SAFETY MEANS FOR MOTORS
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My invention relates to expansible chamber motors, and more particularly to expansible chamber motors of a type especially adapted for pumping and similar uses. From one aspect, my invention relates to protective devices for such motors.

There is available in some oil fields a substantial quantity of oil in wells whose subterranean pressure is inadequate to cause the oil to flow naturally. Pumping motors therefore have to be used for the purpose of raising the fluid to ground level. Expansible chamber, single-acting pumping motors have been found very satisfactory for this purpose, their pistons operating, through suitable pump rod lines, pumps arranged in the oil wells. Such pumping motors are frequently arranged in groups near a central source of operating pressure fluid supply, and individual pumps are not generally attended by runners.

Accordingly, it is quite important that the pumping motors be made as nearly completely automatic and self-protecting as possible.

The pump rod lines by which such pumping motors are connected with the pumps in the wells are often some thousands of feet in length. The described method of pumping makes the pump rod lines last much longer than where they are operated, for example, by a walking beam, but pump rod failures do occur at times, and when such a failure occurs it is important to minimize the damage. If the motor piston is allowed to accelerate throughout the remainder of its working stroke, unchecked by the normal weight of its load, and then suddenly brought to rest, it is possible for serious damage to occur to the portion of the pump rods which remain connected to the pump piston, and also to the motor, and accordingly it is desirable to cushion the upward stroke of the pumping motor piston as soon as possible after the breakage occurs. It is also important that the pump motor piston shall not be retarded in its normal working cycle, but that the increase in cushioning, which is the mode of protection upon which I particularly rely, take place automatically when the pump motor piston travels at an excessively high rate. While it is possible to arrange my device in any desired relation to the cycle of the pumping motor, provided there will be time for adequate cushioning before the end of the stroke, following a rupture of the pump rod line, the fact that there is perhaps a greater stressing of the rods during the earlier portions of the working strokes of the motor makes it possible to provide for the automatic control primarily during the early portions of the pumping strokes and still provide a very reasonable range of safety.

In a preferred embodiment of the invention, I associate with a pumping or similar motor means for by-passing pressure from the working side of the motor piston to the other side thereof, and control that bypassing means by means operating concurrently with the pumping motor piston and desirably under the control of the fluid distribution to the pump, such that excessive piston speeds will cause bypassing, whereas normal piston speeds will prevent bypassing. Desirably, this result is accomplished by regulating the rate of movement of a valve controlling a bypass so that the same will close the bypass, if the piston movement is normal, before the moving motor piston attains a position in which fluid would have access to the lower end of the bypass, said valve-closing means, however, being ineffective to effect valve closure before bypassing takes place if the piston speed is materially augmented above normal. Very desirably, the bypass control means may be operated so as to return the bypass controlling valve to its completely inoperative position should bypassing occur.

It is an object of my invention to provide an improved pumping or similar motor having improved protective devices associated therewith. It is another object of my invention to provide an improved pumping motor having an improved fluid-actuated protective device associated therewith. It is a further object of my invention to provide an improved pumping motor having an improved automatically controlled bypassing device associated therewith for checking the piston movement of said motor in the event that excessive piston speeds develop. It is still another object of my invention to provide an improved automatic bypass-controlling device for a pumping motor, or for similar purposes, in which a bypass-controlling valve traverses a working cycle as the pumping or other motor traverses its own cycle, certain portions of the control-device cycle being at a different rate from the corresponding portions of the motor cycle. Other objects and advantages of my invention will hereinafter more fully appear.

In the accompanying drawings, in which for purposes of illustration I have shown one embodiment which my invention may assume in practice—

Fig. 1 is a view, in side elevation, of a pumping motor equipped in accordance with the illustrative embodiment of the invention.

Fig. 2 is a developed section through the lower
end of the pumping motor cylinder and through the distributing valve thereafter.

Fig. 3 is a section approximately on the line 3—3 of Fig. 2, with parts shown in a different position.

Figs. 4, 5 and 6 are views, partially in section, through the pumping cylinder and the automatic bypass-controlling device associated therewith, showing respectively the position of the parts early in a normal pumping stroke, somewhat later in a normal pumping stroke, and at the substantially same time in a stroke where the piston moves with abnormal speed due to some such derangement as a broken pump rod line.

