Jan. 11, 1927.

1,613,782

G. F. C. BAUER

RETARDING DEVICE

Filed April 3, 1925

3 Sheets-Sheet 1

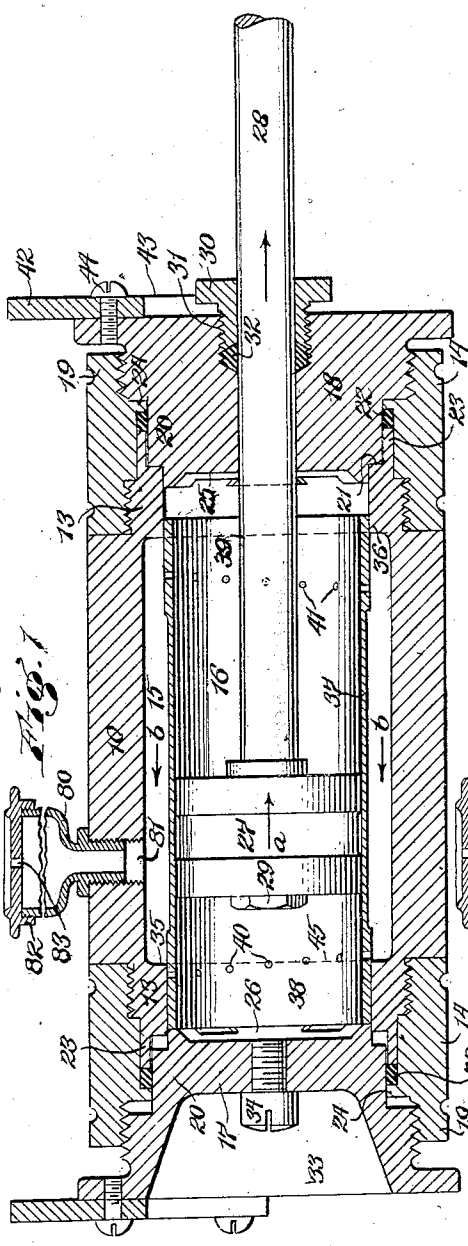


Fig. 1.

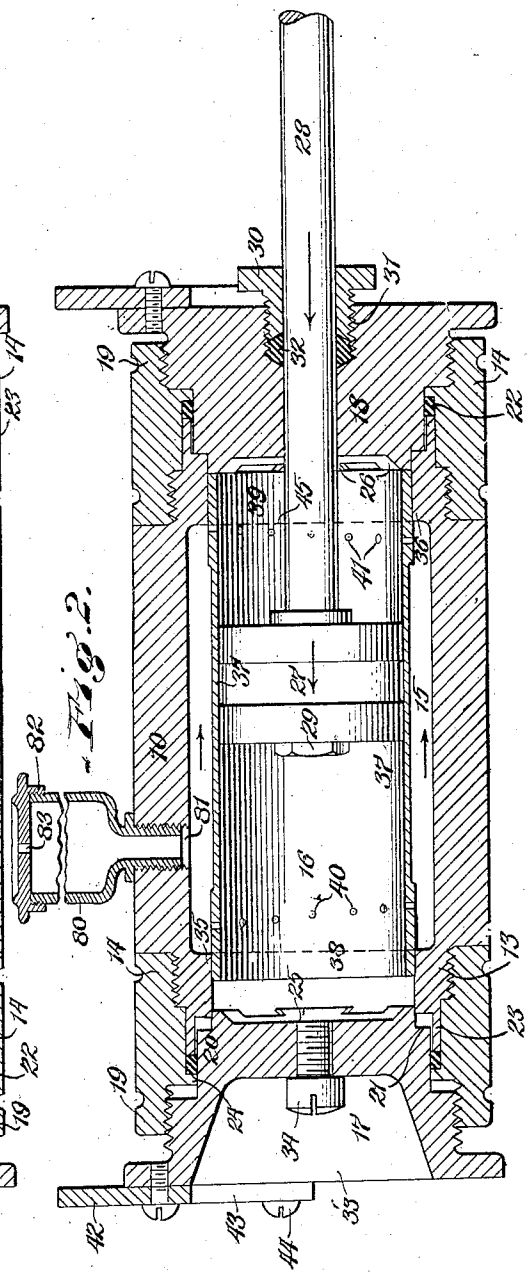


Fig. 2.

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Fig. 4.

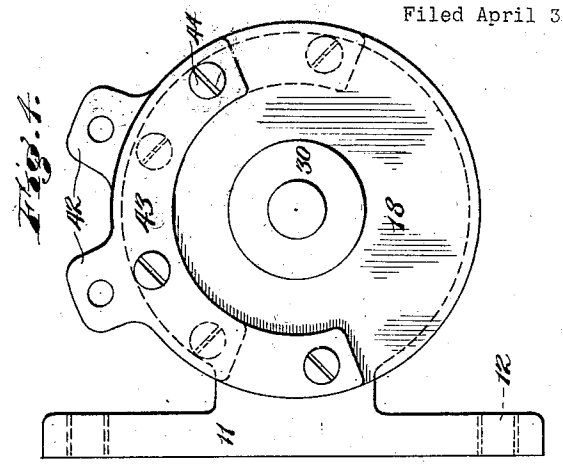


Fig. 3.

