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HYDRAULIC SERVOMOTOR FOR TRAIN CONTROLLERS AND THE LIKE

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Fig. 1.

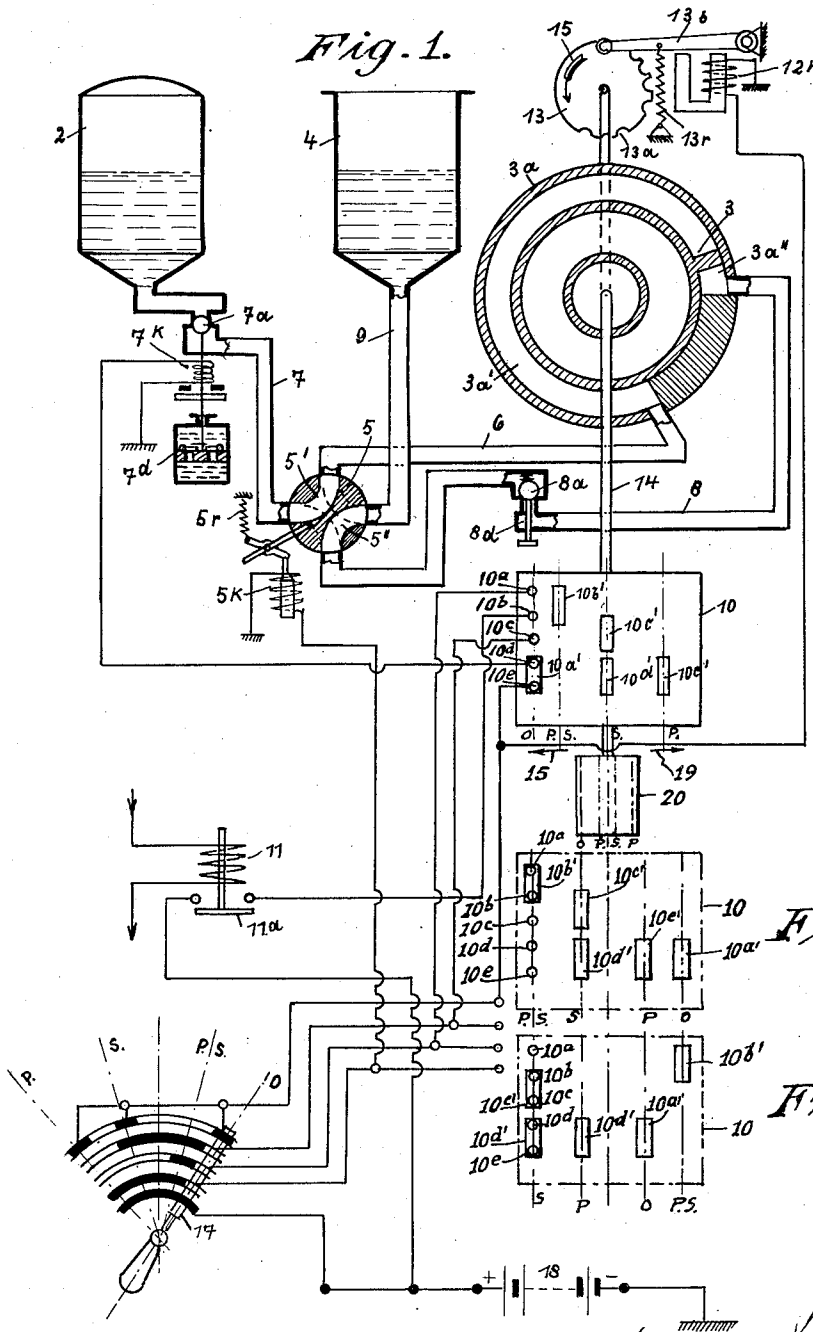


Fig. 2.

Fig. 3.

Inventor:
Henri Pieper,
By James Appleman
attorney.

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HYDRAULIC SERVOMOTOR FOR TRAIN CONTROLLERS AND THE LIKE

Henri Pieper, Brussels, Belgium

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6 Claims. (Cl. 121—40)

My invention relates to a motor driving device for controllers of electric power vehicles in multiple unit trains, for vehicle doors or similar apparatus to be adjusted at different points of a circular, rectilinear or other path of motion, in which apparatus a piston serving to drive this apparatus is moved by a pressure liquid and can be connected, by means of distributing members, at both sides to a charge-reservoir or a discharge reservoir respectively.

