July 7, 1931. M. NYROP 1,813,078

AUTOMATIC PUMP CONTROL MEANS

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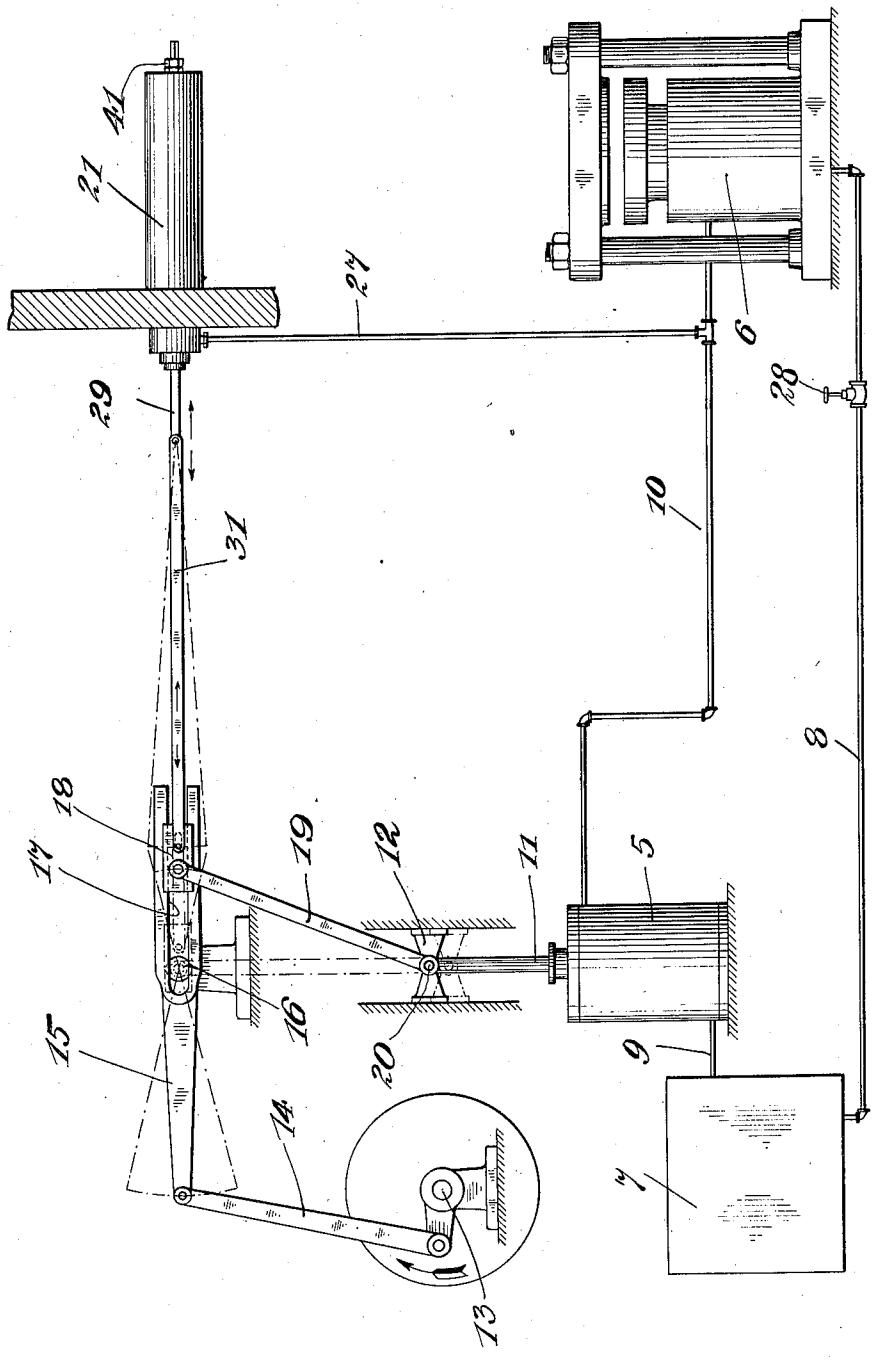


Fig. 1.