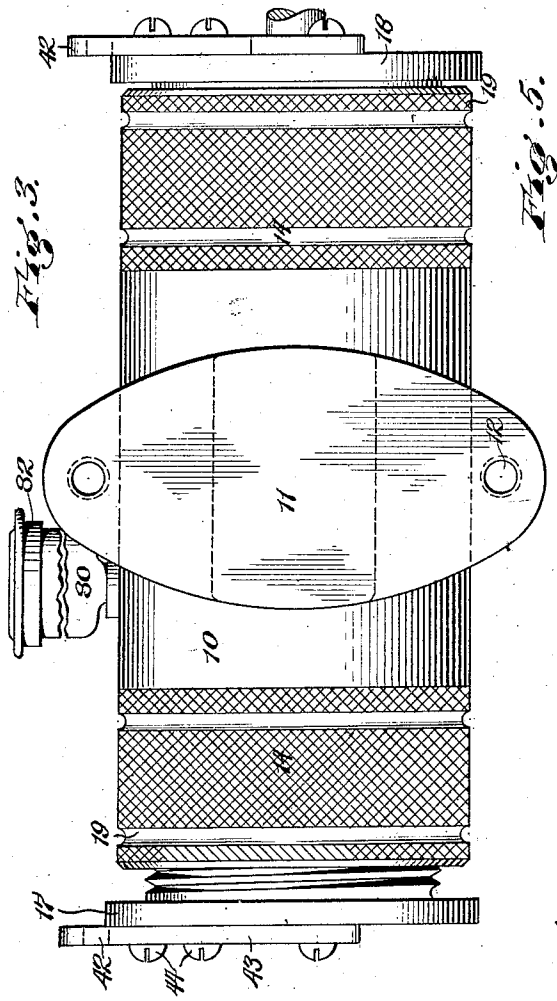
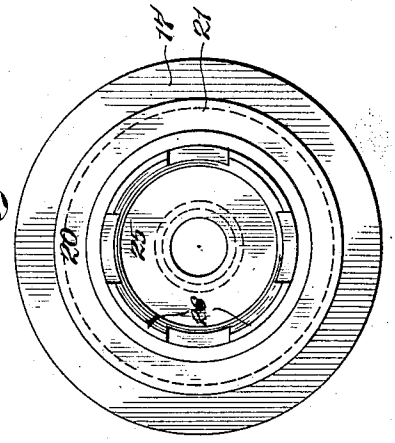


Fig. 5.



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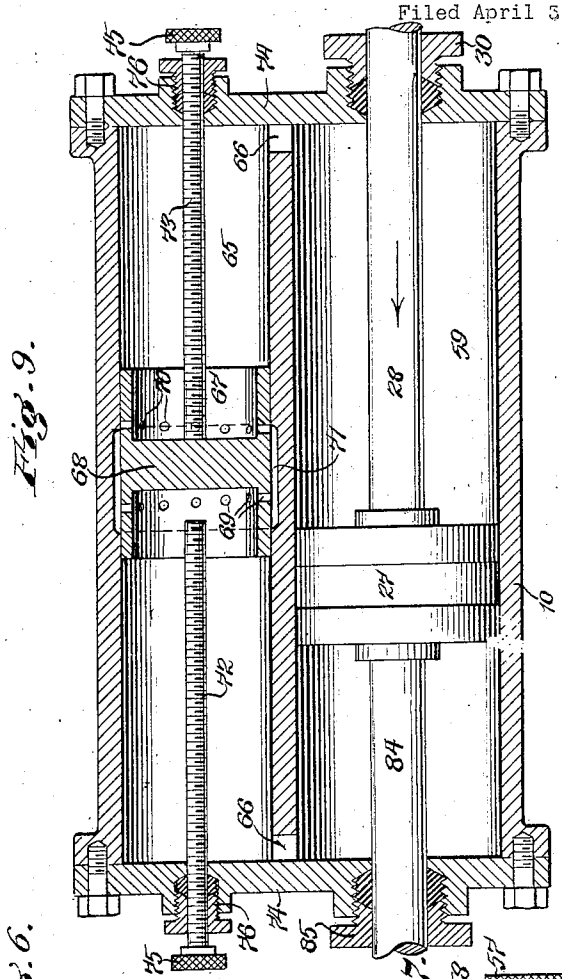


Fig. 9.

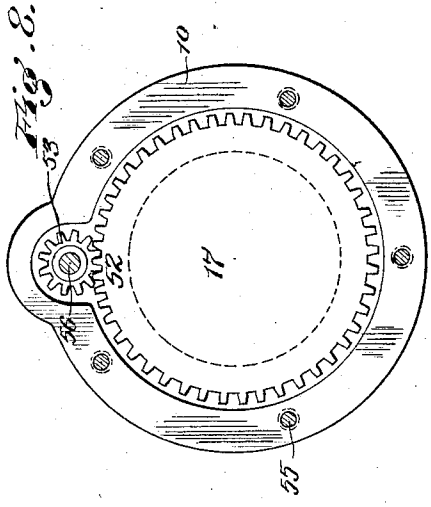


Fig. 8.