According to my invention this driving and controlling device is simplified in its construction and improved in its mode of operation by that an electromagnet effects the stopping of the driving piston and of the apparatus to be adjusted in the desired position without the aid of a special valve inserted otherwise in the circuit of the liquid. For this purpose, according to my invention, this electromagnet which is excited after the starting of the apparatus to be adjusted, effects at the desired instant through the instrumentality of the engagement of a detent in a grooved disc the stopping of the driving piston and thereby also the arresting of the pressure liquid. There is thus effected with simple means a sudden shifting of the apparatus to be adjusted from one position to another and an accurate arrest of the driving piston at the desired point of the path of motion. The excitation of this electromagnet takes place after the starting of the apparatus to be adjusted preferably at the instant at which the detent resting on the periphery of the grooved disc sets about to enter into the groove which corresponds with the desired position and the electromagnet remains excited until the driving piston is started again, before which start it is switched off for an instant.

The drawing shows in Fig. 1 by way of example one embodiment of my invention as applied to a driving device to adjust a controller for an electric power car. Figs. 2 and 3 show the rotating contact drum of the arrangement of Fig. 1 in two positions differing from the position shown in Fig. 1.

The driving device comprises a driving liquid, for example, oil and a charge reservoir 2 containing compressed gas, for example, compressed air, a discharge reservoir 4 which is open to the atmosphere and a hydraulic rotary piston motor, which consists of an annular cylinder 3*a* and an oscillating blade-like piston 3. The two spatially variable compartments 3*a'* and 3*a''*, which are formed in the cylinder 3*a* by means of the blade-piston 3, can be placed in communication alternately with the charge reservoir 2 or the discharge reservoir 4 by means of a distributing cock 5, which is adjusted by means of an electromagnet 5*k* in opposition to the action of a spring 5*r*. When the electromagnet 5*k* is not excited, the spring 5*r* holds the cock 5 in the position represented in full lines in the drawing, in which the cylinder compartment 3*a'* is connected with the pressure reservoir 2 through the ducts 6, 7 and the port 5' in the cock, while the cylinder compartment 3*a''* is connected to the discharge reservoir 4 by way of the ducts 8, 9 and the port 5'' in the cock. When the electromagnet 5*k* is excited, it rotates the cock 5 into the position indicated in dotted lines in the drawing, in which the cylinder compartment 3*a'* is connected with the discharge reservoir 4 and the cylinder compartment 3*a''* with the charge reservoir 2. By turning the cock 5 into the one or the other of these two positions the rotation of the blade-piston 3 in the clockwise direction or in the opposite direction of rotation is in this manner effected by the driving liquid.

The shaft 14 of the rotary piston 3 carries a disc 13 provided with grooves 13*a* and a latch-shaped detent 13*b* is drawn against the periphery of the disc 13 by means of a spring 13*r* and also by means of an electromagnet 12*k* when the latter is excited. The electromagnet 12*k* is designed to be powerful enough to arrest the motion of the rotary piston 3 and so to stop said piston and the apparatus which is to be adjusted, when the electromagnet coil 12*k* is switched in and holds the detent 13*b* in firm engagement with a groove 13*a* of the disc 13. The spring 13*r* alone is unable to stop the piston 3. The duct 7 contains a valve 7*a* which opens according to the cock 5 and is held closed by means of an electromagnet 7*k*, when the latter is excited. A damper 7*d*, the piston of which moves in a liquid and is provided with small openings, permits the valve 7*a* to be opened quickly by switching off the electromagnet 7*k* but retards the closing movement of this valve when the electromagnet 7*k* is excited. The duct 8 possesses a valve 8*a* which rests on a set-screw 8*d* under the action of its weight or of a spring, which set-screw is so set that the valve 8*a* offers a small opening for the liquid in the direction of flow towards the cylinder 3*a* and a large opening in the opposite direction of flow.

The electromagnets 7*k* and 12*k* are controlled by means of a drum 10, which is coupled with the piston shaft 14 and is provided with contact-pieces 10*a'*, 10*b'*, 10*c'*, 10*d'*, and 10*e'*. The drum 10 can be set in different positions, for example, in four different positions relatively to the fixed

contacts 10a, 10b, 10c, 10d and 10e. The circuits of the electromagnets 7k and 12k also pass through the segments of a hand change-over switch 17, which is connected with the battery 18 or another source of electric energy. The electromagnet 5k, which controls the cock 5, is connected directly to one of the segments of the change-over switch 17. The hand-lever of the change-over switch 17 can occupy four positions corresponding to the four positions of the drum 10. When it is a matter of driving a controller 20 for electric motors, the position 0 of the change-over switch 17 corresponds to the zero position of the controller, the position P. S to the connection of the electric motors in series with resistances switched in, the position S to the connection in series without resistances and the position P to the connection of the electric motors in parallel, while the return of the controller into the zero position can take place in one movement without intermediate positions. In order to block the driving device if the current of the electric motors exceeds a definite amount, a relay which is traversed by said current is provided, which closes a keeper 11a when the current strength reaches the determined amount. The switch 11a of the relay 11 then connects the electromagnet 12k directly with the battery 18 and this electromagnet effects the stopping of the motor 3 and consequently also that of the controller of the electric motors, until the motor current resumes its ordinary value.

