A. T. DAWSON & J. HORNE.

CONTROLLING APPARATUS FOR USE IN CONNECTION WITH HYDRAULIC PUMPS.

APPLICATION FILED MAY 9, 1917.

1,270,794.

Patented July 2, 1918.

3 SHEETS—SHEET 1.

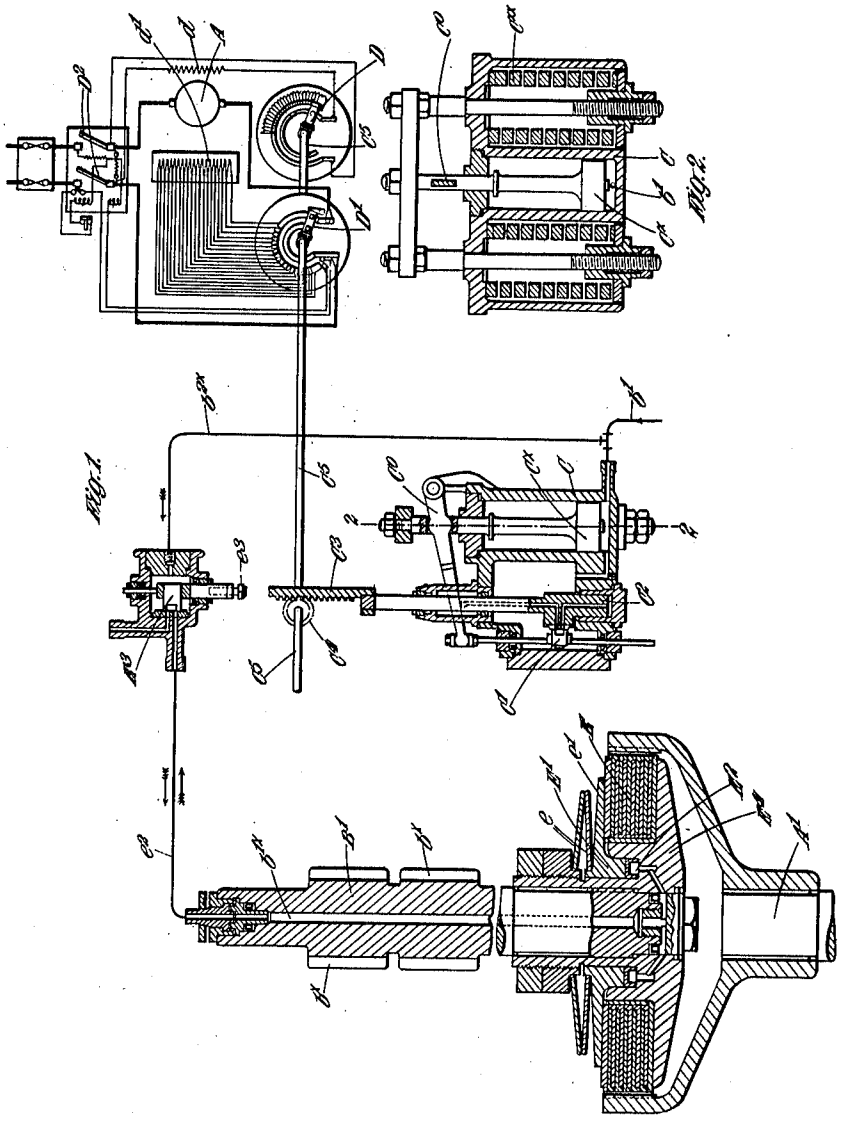


Fig. 2.

Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 3.