Referring to the drawings, and particularly to Fig. 1, it will be noted that a suitable support, of which a fragment is shown at 1, carries a motor, generally designated 3. Said motor may be of widely differing constructions, and herein there is shown, for illustration, a motor which is the invention of one Wade H. Wineman, and which forms a portion of the subject matter of his application Serial No. 102,387, filed September 28, 1938, and owned by my assignee. This motor includes an upper cylinder head member 4, a lower cylinder head and valve chest member 5, and an elongated cylinder member 6. The cylinder member 6 is herein made up of two parts, the lower one designated 6A, and the upper one designated 6B, the part 6A being more properly a motor cylinder and the part 6B essentially a dash-pot cylinder. A bore of uniform diameter, and designated 7, extends throughout the full length of the cylinder 6. A piston 8 is reciprocally within the bore 7 and has connected to it a piston rod 9 which is connected in any suitable manner through a pump rod line to a pumping motor arranged in a well. The piston 8 is single-acting, and pressure admitted beneath the same raises it, while its downward movements are caused by its own weight and that of the connected pump rod line and pump parts when a reduction in the pressure beneath the piston occurs. The downward movement of the piston is suitably retarded by providing a constant back-pressure of an appropriate amount against which the non-working strokes of the piston are made. Tie rods 10 connect the two cylinder heads 4 and 5 and clamp them to the opposite ends of the cylinder 6.

The lower cylinder head 5 supports the distribution means for the motor. A fluid supply space 13 has fluid supplied to it through a supply connection 14, as shown in Fig. 1. An exhaust space 15, which has an exhaust connection 16, as shown in Fig. 1, is adapted to receive the exhausting fluid from the pump motor cylinder and to deliver it against a back pressure, as above described. Operating fluid may desirably be supplied at a pressure of perhaps 200 or 300 pounds per square inch, the pressure depending, of course, upon the depth of the well, the size of the pump, and may have to be raised. The back pressure may advantageously be from fifty to a hundred pounds, depending also upon the operating conditions. The back pressure simply needs to be made high enough to control in a proper manner the downward movement of the motor cylinder, the oil in the connected parts, without being so high as unduly to retard the downward movement of these parts. A generally annular space 17, arranged between the spaces 13 and 15, is connected by a suitable port 18 to the lower end of the motor cylinder 1.

A septum 19 separates the supply space 13 from the cylinder connected space 17, while the exhaust space 15 is separated from the cylinder connected space 17 by another septum 20. A sleeve 21 provides a valve chamber and is mounted in vertical position in a series of bores of progressively decreasing size, numbered respectively 22, 23, 24, 25 and 26, and has shoulders, unmarked with reference characters, cooperating with the annular surfaces provided at the ends of certain of said stepped bores. A head 20 closes the bore 26 and has a reduced portion 29 fitting and closing the lower end of a bore 30 which extends for approximately the lower three-fourths of the length of the sleeve 21. A larger bore 31 communicates with the bore 30 at the upper end of the member 21. The bores 30 and 31 together form a valve chest 32. An upper head 33, held by a series of side rods 34, clamps the member 21 in position, while suitable screws 35 clamp the lower head 28 in position. It may be noted that the valve chest member 21 is not a close fit for the surrounding wall of the lower head member, and accordingly, since a passage 28* is provided in the lower head member 28 to connect the periphery of the reduced portion 29 thereof with the central upper face thereof, there is communication between the exhaust space 15 and the lower end of the bore 30, so that the lower end of said bore 30 is continuously under motor back pressure.

The sleeve member 21 is provided with radially extending ports 35 connecting the bore 30 with the space 13, while ports 37 connect the space 17 with the bore 30, and ports 38 connect the space 15 with the bore 30.

A valve 40, desirably constructed of aluminum or other light metal in order to speed up its movements and reduce the forces necessary to move it, is reciprocable in the bores 30, 31, and has a large head 41 fitting the bore 31 and two smaller heads 42 and 43, each fitting the bore 33. Suitable packing means 44 are provided for each head, and the upper and lower heads are separated from the middle head by annular grooves. The lower annular groove 45 is so arranged as to be capable of connection with the supply space 13 and with the exhaust space 15. The valve member 40 carries centrally thereof and at its upper end a spring pressed valve 45, which normally projects slightly above the top of the valve member and is normally held in its maximum degree of permitted projection by a spring 46. The strength of this spring is such as to maintain the valve 45 seated despite the action of fluid pressure upon its extremity, 55 when said valve is seated, but the spring yields, none the less, to prevent jamming of the parts as the valve member 40 moves upwardly against its seat. A stationary guide rod 48, and a bore 41 in the valve, prevent rotation of the valve 40 during its reciprocation. The upper end of the valve is provided with a small block of material, at 49, and this is adapted to engage the stem of a valve 50 carried within the upper head 33. The top of the valve chest 32 is connectible with the cylinder bore at two widely spaced points in the latter. A bushing 52, having a passage 53 therein, is arranged centrally on the valve of the piston 8 and its connected parts, without being so high as unduly to retard the downward movement of these parts. A generally annular space 17, arranged between the spaces 13 and 15, is connected by a suitable port 18 to the lower end of the motor cylinder 1.