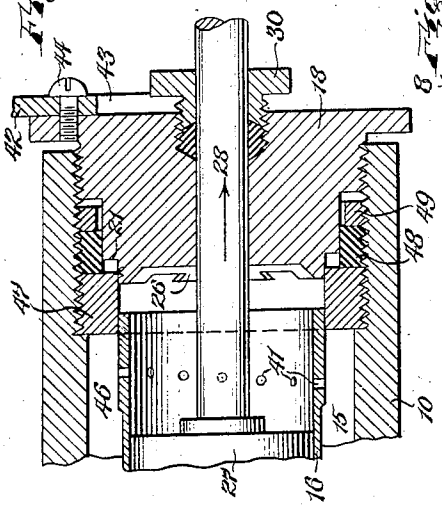


Fig. 6.

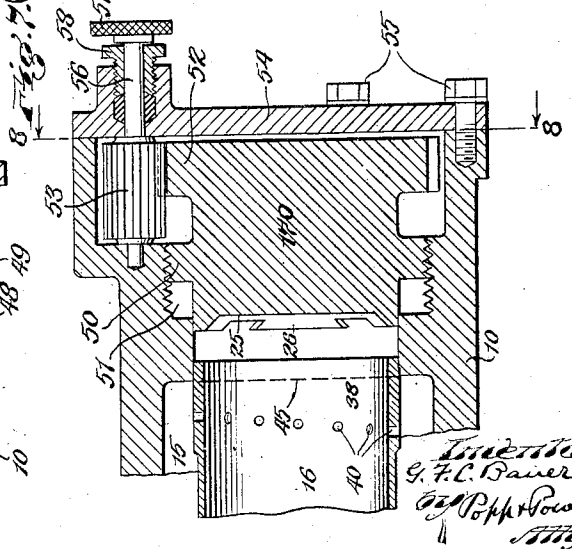


Fig. 7.

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Patented Jan. 11, 1927. 1,613,782

UNITED STATES PATENT OFFICE.

GUSTAV F. C. BAUER, OF TONAWANDA, NEW YORK, ASSIGNOR TO ROCK ASPHALT & CONSTRUCTION CO. INC., OF BUFFALO, NEW YORK, A CORPORATION OF NEW YORK.

RETARDING DEVICE.

Application filed April 3, 1925. Serial No. 20,507.

This invention relates to a retarding device which is adapted to be used for a variety of purposes but is more particularly intended for use in an automatic flasher of electric traffic control systems, said flasher operating a visible signal located at a traffic crossing. This flasher is adapted to give alternating signals by which the traffic in one direction is given a "go" signal while intersecting traffic is given a "stop" indication, and upon reversing the signals intersecting traffic is permitted to cross while the main traffic is given a warning signal to stop, a suitable audible and visible caution signal sometimes being given to indicate a change of signals. When used in such a system this retarding device operates a system of electric switches (not shown) and determines the period of time during which each signal is held, and for this purpose it is so designed that the time period of each signal can be quickly changed independently of the other signal time period so that the traffic control system can be readily adapted to changing traffic conditions. Thus at a certain crossing where the main traffic is heavier than the intersecting traffic, a longer time period can be given to the main traffic, and at another crossing where the traffic conditions are equal the time periods of the signal can be made of equal length.

Further objects of this invention are to provide a retarding device which is of simple construction and not liable to get out of order or adjustment by continuous use and which is not affected by temperature or other climatic changes.

In the accompanying drawings:

Figure 1, is a longitudinal sectional elevation of the retarding device showing the piston traveling in the direction of the arrow associated therewith at a retarded speed.

Figure 2 is a similar view showing the plunger traveling in the opposite direction at a greater speed.

Figure 3 is a side elevation of the retarding device showing the end heads in the same adjustment as in Figures 1 and 2.

Figure 4 is an end elevation thereof.

Figure 5 is an end elevation of one of the adjusting heads.

Figure 6 is a longitudinal fragmentary sectional elevation of a modification of the sleeve supporting means.

Figure 7 is a fragmentary section showing a modification of the adjusting means.

Figure 8 is a transverse sectional elevation, the same being taken on line 8—8, Fig. 7.

Figure 9 is a longitudinal section of a modified form of the retarding device showing the piston traveling in the direction of the arrow associated therewith.

In its general organization the retarding device comprises a casing or cylinder containing a fluid in which is arranged a plunger reciprocated against the resistance of the fluid, and by-pass means formed in the casing whereby the fluid is forced from one end of the cylinder to the other, the rate of flow of the fluid through the by-pass being adjustably controlled by a controller which covers the by-pass and is reciprocated by the alternating pressure of the fluid, suitable ports being provided at each end of the controller which give a variable resistance to the flow of fluid depending upon the longitudinal movement of the controller which is controlled by movable abutments arranged at each end of the casing.

In the preferred embodiment of this invention, as shown in Figures 1, 2, 3, 4 and 5, the enclosing casing 10 is of cylindrical form and is provided on one side with an integral bracket 11 having transverse holes 12 by which it may be secured to an adjacent wall or stationary part in any suitable manner. Both ends of this cylinder are provided with externally threaded reduced portions 13 on which are secured the end screw collars 14. Within the casing and extending outward from the bore thereof is a central annular recess 15 forming a by-pass which extends adjacent the ends of the casing and forms a channel through which the fluid with which the casing is filled passes from one side of the plunger head to the other as it is reciprocated.