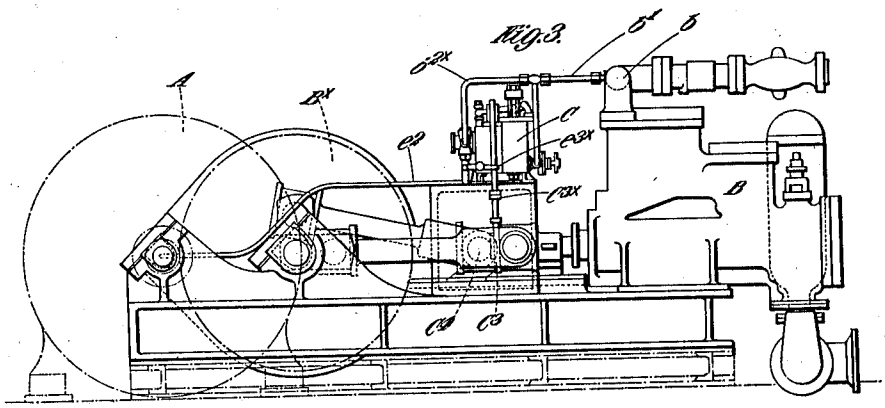
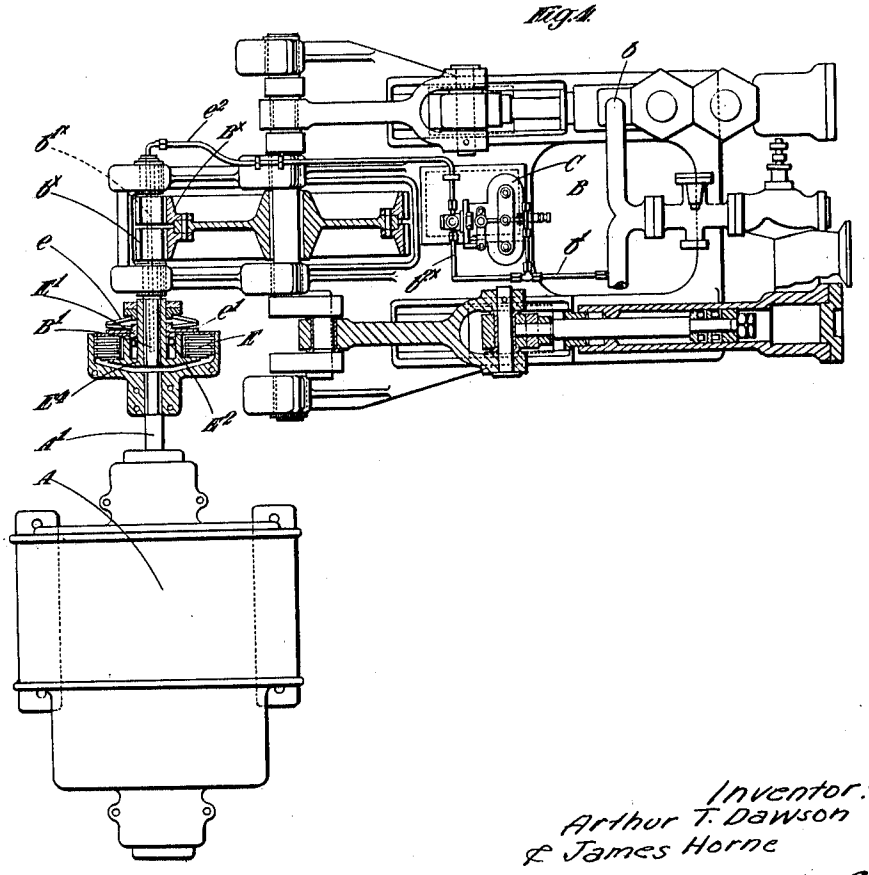