A septum 19 separates the supply space 13 from
a seat #51 for the valve #52 when the valve #53 is in its upper position. Another connection leads from #27 at a point #54 thereon, so that the lower end of the #55 piston #56 passes above it only substantially as the valve #57 completes its desired upward travel. The point #58 is connected through suitable tubing arrangements, generally designated #59, with a space #58 above the ported check valve element #60 heretofore mentioned. When the ported valve has passages #61 therein which enable fluid to flow through said valve from end to end thereof when said valve is unseated. The valve #56 is unseated, of course, when the block #62 engages the valve stem #63, and a passage is then opened, through the annular space #64 surrounding the stem #1 and through the passages #65 and through the connection #66, between the chamber #31 and the cylinder bore.

The bore of the cylinder section #67 may desirably be vented to atmosphere through a mechanism including an automatic vent check device, generally designated #68. The structure of this device is shown in my assignee's pending application Serial No. 102,987, and it will suffice to say that this device permits breathing of the motor cylinder during normal motor operation with very little, if any, loss of fluid to the cylinder. When, however, air tends to be displaced from the motor cylinder at a rate in excess of a certain predetermined one, the vent check device closes all except a relatively small port between the top of the pump motor cylinder and the atmosphere, and accordingly the fluid is largely trapped within the top of the pump motor cylinder and a cushion pressure more quickly built up.

The mode of operation of the structure so far described will be clear. To trace a cycle through, assume that the distributing valve #69 is in the position shown in Fig. 2. In this position of the distributing valve, the piston #8 is still moving downwardly. In a short time, however, its upper end will pass below the point of connection #55, and the cylinder bore, and consequently, through the connection #54 and through the upper end of the cylinder, the cylinder pressure which is acting, in the position of Fig. 2, on the upper end of the piston portion #41 and holding the valve in the lower position in which it is shown, will be vented to the atmosphere; and accordingly the constant pressure acting on the lower end of the piston portion #42 will move the distributing valve up to the position shown in Fig. 3. The pressure previously acting on #41 in Fig. 2 was, of course, only that which was concurrently acting on the bottom of #43, but since #41 is larger than #43 the valve was held in the position shown, both by the preponderance of pressure on its upper end and by its own weight. As soon as the parts attain the position shown in Fig. 3, motive fluid will pass from the space #13 through the groove #7 into the space #17, and thereby into the lower end of the cylinder, beneath the piston #8, and the piston #8 will begin to move up. As it moves upward, its lower end will first move above the point #55, and live fluid from the cylinder bore will pass through the passage #63. If the fluid #64 has not been able to attain entrance into the top end of the valve chest because the valve #45 will be seated. The piston #8 will accordingly continue its upward movement until its lower end passes above the connection point #56, and then pressure will flow through the connection #57, through the passages #87 in the then-opened valve #50, and through the annular space #62, and act on the larger, upper area of the distributing valve #46, and start the latter down to cylinder-setting position; and valve #45 which will be commenced by pressure through the connection #57, will be completed by pressure through the connection #54 and passage #53.

As soon as the valve again attains the position shown in Fig. 3, the motor piston #8 will start downward, because the mechanism is designed to substantially to motor back pressure, an amount inadequate to support the weight of the piston #8, piston rod #9, etc. When the piston #8 moves below the connection point #56, the pressure within the line #61 will be vented, but the pressure above the distributing valve will be retained because the valve #50 will still prevent the escape of any pressure through the line #56. Accordingly, the piston #8 will continue to move downward until its upper end passes below the connection point #55, at which time the pressure acting on the upper end of the distributing valve will be vented to atmosphere through the connections #53, #54 and the upper end of the cylinder bore, and the valve will again move to the position shown in Fig. 3, so that a new up stroke of the motor piston #8 will take place. Such mode of operation will continue as long as the fluid is supplied to the pumping motor, barring derangement thereof or loss of load thereby.