The controlling sleeve 16 by which this flow is regulated is arranged within the casing and is supported at its opposite ends in the bore thereof bridging the annular recess 15. In order to limit the movement of the sleeve, end heads or abutments 17 and 18 are

provided, each of which is externally threaded adjacent its outer end and is adapted to engage the corresponding internally threaded outer end 19 of the respective screw collar 14. The intermediate portion 20 of each of these heads is of somewhat greater diameter than the bore of the cylinder and forms an annular shoulder 21 which is adapted to engage the end of the cylinder and thereby limit the inward movement of the adjusting head. To prevent leakage of the fluid from the interior of the casing past the end heads a ring 22 of packing is provided between each head and the casing which is compressed between a longitudinally outward extending annular flange 23 provided on the casing and a radially inwardly extending flange or bead 24 provided on the screw collar. The screw collars 14 therefore serve to compress the packing, without however affecting the limit of movement of the adjusting head, since this is determined by the engagement of the shoulder 21 with the casing. On the rim of the inner end 25 of each of the adjusting heads and projecting within the bore of the casing a plurality of stop lugs 26 are provided which extend inwardly from said rim and form a seat or stop for the sliding sleeve 16. By providing these lugs the adhesion between the end heads and the contacting sleeve is reduced rendering the sleeve more sensitive to slight pressures.

The plunger comprises a head or piston 27 which is arranged within the cylindrical bore of the sleeve and adapted to reciprocate therein, and a longitudinal rod 28 secured to said plunger head by a nut 29, which rod extends through the adjusting head 18. The rod and plunger head may be reciprocated by any suitable yielding pressure means (not shown) so that the rate of travel of the plunger is affected by the resistance offered by the fluid in the casing. A stuffing box of any suitable form may be provided to prevent leakage of the fluid past the plunger rod, that shown comprising an externally threaded gland 30 arranged around the piston rod and screwing into a recess 31 in which is arranged suitable packing 32.

The opposite head 17 is hollow or dished inwardly forming a recess 33 in which is arranged a screw 34 which closes an opening extending through this head to the interior of the casing. The fluid is introduced through this opening into the casing when this becomes necessary.

The sleeve 16 has a relatively slight longitudinal movement and bears on the inwardly extending annular rims 35 and 36 formed by the recess 15, the intermediate portion 37 of the sleeve being of smaller diameter than its ends 38 and 39 to facilitate removal and insertion of the same. At opposite ends of the sleeve beyond the path of the plunger head series of ports 40 and 41 are provided which extend radially through the sleeve and each arranged in a spiral line around the same, the pitch of the same being exaggerated for the purpose of illustration. Each of these series of ports is adapted to register with and be covered to a greater or less extent by the adjacent rim 35 or 36 according to the adjustment of the adjacent adjusting head and thereby increase the resistance to the flow of the fluid from one side of the plunger, through the sleeve and recess 15 to the other side of said plunger. Adjustment of the end heads for this purpose is facilitated by providing each of the same with a handle or lever 42 having a flat arcuate portion 43 which is adapted to be secured to the outer side of the head by a plurality of screws 44.

Assuming the end heads to be adjusted, as shown in Figures 1, 2 and 3 i. e., the end head 17 screwed inwardly only a short distance while the end head 18 is adjusted inwardly to its maximum extent, the operation of the retarding device is as follows:

As the plunger moves in the direction of the end head 18, as indicated by the arrow *a* associated with the piston rod in Figure 1, the fluid in that end of the casing within the sleeve is put under pressure, while the fluid pressure on the other side is correspondingly reduced, it being understood that the ports of the sleeve at all times offer a substantial resistance to a free flow of fluid. Since the sleeve is free to move longitudinally, this difference in pressure forces the sleeve toward the head 17 in the direction of the small arrow *b* in Figure 1 until the same abuts against the stop lugs 26 provided on said head, as shown in Fig. 1, this sleeve operating in the same manner as an ordinary piston valve put under pressure. As the head 17 has been adjusted outwardly, as compared with the adjustment of the head 18, it is obvious that the sleeve moves a greater distance toward the head 17 relative to the transverse center line of the annular recess than toward the head 18. For the same reason when the sleeve abuts against the head 17 a large number of ports are covered by the bore of the rim 35, as shown by the dotted line 45 indicating the end of the recess, and the flow of the fluid from the advancing side of the piston through the ports 41, which are fully exposed, the recess 15 and through the open ports 40 to the trailing side of the piston is obviously impeded by the resistance offered by these last mentioned ports.

When the plunger reaches he end of its stroke and reverses, as shown in Fig. 2, the pressure built up in front of the plunger forces the sleeve in the opposite direction against the head 18. Since this head is adjusted inwardly its maximum extent, none of the ports 41 are covered by the bore of

the casing, and the resistance to the flow of fluid being correspondingly reduced, the speed of the piston in that direction is increased accordingly.

It is apparent that the adjustment of each head affects the number of ports closed by by the casing and that the speed of the piston is thereby capable of very fine regulation. It is also apparent that in this device the regulation of the rate of travel of the piston in one direction is wholly independent of the regulation of its speed in the opposite direction since the adjustment of one of the end heads does not effect the number of ports covered when the piston reverses its movement. The fluid used in the retarding device is, of course, dependent upon the purpose for which the device is used but preferably should be of such a character that it is not affected by temperature changes or liable to change or deteriorate from other causes. It has been found that certain grades of lubricating oils are a very satisfactory fluid for this purpose.