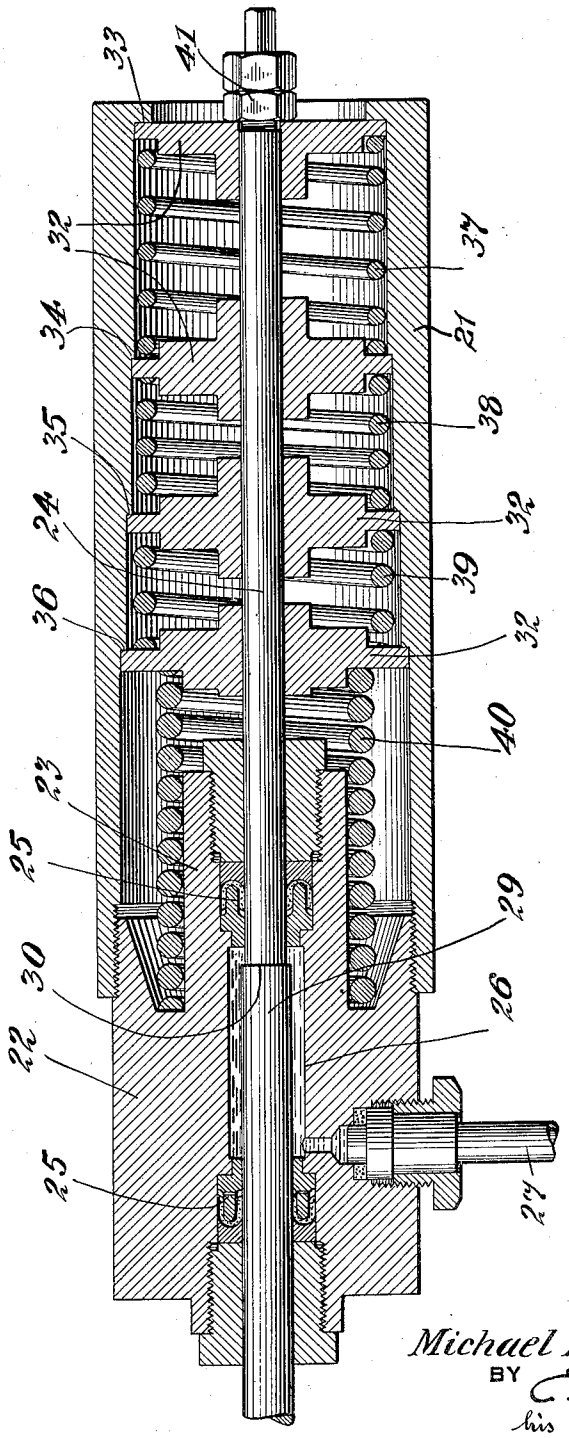
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Fig. 2.



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UNITED STATES PATENT OFFICE

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AUTOMATIC PUMP CONTROL MEANS

Application filed December 7, 1928. Serial No. 324,555.

This invention relates to automatic pump control means, and has for its primary object and purpose to provide simple and reliable means for automatically governing the application of operating power for a hydraulic pump in inverse ratio to the accummulation of pressure at the place of utilization whereby such pumps may be most effectively and economically operated.

Heretofore, in most cases where a pump is employed for the transmission of hydraulic power, accumulators are used to build up or establish a plurality of different pressures, and there is frequently a considerable range between these different pressures which is detrimental to the proper operation of the machine, as for instance, in an oil mill for pressing oil from seed. It is therefore, the purpose of my present invention to provide a device associated with a small pump for each press whereby the stroke of the pump piston will be automatically controlled and varied in inverse ratio to the increase in pressure. In other words, when the pressure at the point of utilization is at its lowest, there will be a maximum stroke of the pump piston, such piston stroke being shortened with each increment of increase in the pressure until at the highest pressure for which the unit is designed, the piston stroke is zero. Thus, appreciably less horse power is necessary for the operation of the pump than in cases where accumulators or pressure adjusting devices are employed.