As a preliminary to describing the improved automatic control means, it may be pointed out that the working strokes of the motor piston #8 include an initial period of relatively rapid acceleration and thereafter a sustained period of relatively constant velocity, acceleration occurring rapidly as the pump rod line stretches.

Now, taking up the automatic protective device for the motor, it will be obvious that the upper end of the cylinder portion #67 has a connection #68 leading thereto; and a connection #61 opens into the motor cylinder portion #69 at any suitable place therealong—desirably a position sufficiently far up so that the upward moving motor piston #8 will reach it and pass beyond it only when moving at the nearly constant rate which prevails during most of its working travel. The connection #61 leads into a valve casing #72 which has a top opening #73 connected by a pipe #84 with a check valve #85 opening toward the connection #86, which is operatively connected with the check valve #85 at the cylinder end of the latter. The casing #82 has a space #83 therein in constant communication with the cylinder bore #7 through the connection #81, and an internal bore #89 in which a valve #90 is reciprocable, the bore #89 being connected with the opening #83 at its upper end, and through a radial passage #91 with the space #88. A spring #92 extends between the upper end of the bore #89 and a surface #93 inside the valve #90. It will be noted that the valve #90 has a substantial distance to travel from its lowermost position in the bore #89 to a position in which it has just overrun the ports #91. The lower end of the bore #89 is closed by a plug #95 through which, and a conduit #96, fluid flow to and from the lower end of the bore #89 is possible. In order to permit a desirable slow supply of fluid to the lower end of the bore #89, the connection #90 has a connection with a connection #97 which leads to the cylinder bore #7 at a point near the lower end of the latter. One branch of the double connection, numbered #98, has a check valve #99 therein which precludes flow from #97 towards #96 but enables rapid flow in the opposite direction. The
other branch of the double connection, 100, has a manually adjustable valve 101 therein which may be manually adjusted to provide a controlled slow rate of live fluid flow from the bore of the cylin-
der to the connection 96.

The mode of operation of the complete structure will now be understood. It will be appreciated that every time the distributing valve 40 admits pressure to the motor cylinder bore 7 and the piston 8 is above the point of communication of the connection 97 with the cylinder bore, the fluid will flow past the valve 101, through the connection 100 and the connection 96 and plug 95, beneath the valve element 90, and start the latter to moving upwardly. Because of the controlled rate of fluid supply past the valve 101 and the resistance imposed by the spring 32, a certain amount of time will elapse between the first supply of fluid beneath the valve 90 and the attainment of the valve 90 to a position to close the ports 91. Therefore, if the motor piston 8 moves fast enough to get above the connection 81 before the valve 90 gets above the connection 91, the valve 8 will pass through the connection 81, chamber 88, ports 91, bore 89, connection 84, check valve 86, and connection 80, to the upper end of the pumping cylinder, and begin immediately to cushion the upward move-
ment of the latter. If, however, the pumping motion motor piston 8 does not move rapidly enough to get above the connection 81 before the valve 90 closes the ports 91, the valve 90 will prevent bypassing of fluid from beneath to above the piston 8 when the piston ultimately passes above the connection 81.

Now, by regulating the rate of admission of fluid beneath the valve 90 in such a manner that the same will reach and close the ports 91 slightly before the lower end of the upwardly moving piston 8, if the latter is moving normally, gets to the lower edge of the connection 81, bypassing will be prevented and the motor piston will op-
erate in a normal manner throughout its com-
plete cycle. It will be understood, moreover, that when the motor piston upon its downward move-
ments gets below the point of communication with the cylinder bore of the connection 81, the pressure within said connection will simply be vented to atmosphere. If during the starting of the pump piston and bringing it up to speed, the rod line breaks, the piston 8 will jump ahead, so to speak, and uncover the point of communica-
tion of passage 81 with the bore 7 before valve 90 closes passages 91, and so fluid will pass through connection 84 and cushion the upwardly moving, relatively unloaded piston. As valve 90 will have similar pressures on its opposite ends, its upward movement will be checked and the spring 32 will force it down to its bottom position.

Desirably this device may be used with equip-
ment for locking the distributing valve in exhaust position, as described in my assignee's application Serial No. 102,989, filed September 28, 1938, now Patent No. 2,156,326, granted May 2, 1939, so as to insure complete stopping of the motor.

It will be evident that I have provided an im-
proved safety device of the character described which is simple, certain in operation, and highly effective under the conditions for which it is de-
signed, and that it is adapted to certainty of functioning because it goes through cyclic move-
ments continuously while the motor which it is protecting operates.