Any suitable means may be provided for compensating for the oil displaced by the body of the plunger rod 28 as it is moved in and out of the cylinder. This means, as shown in Figs. 1, 2 and 3 comprises an oil cup 80 provided on the upper side of the cylinder casing, the neck of which is received in a threaded opening 81 extending through the casing. This oil cup is preferably provided at its upper end with a removable cap 82 which screws over the same and is provided with a vent opening 83 extending therethrough. The cup is of such a size that it will contain all of the oil displaced by the plunger rod so that as the rod moves into the cylinder the oil rises in the cup expelling the air therein through the vent opening and as the rod is moved out, the oil is drawn from the cup back into the cylinder, and the cup is again filled with air. Providing an oil cup of this character also compensates for expansion and contraction of the liquid when the same is heated or chilled and thereby reduces the danger of the oil being forced out of the cylinder past the stuffing box and heads and being thereby lost. Inasmuch as the operation of the retarding device is due to the difference in pressure at the advancing and following end of the plunger, the provision of such an oil cup for receiving the oil displaced by the plunger rod has no effect upon the retarding action of the same.

In the modification shown in Figure 6 the casing is provided with a cylindrical bore 46 threaded at its opposite ends. The sleeve is supported in the casing by externally threaded supporting rings 47 which engage the threaded part of the casing and correspond to the rims 35 and 36 in the preferred construction. The packing 48 is arranged outside of each of these rings and is compressed by an externally threaded packing ring 49. In other respects this form is similar in construction and operation to the preferred form.

Figures 7 and 8 show a modification which is intended to reduce the loss of fluid from the casing. In this form the adjusting head 170 is entirely enclosed and has a threaded rim 50 which engages an internally threaded recess 51 of the casing so that upon turning the head a longitudinal adjustment is effected. To turn the head the same is provided with a rim 52 at its rear end provided with gear teeth which teeth are engaged by a pinion 53 which is of sufficient length to ensure engagement of the teeth in any adjustment of the head. Over the end of the casing a cover or head 54 is secured by bolts 55 or other suitable fastenings. The pinion is mounted on a shaft or pin 56 which is journaled in the casing and extends through the cover 54 and is turned by a knurled adjusting wheel 57, a suitable stuffing box 58 being provided to prevent leakage of the fluid at this point. By this arrangement the danger of losing the fluid past the head is reduced and it is also possible to secure a much finer adjustment of the head.

A further modification is shown in Figure 9 which is adapted to be used when the fluid pressure caused by the movement of the piston is very low. In this form the plunger operates in a separate cylinder 59 above which a cylinder 65 is provided in which the controlling sleeve 67 is arranged. Passages 66 are provided which permit an intercommunication of the fluid at both ends of the cylinders so that the movement of the piston in either direction influences the sleeve 67. The latter is preferably arranged substantially central of its cylinder and is provided with an integral web 68 intermediate its two series of spirally arranged ports 69 and 70 and an annular recess 71 is provided similar to the annular recess 15 in the other forms of this invention. The means for limiting the longitudinal movement of the sleeve and thereby regulating the speed of the piston in the same manner as previously described, comprise two adjusting screws 72 and 73 threaded in the cylinder heads 74 and having heads 75 at their outer ends by which each screw may be adjusted inwardly or outwardly. The inner ends of these screws are arranged adjacent the web 68 of the sleeve on opposite sides thereof and function in the same manner as the adjusting heads in the preferred construction, i. e., determine the number of ports through which the fluid can flow when the sleeve is forced against said screws by the fluid pressure. Suitable stuffing boxes 76 are provided for each of these screws and

also for the plunger rod to prevent loss of the fluid.

In this construction, instead of providing an oil cup to compensate for the oil displaced by the plunger rod 28, the shaft is extended beyond the plunger head 27 in the form of an extension 84, which extension is guided in the head 74 and is of such a length that the outer end thereof is always arranged out side of the casing. A stuffing box 85 is provided for this extension similar to the stuffing box 30 of the plunger or power shaft. Inasmuch as the plunger shaft 28 and the extension 84 are of equal diameter, as the shaft 28 moves into the cylinder, the oil displaced thereby is exactly compensated for by the extension 84 which is moving out of the cylinder at precisely the same rate of speed, and thereby balances the operation of the retarding device.

In the preferred construction, shown in Figs. 1–5, the cross sectional area against which the fluid pressure is effective in moving the sleeve reversely to the plunger, is relatively small and it is hence obvious that where the pressure operating the piston is very small the separate sleeve and cylinder construction shown in Fig. 9 will be more effective and positive since the fluid pressure acts on a greater area of the same.

This invention provides a very simple, inexpensive and durable device for retarding the motion of the transmitting rod in either direction, it can be quickly adjusted to meet varying conditions, and is not likely to get out of adjustment by ordinary use. It also requires little attention and is not affected by temperature changes, etc., rendering it useful for many other purposes than that specified.

I claim as my invention:—

1. In a retarding device, a casing adapted to contain a fluid, a plunger reciprocable in said casing against the resistance of said fluid, means permitting said fluid to pass from one side of said plunger to the other, and means for retarding the flow of fluid from one side of the plunger to the other on each stroke thereof comprising a reciprocating member actuated by the reversing pressures of said fluid.