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

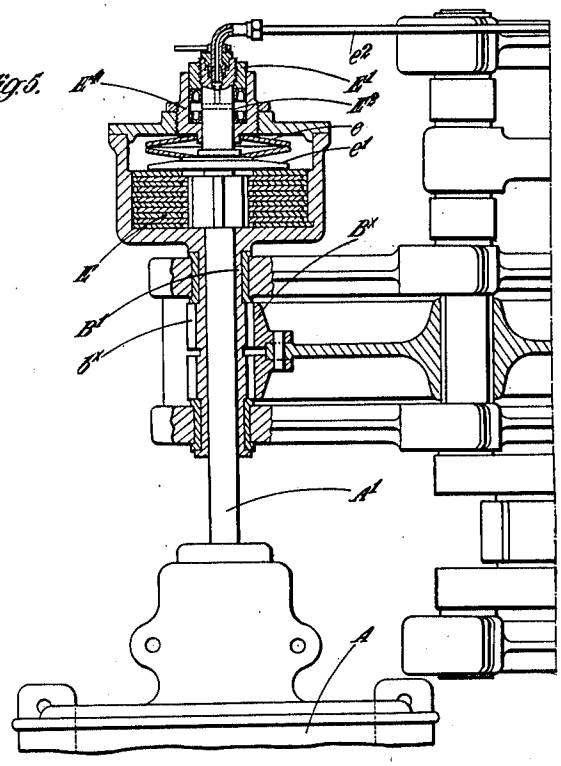
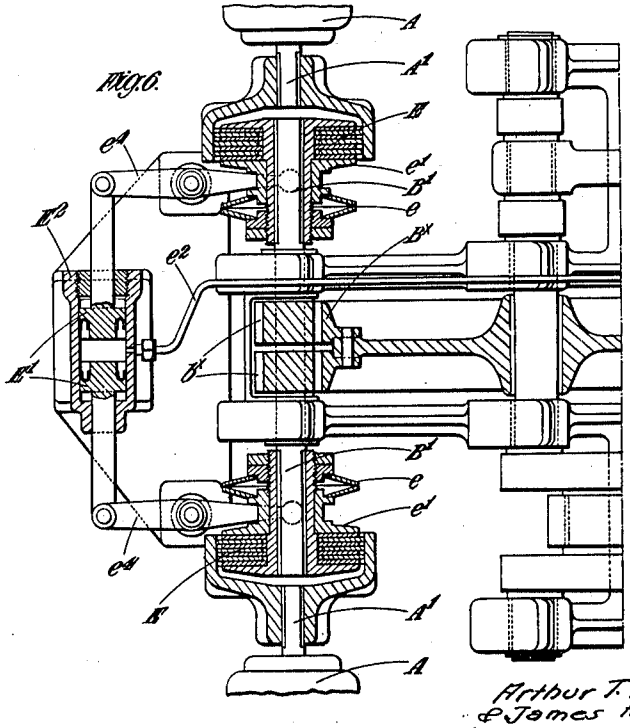


Fig. 6.



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UNITED STATES PATENT OFFICE.

ARTHUR TREVOR DAWSON, OF WESTMINSTER, AND JAMES HORNE, OF BARROW-IN-FURNESS, ENGLAND, ASSIGNORS TO VICKERS LIMITED, OF WESTMINSTER, ENGLAND.

CONTROLLING APPARATUS FOR USE IN CONNECTION WITH HYDRAULIC PUMPS.

1,270,794. Specification of Letters Patent. Patented July 2, 1918.

Application filed May 9, 1917. Serial No. 167,621.

To all whom it may concern:

Be it known that we, ARTHUR TREVOR DAWSON and JAMES HORNE, both subjects of the King of Great Britain, residing, respectively, at Vickers House, Broadway, Westminster, in the county of London, England, and Naval Construction Works, Barrow-in-Furness, in the county of Lancaster, England, have invented certain new and useful Improvements in or Relating to Controlling Apparatus for Use in Connection with Hydraulic Pumps, of which the following is a specification.

This invention relates to controlling apparatus for use in connection with hydraulic pumps such as employed for supplying liquid under pressure to presses or other hydraulic motors employed in operating machinery, for example heavy gun mountings.

According to this invention the motor which drives the pump is automatically disconnected from the latter when the demand on the pressure liquid of the pump reaches a predetermined low limit, but is adapted to be automatically connected to the pump when the demand on the pressure liquid increases. For this purpose a hydraulically actuated clutch may be provided, the operation of which is dependent upon the pressure of the liquid in the pump system. This invention has particular reference to apparatus wherein the pump is operated by an electric motor the speed of which is automatically controlled in accordance with the pressure of the liquid in the pump system; a device is provided which is responsive to varying fluid pressures which through a suitable switch regulates the speed of the motor from full speed to half speed by cutting out the resistance from the field circuit of the motor and from half speed to lowest running speed by inserting resistance in the armature circuit, the said device also being adapted to actuate a hydraulic valve when the motor is running at its lowest practical running speed for allowing the hydraulic clutch to be operated and so disconnect the electric motor from the pump.

In order that the said invention may be clearly understood and readily carried into effect we will describe the same more fully with reference to the accompanying drawings, in which:—

Figure 1 is a general view illustrating diagrammatically, one embodiment of the invention, the separate parts being shown for purposes of illustration in positions which they do not necessarily occupy in practice.

Fig. 2 is a section taken approximately on the line 2, 2 of Fig. 1.