While there is in this application specifically described one form which this invention may as-
sume in practice, it will be understood that this form of the same is shown for purposes of illus-
tration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the ap-
pended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In combination, an expansible chamber motor having a cylinder containing a reciprocating piston, a bypass connecting spaces at opposite sides of said piston during the working stroke, a valve controlling said bypass and traversing a cycle of movement concurrently with said piston.

2. In combination, an expansible chamber motor having a cylinder containing a reciprocating piston, a bypass connecting spaces at opposite sides of said piston during the working stroke, a valve controlling said bypass and traversing a cycle of movement concurrently with said piston.

3. In combination, an expansible chamber motor having relatively reciprocable cylinder and piston elements, a bypass extending between spaces in said cylinder separated by said piston, a valve controlling said bypass, and means for causing said valve to traverse a cycle of movement occluding said bypass during the latter per-
iods of each normal working stroke of said motor.

4. In combination, an expansible chamber motor having relatively reciprocable cylinder and piston elements, distributing valve means for ad-
mitting and venting pressure relative to one end of said motor cylinder, means connecting the other end of said motor cylinder to a point in the first end to which working pressure attains only after a predetermined portion of the work-
ing stroke, and means controlling said connect-
ing means including a valve yieldingly pressed towards open position and subjected to working pressure under the control of said distributing me-
ans to the said valve in closing direction.

5. In combination, a motor including a cy-

linder, distributing valve mechanism, a piston, and fluid supply and exhaust means for said motor, and means for automatically delivering fluid from the working end of said motor to the opposite end in the event of excessive piston speeds including means forming a passage for the transmission of such fluid, and a controlling valve for said passage automatically moved in a direc-
tion to preclude delivery of fluid through said passage upon each admission of fluid to said motor.

6. In combination, a motor including a cy-

linder, distributing valve mechanism, a piston, and fluid supply and exhaust means for said motor, and means for automatically delivering fluid from the working end of said motor to the opposite end in the event of excessive piston speeds including means forming a passage for the transmission of such fluid, a controlling valve for said passage automatically moved in a direction to preclude delivery of fluid through said passage upon each admission of fluid to said motor, and means for controlling the rate of movement of said valve.

7. In combination, a motor including a cy-

linder, distributing valve mechanism, a piston, and fluid supply and exhaust means for said motor, and means for automatically delivering
12. In combination, a motor including a cylinder, distributing valve mechanism, a piston, and fluid supply and exhaust means for said motor, and means for automatically effecting a supply of cushioning fluid from the working end of said motor to oppose end thereof in the event of over speeding of said motor piston including a passage having one end thereof uncovered by the motor piston after a predetermined movement of the latter in a working direction and having its other end opening into the opposite end of said cylinder, and a controlling valve for said passage having means for admitting operating fluid to move the same upon admission to said motor cylinder and for venting such fluid upon exhaust of fluid from said motor cylinder, said admitting means having adjusting means for controlling the rate of flow there through.

13. In combination, a motor including a cylinder, distributing valve mechanism, a piston, and fluid supply and exhaust means for said motor, and means for automatically effecting a supply of cushioning fluid from the working end of said motor to the opposite end thereof in the event of over speeding of said motor piston including a passage having one end thereof uncovered by the motor piston after a predetermined movement of the latter in a working direction and having its other end opening into the opposite end of said cylinder, and a controlling valve for said passage having means for admitting operating fluid to move the same upon admission to said motor cylinder and for venting such fluid upon exhaust of fluid from said motor cylinder, said admitting means having adjusting means for controlling the rate of flow there through.

14. In combination, a motor including a cylinder, distributing valve mechanism, a piston, and fluid supply and exhaust means for said motor, and means for automatically effecting a supply of cushioning fluid from the working end of said motor to the opposite end thereof in the event of over speeding of said motor piston including a passage having one end thereof uncovered by the motor piston after a predetermined movement of the latter in a working direction and having its other end opening into the opposite end of said cylinder, and a controlling valve for said passage having means for admitting operating fluid to move the same upon admission to said motor cylinder and for venting such fluid upon exhaust of fluid from said motor cylinder, said admitting means having adjusting means for controlling the rate of flow there through and said venting means having a check valve limiting flow to a direction towards said motor cylinder.