2. In a retarding device, a cylinder containing a fluid, a plunger reciprocated against the resistance of said fluid, a loosely arranged member adapted to resist and thereby control the flow of fluid from one side of said plunger to the other, said member being movable by the pressure of the fluid into a position in which the flow of fluid in the corresponding direction is regulated, and movable by the reverse fluid pressure into a position in which it controls the flow of fluid in the reverse direction, and means controlling the movement of said member and regulating the resistance offered thereby to the flow of fluid in either direction.

3. In a retarding device, a cylinder containing a fluid, a plunger reciprocated against the resistance of said fluid, a loosely arranged member adapted to resist and thereby control the flow of fluid from one side of said plunger to the other, said member being movable by the pressure of the fluid into a position in which the flow of fluid in the corresponding direction is regulated, and movable by the reverse fluid pressure into a position in which it controls the flow of fluid in the reverse direction, and means arranged at one end of said member for controlling its longitudinal movement and thereby control the flow of fluid in the corresponding direction, and means arranged at the other end of said member for similarly controlling the flow of fluid in the opposite direction.

4. In a retarding device, a casing adapted to contain a fluid, a plunger reciprocable in said casing against the resistance of said fluid, said casing having a by-pass around said plunger, and means for retarding the flow of fluid through said by-pass comprising a sleeve arranged over said by-pass, said sleeve being reciprocated by the alternating pressure of the fluid so that this sleeve moves opposite to the movement of the piston.

5. In a retarding device, a casing containing a fluid, a plunger reciprocated in said casing against the resistance of said fluid, said casing being provided with a by-pass through which the fluid is forced from one end of said plunger to the other, and a sleeve covering said by-pass and reciprocated by the alternating pressure of said fluid so that this sleeve moves opposite to the movement of the piston, said sleeve having ports adapted to register with said by-pass and retard the flow of the fluid through the same.

6. In a retarding device, a casing containing a fluid, a plunger reciprocated in said casing against the resistance of said fluid, said casing being provided with a recess through which the fluid flows from one side of said plunger to the other side thereof, and a sleeve covering said recess and reciprocated by the alternating pressure of said fluid, said sleeve having ports adjacent each of its ends which ports are adapted to register with said recess and retard the flow of the fluid through the same.

7. In a retarding device, a casing containing a fluid, a plunger reciprocated in said casing against the resistance of said fluid, said casing being provided with an annular recess through which the fluid flows from one side of said plunger to the other side thereof, a sleeve reciprocated by the alternating pressure of said fluid and bridging said annular recess, said sleeve having a

series of ports adjacent each of its ends each series being arranged spirally around said sleeve, and adjustable means for limiting the movement of said sleeve in either direction.

8. In a retarding device, a casing containing a fluid, a plunger reciprocated in said casing against the resistance of said fluid, said casing having a cylindrical bore provided with an annular recess through which recess the fluid is forced from one side of said plunger to the other, a sleeve arranged within the bore of said casing and bridging said recess, said sleeve being reciprocated by the alternating pressure of said fluid, and said sleeve having a series of ports at each of its ends through which the fluid is forced through said recess, each of said series being arranged spirally around said sleeve, and a movable abutment arranged at each end of said sleeve and each adjustably limiting its forward movement in either direction whereby the sleeve may be permitted to slide into a position in which a number of ports at the advancing end of the same register with the bore of the casing.

9. In a retarding device, a casing containing a fluid, a plunger reciprocated in said casing against the resistance of said fluid, said casing having a cylindrical bore provided with an annular recess through which recess the fluid is forced from one side of said plunger to the other, a sleeve arranged within the bore of said casing and bridging said recess, said sleeve being reciprocated by the alternating pressure of said fluid, and said sleeve having a series of ports at each of its ends through which the fluid is forced through said recess, each of said series being arranged spirally around said sleeve, and a movable abutment arranged at each end of said sleeve and each adjustably limiting its forward movement in either direction whereby the sleeve may be permitted to slide into a position in which a number of ports at the advancing end of the same register with the bore of the casing, each of said movable abutments being adjustable independently of the other.

10. In a retarding device, a casing containing a fluid, a plunger reciprocated in said casing against the resistance of said fluid, said casing having a cylindrical bore provided with an annular recess through which recess the fluid is forced from one side of said plunger to the other, a sleeve arranged within the bore of said casing and bridging said recess, said sleeve being reciprocated by the alternating pressure of said fluid, and said sleeve having a series of ports at each of its ends through which the fluid is forced through said recess, each of said series being arranged spirally around said sleeve, and a movable abutment arranged at each end of said sleeve and each adjustably limiting its forward movement in either direction whereby the sleeve may be permitted to slide into a position in which a number of ports at the advancing end of the same register with the bore of the casing, each of said movable abutments being adjustable independently of the other and comprising a threaded member engaging said casing.

11. In a retarding device, a cylinder containing a fluid, a plunger arranged in said cylinder and reciprocated against the resistance of said fluid, said cylinder being provided with by-pass means communicating with the chamber of said cylinder on opposite sides of said plunger, and means for retarding the flow of fluid through said by-pass comprising a sleeve arranged in said cylinder and covering said by-pass, said sleeve being reciprocated by the alternating pressure of said fluid, and said plunger operating within said sleeve.

