door closer casing, a fluid pressure chamber formed in said casing, a piston movable in said chamber, a door closing spring, means movable upon opening movement of the door to wind said spring and move said piston from the high pressure end of said fluid pressure chamber toward the low pressure end, the said spring thereafter closing said door as said piston moves towards the high pressure end of said fluid pressure chamber, a fluid passage in said casing between the high pressure end of said chamber and the low pressure end thereof, a control valve in said fluid passage for slowing down the flow of fluid from the high pressure end of said chamber to

the low pressure end to control the piston movement incidental to the closing action of said door closer, means whereby as said piston moves from the high pressure end of said chamber towards the low pressure end thereof fluid will flow freely from said low pressure end to said high pressure end to allow displacement of said piston and easy manual opening of the door, a source of fluid pressure displaced from said casing, a pipe connecting the pressure side of said source to the high pressure end of said chamber, a pipe connecting the intake side of said source to the low pressure end of said chamber, means initiating the application of fluid under pressure from said source to the high pressure end of said chamber and against said piston to reverse the action of said door closer by forcing said piston toward the low pressure end of said chamber, the fluid from the low pressure end of said chamber passing through said pipe towards the intake side of said source to allow displacement of said piston, the stoppage of fluid application from said source allowing the door closer spring to close the door, whereupon the piston forces the fluid to flow through the fluid passage in said casing from the high pressure end of said chamber to the low pressure end in by-passing relation to said source and past the said control valve, whereby to control the door closing speed in the same manner as when the door is manually opened and subsequently released for closing.

6. In a combination of the class described, a door closer casing, a fluid pressure chamber formed in said casing, a piston movable in said chamber, a door closing spring, means movable upon opening movement of the door to wind said spring and move said piston from the high pressure end of said fluid pressure chamber toward the low pressure end, the said spring thereafter closing said door as said piston moves towards the high pressure end of said fluid pressure chamber, a fluid passage in said casing between the high pressure end of said chamber and the low pressure end thereof, a control valve in said fluid passage for slowing down the flow of fluid from the high pressure end of said chamber to the low pressure end to control the piston movement incidental to the closing action of said door closer, means whereby as said piston moves from the high pressure end of said chamber towards the low pressure end thereof fluid will flow freely from said low pressure end to said high pressure end to allow displacement of said piston and easy manual opening of the door, a source of fluid pressure displaced from said casing, a pipe connecting the pressure side of said source to the high pressure end of said chamber, a pipe connecting the intake side of said source to the low pressure end of said chamber, means initiating the application of fluid under pressure from said source to the high pressure end of said chamber and against said piston to reverse the action of said door closer by forcing said piston toward the low pressure end of said chamber, a pressure actuated device actuated by the application of said fluid for shutting off the flow of fluid past said control valve during the application of said fluid under pressure against said piston, whereby to prevent dissipation of said fluid under pressure through said valve, the fluid from the low pressure end of said chamber passing through said pipe towards the intake of said source to allow displacement of said piston, the stoppage of fluid application from said source

allowing the door closer spring to close the door as said pressure actuated device moves to allow once again the flow of fluid past said control valve, whereupon the piston forces the fluid to flow through the fluid passage in said casing from the high pressure end of said chamber to the low pressure end in by-passing relation to said source and past the said control valve whereby to control the door closing speed in the same manner as when the door is manually opened and subsequently released for closing.