With the above and other objects in view, the invention consists in the improved automatic pump control means, and in the form, construction and relative arrangement of the several parts as will be hereinafter more fully described, illustrated in the accompanying drawings, and subsequently incorporated in the subjoined claims.

In the drawings, wherein I have shown one example of my present improvements, and in which similar reference characters designate corresponding parts throughout the several views:—

Figure 1 is a view more or less diagrammatic illustrating one application of the present invention, and

Figure 2 is an enlarged sectional view showing the essential parts of the invention.

Referring in detail to the drawings, and for the present more particularly to Fig. 1 thereof, I have conventionally illustrated therein a hydraulic pump 5, a press 6 and a tank 7 to which the hydraulic pressure fluid is returned from the press through the pipe line 8. The intake of the pump 5 is connected with the tank 7 by the pipe 9 and the outlet from the pump is connected with the press 6 by the pipe 10.

The rod or stem 11 of the pump piston is connected with a sliding cross head 12.

Various mechanical devices may be employed for transmitting reciprocating motion to the pump cross head 12, and in the present instance, I have shown the power shaft 13 operatively connected by the link 14 with one end of a rocking lever 15 fulcrumed intermediate of its ends on a suitable support 16. The other end portion of this lever is provided with a longitudinally extending slot 17 in which a slide block 18 is mounted. It will be noted that the slot 17 extends substantially the entire length of the part of the lever 15 on one side of its support or axis 16, the said fulcrum axis of the lever being positioned in predetermined relation to the piston rod 11 of the pump. The slide block 18 at one of its ends has a longitudinally offset portion with which one end of a link 19 is pivotally connected, the other end of said link being pivoted to the cross head 12 as at 20.

In spaced relation to the lever 15 a cylinder or housing 21 is suitably supported in a fixed position, said cylinder having a head 22 detachably threaded in one of its ends and provided with a reduced cylindrical projection 23 extending into the cylinder. A differential piston rod 24 is slidably mounted in suitably spaced stuffing boxes 25 carried by the head 22 and located at opposite ends of a fluid receiving chamber 26 which is connected with the pressure supply pipe line 10 from the pump 5 by means of the pipe 27. The return pipe 8 is pro-

vided with a pressure release valve indicated at 28.

The section of the piston rod extending through the head 22 has a diametrically enlarged portion 29 terminating within the chamber 26 and providing an annular end face 30 against which the pressure fluid in said chamber may act.

The end of the piston rod 24 extending beyond the cylinder head 22 is connected with the slide block 18 by means of the link 31. Upon the other end portion of said rod within the cylinder 21, longitudinally spaced discs 32 are loosely engaged. These discs are of relatively different diameters so that they may be readily inserted to applied position within the cylinder and against the stop shoulders indicated at 33, 34, 35 and 36 respectively, which are internally formed upon the cylinder wall. Between these spaced discs 32 and acting to yieldingly hold the same against said stop shoulders, the coil springs 37, 38 and 39 are arranged, said springs being of relatively different strengths and successively yielding under the pull of the piston rod 24 to compress said springs and move the discs 32 in one direction away from the stop shoulders. An additional coil spring 40 is arranged between one of the discs 32 and the head 22 and surrounds the extension 23 on said head. These springs 37, 38, 39 and 40 offer successively increasing resistances to the movement of the piston rod 24 under the action of the increasing pressures in the chamber 26. Nuts 41 are threaded upon the end of the piston rod and act against one of the discs 32 and permit of the adjustment of the tension of the spring 37 to determine the normal or low pressure position of the piston 24 and therefore, the maximum stroke of the piston of the pump 5.