Figs. 3 and 4 are respectively a side elevation and a plan showing on a smaller scale a constructional form of the pump and its associated parts.

Fig. 5 is a sectional plan showing on a larger scale than Figs. 3 and 4 a modified form of the means shown in Figs. 1, 3 and 4 for automatically disconnecting the electric motor from the pump, and

Fig. 6 is a view similar to Fig. 5 showing still another form of the said means.

A is the electric motor and A′ its shaft. B is the pump and B′ its driving shaft. The pump may be of the double acting two or three cylinder reciprocating type and delivers water under pressure through a pressure main b (see Figs. 3 and 4) to the hydraulic motor (not shown) for operating the machinery to be driven. The pistons or rams of the pump are actuated by one or more pinions b^x, b^x on the shaft B′ gearing with a toothed wheel B^x on the crank shaft of the pump. Connected to the main b is a small pipe b' which in turn is connected to the lower end of a cylinder C containing a spring loaded piston C^x which can move against the action of the springs C^{xx} under the influence of and to an extent dependent upon the pressure of the liquid in the pipe b'. The piston C^x is connected by a rocking arm or lever C^0 to a slide valve C′ which controls the supply of pressure liquid from the pipe b' through a port leading to the lower surface of a motor ram C^2 to enable the latter to be raised in accordance with the pressure of the liquid, the valve also enabling the aforesaid port to be placed in communication with an exhaust port leading to the upper part of the ram when the ram descends. Thus the ram moves in accordance with the pressure of the liquid in the pump system. This ram carries a rack C^3 which is connected through suitable gearing such as the pinion C^4 and the shaft C^5, to switch arms D, D′: of these the former serves to regulate the speed of the electric motor from full speed to half speed by cut-

ting out resistance from the field circuit d and the switch arm D′ regulates the speed from half speed to lowest running speed by inserting resistance in the armature circuit d'. The said switch arms are preferably arranged to move about a common axis, that is to say they are both mounted on the shaft C^5. The means for automatically disconnecting the electric motor A from the pump B comprise a clutch E of the multiple plate type controlled by a spring e and operated by a hydraulic ram E′ working in a cylinder E^2 to which pressure liquid is admitted when the liquid in the pump system reaches a predetermined high pressure, for displacing the ram E′ into a position to relieve the clutch plates of the pressure of the spring e, thereby enabling the motor A to rotate without actuating the pump B. For this purpose the ram cylinder E^2 is connected by a pipe e^2 to a clutch control valve E^3 which is normally held by a spring, or by pressure liquid supplied by a branch pipe b^{2x} of the pipe b' in its exhaust position shown in Fig. 1 but which is adapted to be moved by the end of the aforesaid rack C^3 in Fig. 1, or by a collar C^{3x} thereon in Fig. 3, coming against a tappet e^3 (see Fig. 1) on the valve, or against a lever e^{3x} (see Fig. 3) connected to this valve, in order to displace the said valve and admit pressure liquid to the ram cylinder E^2, thereby relieving and finally removing the pressure of the clutch spring e from the friction plates. The ram E′ in Figs. 1, 4 and 5 is arranged co-axially with respect to the shafts A′ and B′ and forms part of or is connected to a disk e' interposed between the clutch spring e and the friction plates. The ram cylinder E^2 in these figures is formed in a part E^4 connected to the shaft B′. In Figs. 1 and 4 the shafts A′, B′ are arranged end to end and the shaft B′ is formed with an axial conduit B'^x communicating at one end with the ram cylinder E^2 and at the other end with the pipe e^2. In Fig. 5 the shaft A′ passes axially through the shaft B′ and the clutch E is situated at the outer end of the shaft A′.

In each of the examples shown by Figs. 1, 4 and 5 only one electric motor is employed, but in Fig. 6 two electric motors are used; in this case two clutches E, E are employed, the aforesaid disk e' of each of the clutches being connected by a lever e^4 to the ram or piston E′. These two rams or pistons are disposed in a single cylinder E^2 so that when pressure liquid is admitted to the central portion of the cylinder E^2 by the aforesaid pipe e^2, the disks e' will be moved to relieve the pressure of the springs e, on the friction plates of the clutches, thereby disconnecting the motors simultaneously from the pump as aforesaid.