7. In a combination of the class described, a door closer casing, a fluid pressure chamber formed in said casing, a piston movable in said chamber, a door closing spring, means movable on opening movement of the door to wind said spring and move said piston from the high pressure end of said fluid pressure chamber toward the low pressure end, the said spring thereafter closing said door as said piston moves towards the high pressure end of said fluid pressure chamber, a check valve passage in said piston allowing free flow of fluid from the low pressure side of the piston to the high pressure side thereof whereby to facilitate movement of said piston as the door is manually opened, a fluid passage between the high pressure end of said chamber and the low pressure end thereof, a control valve in said fluid passage for slowing down the flow of fluid from the high pressure end of said chamber to the low pressure end to control the piston movement incidental to the closing action of said door closer, a source of fluid pressure, a pipe connecting the pressure side of said source to the high pressure end of said chamber, a pipe connecting the intake side of said source to the low pressure end of said chamber, means initiating the application of fluid under pressure from said source to the high pressure end of said chamber and against said piston to reverse the action of said door closer by forcing said piston toward the low pressure end of said chamber, the fluid from the low pressure end of said chamber passing through said pipe towards the intake side of said source, the stoppage of fluid application from said source allowing the door closer spring to close the door, whereupon the piston forces the fluid to flow through the fluid passage from the high pressure end of said chamber to the low pressure end in by-passing relation to said source and past the said control valve, whereby to control the door closing speed in the same manner as when the door is manually opened and subsequently closed.

8. In a combination of the class described, a door closer casing, a fluid pressure chamber formed in said casing, a piston movable in said chamber, a door closing spring, means movable on opening movement of the door to wind said spring and move said piston from the high pressure end of said fluid pressure chamber toward the low pressure end, the said spring thereafter closing said door as said piston moves towards the high pressure end of said fluid pressure chamber, a check valve passage in said piston allowing free flow of fluid from the low pressure side of the piston to the high pressure side thereof whereby to facilitate movement of said piston as the door is manually opened, a fluid passage between the high pressure end of said chamber and the low pressure end thereof, a control valve in said fluid passage for slowing down the flow of fluid from the high pressure end of said chamber to the low pressure end to control the piston movement incidental to the closing action of said

door closer, a source of fluid pressure, a pipe connecting the pressure side of said source to the high pressure end of said chamber, a pipe connecting the intake side of said source to the low pressure end of said chamber, means initiating the application of fluid under pressure from said source to the high pressure end of said chamber and against said piston to reverse the action of said door closer by forcing said piston toward the low pressure end of said chamber, a pressure actuated device actuated by the application of said fluid for shutting off the flow of fluid past said control valve during the application of fluid under pressure against said piston, whereby to prevent dissipation of said fluid under pressure through said valve, the fluid from the low pressure end of said chamber passing through said pipe towards the intake of said source, the stoppage of fluid application from said source allowing the door closer spring to close the door as said pressure actuated device moves to allow once again the flow of fluid past said control valve, whereupon the piston forces the fluid to flow through the fluid passage from the high pressure end of said chamber to the low pressure end in bypassing relation to said source and past the said control valve, whereby to control the door closing speed in the same manner as when the door is manually opened and subsequently closed.

9. In a combination of the class described, a door operator comprising a cylinder, a piston movable in said cylinder, a source of fluid pressure, a pipe connecting the pressure end of said cylinder with the pressure side of said source, a pipe connecting the low pressure end of said cylinder with said source, means whereby said piston opens a door when moved from the high pressure end of said cylinder towards the low pressure end thereof, means for initiating the application of fluid under pressure from said source to the high pressure end of the cylinder whereby to move the piston to open the door, means for moving the door to closed position upon the stoppage of application of fluid under pressure, whereupon the closing of the door is controlled by the speed with which said fluid is forced from the high pressure end of the cylinder by said piston, a valved passage leading from the high pressure end of said cylinder toward the low pressure end of the cylinder in bypassing relation to said source of fluid pressure and through which said fluid is forced by said piston as said door closes, means for shutting off said valved passage when fluid under pressure is applied to the high pressure end of said cylinder, and a check valve in said piston also closed by the application of fluid pressure to the high pressure end of said cylinder operable to allow free flow of fluid therethrough as when the door is opened manually without the application of said fluid under pressure.