12. In a retarding device, a cylinder containing a fluid, a plunger arranged in said cylinder and reciprocated against the resistance of said fluid, said cylinder being provided with by-pass means communicating with the chamber of said cylinder on opposite sides of said plunger, means for retarding the flow of fluid through said by-pass comprising a sleeve arranged in said cylinder and covering said by-pass, said sleeve being reciprocated by the alternating pressure of said fluid, and said plunger operating within said sleeve, adjustable means for limiting the longitudinal movement of said sleeve in one direction, and adjustable means for limiting the longitudinal movement in the other direction.

13. In a retarding device, a cylinder containing a fluid, a plunger arranged in said cylinder and reciprocated against the resistance of said fluid, said cylinder being provided with an annular recess in its bore, said recess forming a by-pass communicating with the chamber on opposite sides of said plunger and means for retarding the flow of fluid through said recess comprising a sleeve bridging said recess and adapted to be reciprocated relatively thereto by the alternating pressure of said fluid, said sleeve having a series of ports at each of its ends through which the fluid is forced through said recess, each of said series being arranged spirally around said sleeve adjacent the ends of the recess, and a movable abutment arranged at each end of said sleeve and adjustably limiting its forward movement in either direction whereby the sleeve may be permitted to slide into a position in which a number of ports at the advancing end of the same register with the bore of said cylinder, said plunger operating with said sleeve intermediate said series of ports.

14. In a retarding device, a cylinder containing a fluid, a plunger arranged in said

cylinder and reciprocated against the resistance of said fluid, said cylinder being provided with an annular recess in its bore, said recess forming a by-pass communicating with the chamber on opposite sides of said plunger and means for retarding the flow of fluid through said recess comprising a sleeve bridging said recess and adapted to be reciprocated relatively thereto by the alternating pressure of said fluid, said sleeve having a series of ports at each of its ends through which the fluid it forced through said recess, each of said series being arranged spirally around said sleeve adjacent the ends of the recess, and a longitudinally movable abutment arranged at each end of said sleeve and adjustably limiting its forward movement in either direction whereby the sleeve may be permitted to slide into a position in which a number of ports at the advancing end of the same register with the bore of said cylinder said plunger operating within said sleeve intermediate said series of ports and each of said abutments comprising a threaded head arranged in the corresponding end of said casing and adapted to be screwed longitudinally relatively thereto.

15. In a retarding device, a cylinder containing a fluid, a plunger arranged in said cylinder and reciprocated against the resistance of said fluid, said cylinder being provided with an annular recess in its bore, said recess forming a by-pass communicating with the chamber on opposite sides of said plunger and means for retarding the flow of fluid through said recess comprising a sleeve bridging said recess and adapted to be reciprocated relatively thereto by the alternating pressure of said fluid, said sleeve having a series of ports at each of its ends through which the fluid is forced through said recess, each of said series being arranged spirally around said sleeve adjacent the ends of the recess, and a longitudinally movable abutment arranged at each end of said sleeve and adjustably limiting its forward movement in either direction whereby the sleeve may be permitted to slide into a position in which a number of ports at the advancing end of the same register with the bore of said cylinder said plunger operating within said sleeve intermediate said series of ports and each of said abutments comprising a threaded head arranged in the corresponding end of said casing and adapted to be screwed longitudinally relatively thereto and said head being provided on its inner end adjacent the bore of said cylinder with a plurality of lugs against which said sleeve is adapted to bear.

16. In a retarding device, a cylinder containing a fluid, a plunger arranged in said cylinder and reciprocated against the resistance of said fluid, said cylinder being provided with an annular recess in its bore, said recess forming a by-pass communicating with the chamber on opposite sides of said plunger and means for retarding the flow of fluid through said recess comprising a sleeve bridging said recess and adapted to be reciprocated relatively thereto by the alternating pressure of said fluid, said sleeve having a series of ports at each of its ends through which the fluid is forced through said recess, each of said series being arranged spirally around said sleeve adjacent the ends of the recess, and a longitudinally movable abutment arranged at each end of said sleeve and adjustably limiting its forward movement in either direction whereby the sleeve may be permitted to slide into a position in which a number of ports at the advancing end of the same register with the bore of said cylinder said plunger operating within said sleeve intermediate said series of ports and each of said abutments comprising a threaded head arranged in the corresponding end of said casing and adapted to be screwed longitudinally relatively thereto and said head being provided with a shoulder adapted to engage said cylinder and limit the inward movement of said head.

17. In a retarding device, a cylinder containing a fluid, a plunger arranged in said cylinder and reciprocated against the resistance of said fluid, said cylinder being provided with an annular recess in its bore, said recess forming a by-pass communicating with the chamber on opposite sides of said plunger and means for retarding the flow of fluid through said recess comprising a sleeve bridging said recess and adapted to be reciprocated relatively thereto by the alternating pressure of said fluid, said sleeve having a series of ports at each of its ends through which the fluid is forced through said recess, each of said series being arranged spirally around said sleeve adjacent the ends of the recess, and means for limiting the longitudinal movement of said sleeve in either direction comprising an internally threaded collar secured to each end of said cylinder, an externally threaded head engaging each of said internally threaded collars and adapted to be screwed longitudinally relatively to said casing, said head extending into the bore of said cylinder and forming a movable abutment for said sleeve whereby the sleeve may be permitted to slide into a position in which a number of ports at the advancing end of the same register with the bore of said cylinder said plunger operating within said sleeve intermediate said series of ports.