15. In combination, a motor including a cylinder, distributing valve mechanism, a piston, and fluid supply and exhaust means for said motor, and means for automatically effecting a supply of cushioning fluid from the working end of said cylinder to the opposite end thereof in the event of over speeding of said motor piston including a passage having one end thereof uncovered by the motor piston after a predetermined movement of the latter in a working direction and having its other end opening into the opposite end of said cylinder, and a controlling valve for said passage having means for admitting operating fluid to move the same upon admission to said motor cylinder and for venting such fluid upon exhaust of fluid from said motor cylinder, said admitting means having adjusting means for controlling the rate of flow there through and said venting means having a check valve limiting flow to a direction towards said motor cylinder.

16. In combination, a motor including a cylinder, distributing valve mechanism, a piston, and fluid supply and exhaust means for said motor, and means for automatically effecting a supply of cushioning fluid from the working end of said motor to the opposite end thereof in the event of over speeding of said motor piston including a passage having one end thereof uncovered by the motor piston after a predetermined movement of the latter in a working direction and having its other end opening into the opposite end of said cylinder, and a controlling valve for said passage having means for admitting operating fluid to move the same upon admission to said motor cylinder and for venting such fluid upon exhaust of fluid from said motor cylinder, said admitting means having adjusting means for controlling the rate of flow there through and said venting means having a check valve limiting flow to a direction towards said motor cylinder.

17. In combination, a motor including a cylinder, distributing valve mechanism, a piston, and fluid supply and exhaust means for said motor, and means for automatically effecting a supply of cushioning fluid from the working end of said motor to the opposite end thereof in the event of over speeding of said motor piston including a passage having one end thereof uncovered by the motor piston after a predetermined movement of the latter in a working direction and having its other end opening into the opposite end of said cylinder, and a controlling valve for said passage having means for admitting operating fluid to move the same upon admission to said motor cylinder and for venting such fluid upon exhaust of fluid from said motor cylinder, said admitting means having adjusting means for controlling the rate of flow there through and said venting means having a check valve limiting flow to a direction towards said motor cylinder.
the cylinder to the opposite end thereof but precluding reverse flow, and an automatic controlling valve governed by motor cylinder pressure for closing said by-pass to working fluid during normal motor operation, said controlling valve moving in a closing direction during working strokes of said motor piston and oppositely during the latter part of the intermediate strokes of said motor piston.

17. In combination, a motor including a cylinder, distributing valve mechanism, a piston, and fluid supply and exhaust means for said motor, and means for cushioning movement of said piston in the event of overspeeding of the latter including a by-pass provided with means for permitting passage of fluid from the working end of the cylinder to the opposite end thereof but precluding reverse flow, a controlling valve governed by cylinder pressure closing said by-pass to working fluid during normal motor operation, yielding means opposing closure of said controlling valve, and means admitting cylinder pressure to said said yielding means in preventing closure of said controlling valve during excessive piston speeds.

18. In combination, a motor including a cylinder, distributing valve mechanism, a piston, and fluid supply and exhaust means for said motor, and means for automatically effecting a supply of cushioning fluid from the working end of said motor to the opposite end thereof in the event of overspeeding of said motor piston including a passage having one end thereof uncovered by the motor piston after a predetermined movement of the latter in a working direction and having its other end opening into the opposite end of said cylinder, and a controlling valve for precluding flow of cushioning fluid through said passage during normal operation of said motor and controlled by pressure in said cylinder.

19. In combination, a motor including a cylinder, distributing valve mechanism, a piston, and fluid supply and exhaust means for said motor, a bypass for delivering pressure fluid from the working end of said motor to its opposite end in the event of excessive piston speeds, a controlling valve for precluding flow of pressure fluid in said bypass during normal motor operation, and means for permitting passage of fluid through said bypass in the event of overspeeding of said motor, said pressure fluid in said bypass opposing closing movement of said control valve.

20. In combination, an expandable chamber motor including a cylinder containing a reciprocable piston and fluid supply and exhaust means for said cylinder, and means automatically responsive to an excessive rate of piston movement during the working stroke of the motor and controlled by the cylinder pressure for supplying pressure fluid to one end of said cylinder at one side of said piston, thereby to provide a cushioning pressure for said piston for automatically checking movement of said piston as it approaches said end of said cylinder.

21. In combination, an expandable chamber motor including a cylinder containing a reciprocable piston and fluid supply and exhaust means for said cylinder, means automatically responsive to an excessive rate of piston movement during the working stroke of the motor and controlled by the cylinder pressure for supplying pressure fluid to one end of said cylinder at one side of said piston, thereby to provide a cushioning pressure for said piston for automatically checking movement of said piston as it approaches said end of said cylinder, said automatic means including means for automatically rendering said cushioning-fluid-supply ineffective during a normal rate of piston movement.

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