From the foregoing description, the operation of the device will be understood as follows: At the lowest pressure, the slide 18 and the end of the link 19 are in the position shown in full lines with respect to the axis 16 of lever 15 so that a maximum reciprocating stroke is imparted to the piston of the pump 5. In the piston movement in one direction, the hydraulic pressure fluid is drawn into the pump cylinder from the tank 7 and in the movement of the piston in the opposite direction, it is ejected therefrom through the pipe 10 and conducted to the press 6. As this operation continues and the pressure gradually increases, said pressure fluid being transmitted through the pipe 27 to the chamber 26 acts against the surface 30 of the differential piston 24 and moves said piston to the left against the expansive pressure of the first spring 37. In this movement of the piston 24, through the link connection 31, the slide block 18 is shifted on lever 15 towards the axis 16 thereof, thus automatically shortening the stroke of the pump piston in the rocking movement of said lever and to a corresponding extent reducing the transmission of power necessary to operate the pump. With each further increase of pressure, there will be a further movement of the piston rod 24. It will be noted that the discs 32 are provided with hub portions and when the first spring 37 is fully compressed, the hub portions of the discs at the opposite ends thereof are in contact with each other so that the two discs will then move as a unit and the next spring 38 of greater resistance will then be compressed. As the increase of the pump pressure continues, the spring 39 is compressed, and finally at the maximum pressure, the spring 40 is compressed at which time the pivotal connection between the end of link 19 and slide block 18 will be coincident with the fulcrum 16 of the rocking lever 15 so that no movement will be transmitted to the piston of the pump 5. Upon a decrease of pressure at the place of utilization, as by the opening of valve 28, the several springs 40, 39, 38 and 37 will successively expand and return the discs 32 to their normal positions within the cylinder 21. To the extent to which the pressure is decreased, the reciprocating movements of the pump piston are resumed. In this manner, it will be apparent that the length of stroke of the pump piston is approximately in inverse ratio to the variations in pressure in the press 6 or other machine where the hydraulic pressure developed by the operation of the pump is to be utilized. It will of course, be understood that the connections between the differential piston 24 and the operating means for the piston of the pump 5 as herein disclosed is merely suggestive, and the arrangement of this differential piston and the successively acting springs as shown in Fig. 2 of the drawings may be also utilized to function in the manner above explained in connection with various other mechanical means for transmitting power to the piston of the pump 5. Also, it will be evident that this automatic power control means is applicable to hydraulic pumps which may be used for a great variety of purposes other than the furnishing of pressure to a seed press mill. In every case, the response of the power control mechanism to the variation in pressure is highly sensitive and by the employment of the separate and independently acting springs, the variable operation of the pump proceeds progressively, thereby obviating abrupt changes such as unavoidable accompany the use of pressure accumulators or the like.

While I have illustrated in Fig. 2 a preferable practical arrangement of the differential piston and the several independently acting spring members, it is nevertheless to

be understood that certain variations in detail in this part of the apparatus are possible, and I accordingly reserve the privilege of resorting to all such legitimate changes therein as may be fairly embodied within the spirit and scope of the invention as claimed.

I claim:

1. In automatic control means for pumps, a cylinder having a detachable head at one end provided with a chamber for connection to the pressure side of the pump, a piston reciprocating in said cylinder adapted for connection with a part of the pump operating means, and said piston having a part in said chamber acted upon by the pump pressure to move the piston in one direction, and a plurality of springs in said cylinder progressively increasing in strength and independently acting to resist movement of said piston in response to cumulative pressure within said chamber.

2. In automatic control means for pumps, a cylinder having a detachable head at one end provided with a chamber for connection to the pressure side of the pump, a piston reciprocating in said cylinder adapted for connection with a part of the pump operating means, and said piston having a part in said chamber acted upon by the pump pressure to move the piston in one direction, the wall of said cylinder having longitudinally spaced internal stop shoulders thereon, a series of spaced discs loosely engaged upon the piston within said cylinder, and coil springs progressively increasing in strength bearing upon said discs to yieldingly hold the same in contact with the stop shoulders and independently acting in succession to yieldingly resist the movement of the piston in response to cumulative pump pressure within said chamber.

In testimony that I claim the foregoing as my invention, I have signed my name hereto.

MICHAEL NYROP.