18. In a retarding device, a cylinder containing a fluid and having internally threaded ends, a plunger reciprocated in said cylinder against the resistance of said fluid, the bore of said cylinder being provided with an annular recess through which recess the

fluid is forced from one side of said plunger to the other, a sleeve arranged within said cylinder and bridging said recess, said sleeve being reciprocated by the alternating pressure of said fluid and said sleeve having a series of ports at each of its ends through which the fluid is forced through said recess, each of said series being arranged spirally around said sleeve, an externally threaded cylindrical adjusting head arranged at each end of said cylinder within the bore of the same and engaging the internally threaded ends thereof, each of said adjusting heads being adapted to be moved longitudinally and adjustably limit the forward movement of said sleeve in either direction whereby the sleeve may be permitted to slide into a position in which a number of ports at the advancing end of the same register with the bore of said cylinder, and means for moving each of said adjusting heads longitudinally relatively to said cylinder comprising a plurality of gear teeth arranged on the periphery of said head, a pinion engaging said teeth, and means arranged without said cylinder for turning said pinion.

19. In a retarding device, a cylinder containing a fluid and having internally threaded ends, an externally threaded ring arranged in each end of said cylinder and engaging the threaded portion thereof, said rings forming an annular by-pass therebetween, a sleeve arranged within said cylinder and supported by said threaded rings, a plunger arranged in said sleeve and reciprocated against the resistance of said fluid, said sleeve being reciprocated by the alternating pressure of said liquid and said sleeve having a series of spirally disposed ports at each of its ends adjacent said threaded rings through which said liquid is forced through said by-pass, an externally threaded adjusting head engaging each internally threaded end of said cylinder and having its inner end arranged within said threaded ring and adapted to adjustably limit the forward movement of said sleeve in either direction, and means for moving said adjusting head longitudinally relatively to said cylinder whereby the sleeve may be permitted to slide into a position in which a number of ports at the advancing end of the same register with the bore of said threaded rings.

20. In a retarding device, a cylinder containing a fluid, a plunger reciprocated in the chamber of said cylinder against the resistance of said fluid, a by-pass cylinder having a chamber communicating with the chamber of said first named cylinder on opposite sides of said plunger, and a loosely arranged member arranged in said by-pass cylinder and reciprocated by the alternating pressure of said fluid so that said member moves opposite to the piston, said member being adapted to retard the flow of fluid in both directions through said chamber.

21. In a retarding device, a cylinder containing a fluid, a plunger reciprocated in the chamber of said cylinder against the resistance of said fluid, a by-pass cylinder having a chamber communicating with the chamber of said first named cylinder on opposite sides of said plunger and said by-pass chamber having a recess, and a sleeve reciprocted by the alternating pressure of said fluid arranged over said recess and having ports at its opposite ends adapted to permit a flow of liquid through said recess, and a web arranged centrally within said sleeve and preventing a direct flow of fluid therethrough.

22. In a retarding device, a cylinder containing a fluid, a plunger reciprocated in the chamber of said cylinder against the resistance of said fluid, a by-pass cylinder having a chamber communicating with the chamber of said first named cylinder on opposite sides of said plunger and said by-pass chamber having a recess, and a sleeve reciprocated by the alternating pressure of said fluid arrangd over said recess and having ports at its opposite ends adapted to permit a flow of liquid through said recess, a web arranged centrally within said sleeve and preventing a direct flow of fluid therethrough, and adjustable means engaging said web and limiting the longitudinal movement of said sleeve in either direction.

23. In a retarding device, a cylinder containing a fluid, a plunger reciprocated in the chamber of said cylinder against the resistance of said fluid, a by-pass cylinder having a chamber communicating with the chamber of said first named cylinder on opposite sides of said plunger and said by-pass chamber having an annular recess, and a loosely arranged sleeve reciprocated by the alternating pressure of said fluid and having a series of spirally disposed ports at each of its ends adapted to permit a flow of liquid through said recess and means arranged at each end of said sleeve for adjustably limiting its longitudinal movement in either direction whereby the sleeve may be permitted to slide into a position in which a number of ports at the advancing end of the same are covered by the adjacent wall of the chamber in which said sleeve is arranged and the flow of fluid through the same correspondingly decreased.

24. In a retarding device, a chamber adapted to contain a fluid, a piston movable back and forth in said chamber and dividing the same into compartments, and by-pass means whereby said compartments communicate with each other and which operate to permit the fluid to pass more rapidly in one direction than the other.

25. In a retarding device, a chamber adapted to contain a fluid, a piston movable back and forth in said chamber and dividing the same into compartments, a by-pass which connects said compartments and conducts the fluid alternately from one to the other upon moving said piston back and forth, and controlling means which are actuated by the fluid which is pressed by said piston and which means move opposite to the piston.

26. In a retarding device, a chamber adapted to contain a fluid, a piston movable back and forth in said chamber and dividing the same into compartments, a by-pass which connects said compartments and conducts the fluid alternately from one to the other upon moving said piston back and forth, regulating means which are actuated by the fluid which is pressed by said piston, and adjusting means for said regulating means whereby the liquid may be permitted to flow more freely in one direction than the other and the rate of flow in either direction may be varied independently of the other.

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