10. In a combination of the class described, a door operator comprising a cylinder, a piston movable in said cylinder, a source of fluid pressure, a pipe connecting the pressure end of said cylinder with the pressure side of said source, a pipe connecting the low pressure end of said cylinder with said source, means whereby said piston opens a door when moved from the high pressure end of said cylinder towards the low pressure end thereof, means for initiating the application of fluid under pressure from said source to the high pressure end of said cylinder whereby to move the piston to open the door, means for moving the door to closed position upon the stop-

page of application of fluid under pressure, whereupon the closing of the door is controlled by the speed with which said fluid is forced from the high pressure end of said cylinder by said piston, a valved passage leading from the high pressure end of said cylinder toward the low pressure end of the cylinder in by-passing relation to said source of fluid pressure and through which said fluid is forced by said piston as said door closes, and means whereby the application of fluid under pressure from said source to the high pressure end of said cylinder shuts off said valved passage

11. In a combination of the class described, a door operator comprising a cylinder, a piston movable in said cylinder, a source of fluid pressure, a pipe connecting the pressure end of said cylinder with the pressure side of said source, a pipe connecting the low pressure end of said cylinder with said source, means whereby said piston opens a door when moved from the high pressure end of said cylinder towards the low pressure end thereof, means for initiating the application of fluid under pressure from said source to the high pressure end of the cylinder whereby to move the piston to open the door, means for moving the door to closed position upon the stoppage of application of fluid under pressure, whereupon the closing of the door is controlled by the speed with which said fluid is forced from the high pressure end of the cylinder by said piston, a valved passage leading from the high pressure end of said cylinder toward the low pressure end of the cylinder in by-passing relation to said source of fluid pressure and through which said fluid is forced by said piston as said door closes, and a check valve in said piston allowing free flow of fluid therethrough from the low pressure side thereof to the high pressure side whereby to facilitate manual opening of the door.

12. In a combination of the class described, a door operator comprising a cylinder, a piston movable in said cylinder, a source of fluid pressure, a pipe connecting the pressure end of said cylinder with the pressure side of said source, a pipe connecting the low pressure end of said cylinder with said source, means whereby said piston opens a door when moved from the high pressure end of said cylinder towards the low pressure end thereof, means for initiating the application of fluid under pressure from said

source to the high pressure end of the cylinder whereby to move the piston to open the door, means for moving the door to closed position upon the stoppage of application of fluid under pressure, whereupon the closing of the door is controlled by the speed with which said fluid is forced from the high pressure end of the cylinder by said piston, a valved passage leading from the high pressure end of said cylinder toward the low pressure end of the cylinder in by-passing relation to said source of fluid pressure and through which said fluid is forced by said piston as said door closes, and a check valve in said piston allowing free flow of fluid therethrough from the low pressure side thereof to the high pressure side whereby to facilitate manual opening of the door, said check valve closing upon application of fluid pressure against the end of said piston as when the door is thereafter moved to closed position and when fluid from said pressure source is applied thereagainst.

13. In a combination of the class described, a door closer having a door closing spring, a fluid pressure chamber, a piston movable in said chamber, means in engagement with said piston and spring and movable upon manual opening movement of the door to wind said spring and move said piston from the high pressure end of said fluid pressure chamber toward the low pressure end thereof, the said spring thereafter closing said door as said piston moves towards the high pressure end of said fluid pressure chamber, a fluid passage leading from the high pressure end of said chamber to the other end thereof, a control valve in said passage whereby to slow down the action of the door closing spring, a source of fluid pressure, a pipe between said source of fluid pressure and the high pressure end of said fluid pressure chamber, means whereby the application of fluid pressure to said chamber through said pipe shuts said fluid passage while said fluid pressure moves said piston to reverse the operation of said door closer whereby to open the door to which said closer is applied, the stoppage of application of fluid from said fluid pressure source opening said fluid passage and allowing the piston to force the fluid through said passage and control valve in by-passing relation to said fluid pressure source as the door closing spring closes said door.

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