The aforesaid switch D may be employed for starting the motor or motors by disconnecting the switch from the rack C^3, and in order that the switch may thus be used with safety, a double pole circuit breaker D^2 is provided.

The operation of the apparatus shown on the drawings is as follows:—

Assuming the motor to be running at full speed and a demand for full hydraulic power, the piston C^x will be in its lowest position, the springs C^{xx} being capable of holding it against normal pressure. The motor ram C^2 will hold the speed regulating switch at a position for full speed and the clutch control valve slide E^3 will allow liquid in the ram cylinder E^2 of the clutch E to pass to the exhaust so that spring e acts on the friction plates of the clutch thereby transmitting the drive of the motor to the driving shaft of the pump. When the demand for hydraulic power becomes less, the liquid pressure in pipes b and b' will gradually rise and acting on the piston C^x will raise motor ram C^2 in the manner previously explained and consequently the switch arm will be moved to a position corresponding to the power required. The clutch control valve E^3 will only come into operation when the demand for hydraulic power has become so small that the speed of the motor is at its lowest practical limit, the said valve being then operated by the motor ram C^2 to admit fluid pressure to ram E′ of the clutch so as to first relieve and finally release the pressure of the springs e from the friction plates, and thus allow the motor to run free until a further demand for hydraulic power when the reverse operation takes place.

It will, of course, be understood that the operation of the arm D to cut out resistance from the field circuit of the motor, the operation of the arm D′ to insert resistance in the armature circuit of the motor and the subsequent operation of the fluid controlled means to throw out the clutch, results in a three step control of the pump so that the speed of the motor may be reduced initially and then further reduced as the occasion requires. If this reduction is not sufficient, the motor will be entirely disconnected from the system but will remain running at a low speed.

What we claim and desire to secure by Letters Patent of the United States is:—

1. The combination with a hydraulic pump, of an electric motor for driving same, means responsive to and actuated by the pressure of the liquid in the pump system, a switch for controlling the speed of the motor and operated by said means so that the speed of the motor is controlled in accordance with the pressure of the liquid, a hydraulically operated clutch for connecting the motor to the pump and a device operated by said liquid responsive means for allow-

ing pressure liquid to actuate said clutch and thus disconnect the motor from the pump.

2. The combination with a hydraulic pump, of an electric motor for driving same, means responsive to and actuated by the pressure of the liquid in the pump system, a regulating device actuated by said means for controlling the speed of the motor in accordance with the liquid pressure in the system by controlling resistances in the armature and field circuits of the motor, a hydraulically operated clutch for connecting the motor to the pump and a valve operated by said liquid responsive means when the speed of the motor reaches a predetermined low limit for allowing liquid pressure to actuate said clutch and thus disconnect the motor from the pump.

3. The combination with a hydraulic pump, of an electric motor for driving the same, means responsive to and actuated by the pressure of the liquid in the pump system, a regulating device actuated by said means for controlling the speed of the motor in accordance with the pressure in the pump system, and comprising two switches one which regulates the speed of the motor from full speed to half speed by cutting out resistance from the field circuit of the motor and the other for controlling the speed from half speed to lowest running speed by inserting resistance in the armature circuit of the motor, a hydraulically operated clutch which normally connects the motor to the pump and a valve operated by said liquid responsive means when the speed of the motor reaches a predetermined low limit for allowing liquid pressure to operate said clutch and thus disconnect the motor from the pump.

4. The combination with a hydraulic pump, of an electric motor for driving same, means responsive to and actuated by the pressure of the liquid in the pump system, a regulating device actuated by said means for controlling the speed of the motor in accordance with the pressure of the liquid in the pump system, a hydraulically operated clutch, a spring acting on said clutch to cause the latter to connect the motor and the pump together, a valve actuated by said liquid responsive means when the speed of the motor reaches a predetermined low limit for allowing pressure liquid to move said clutch against the action of the spring to disconnect the motor from the pump.

5. The combination with a hydraulic pump of a motor for driving same, a clutch for connecting the motor to the pump, a device for controlling the speed of motor, a motor actuated by and in accordance with the pressure in the pump system for operating said speed controlling device and said clutch.

In testimony whereof we affix our signatures.

ARTHUR TREVOR DAWSON.
JAMES HORNE.