The driving device works as follows:—When the hand-switch 17 occupies the position 0 the drum 10 is also in the position 0 shown in Fig. 1 and the electromagnet 7k is excited by way of the contact-piece 10a' in the drum 10 and keeps the valve 7a closed, while the electromagnets 5k and 12k are switched off. The closed valve 7a prevents the pressure in the reservoir 2 from acting on the liquid in the cylinder 3a, so that in the latter no losses of liquid can occur through liquid passing over from one side of the blade-piston 2 to the other. If the hand switch 17 is moved into the position P. S the electromagnet 7k is switched off so that the valve 7a can open and at the same time the electromagnet 5k is switched in, which electromagnet then moves over the cock 5 into the position drawn in dotted lines, in which position the cylinder compartment 3a' is connected to the discharge reservoir 4 and the cylinder compartment 3a'' to the charge reservoir 2. The piston 3 and the drum 10 are consequently set in rotation in the direction of the arrow 15 by means of the driving liquid. As soon as the drum 10 has reached the position P. S shown in Fig. 2 it closes the circuit of the electromagnet 12k at the contact-piece 10b', which at this instant bridges over the fixed contacts 10a and 10b. The excited electromagnet 12k presses the detent 13b into the groove 13a of the disc 13 which corresponds to the position P. S. and so arrests instantaneously the piston 3 and the driving liquid in this position. The excitation of the electromagnet 12k commences at the instant at which the detent 13b sets about to fall into the groove 13a corresponding to the position P. S.

When the hand-switch 17 is brought from the position P. S into the position S, there takes place another switching off of the electromagnet 12k, so that the driving liquid can again set in rotation the rotary piston 3 and the drum 10 and also the apparatus to be adjusted. As soon as the drum 10 reaches the position S shown in Figure 3, its contact-pieces 10c' and 10d' close the circuits of the electromagnets 12k and 7k. The electromagnet 12k again stops the piston 3 and the drum 10, while the closure of the valve 7a produced by means of the excited electromagnet 7k is accomplished slowly owing to the retarding action of the damper 7d. If the hand-switch 17 is brought from the position S into the position P the circuits of the electromagnets 7k and 12k are again broken by the hand switch 17 before it reaches the position P, which permits the restarting of the piston 3 and of the drum 10 by means of the driving liquid because the deenergized electromagnet 7k allows the valve 7a to be opened by the pressure of the reservoir 2, whilst the deenergized electromagnet 12k allows the piston 3 to be driven by the pressure liquid coming from the reservoir 2 through the valve 7a and the pipes 7 and 8. The drum 10 maintains the break in the circuit of the electromagnet 7k during its passage from the position S to the position P whilst it on its arrival in the position P closes by means of its contact piece 10e' again the circuit of the electromagnet 7k, which on the other hand is completed by the hand switch 17 occupying at this instant the position P. The excited electromagnet 7k arrests the motion of the driving liquid by closing the valve 7a, while the piston 3, which has now reached the end of its stroke can be stopped in the position P simply by means of a stop on the cylinder 3a so that a further excitation of the electromagnet 12k is not necessary.

The electromagnet 5k remains excited in the three positions P. S, S and P of the hand-switch 17 and during the whole of this time holds the cock 5 in the position indicated by dotted lines, in which it connects the cylinder compartment 3a'' with the pressure reservoir 2. Since the valve 8a has a passage of small cross-section for the driving liquid in the direction of flow towards the cylinder compartment 13a, the movement of the piston 3 and consequently of the apparatus to be adjusted can take place in the direction of the arrow 15 at only a moderate velocity. In order to return the apparatus to be adjusted into the zero position, the hand-lever 17 is brought back into the position 0 in one movement without intermediate positions. On the arrival of the hand-lever 17 in the position 0 the circuit of the electro-magnet 5k is interrupted, so that the spring 5r can shift the cock into the position indicated in full lines, in which the pressure-reservoir 2 is connected with the cylinder-compartment 3a' and the discharge reservoir 4 with the cylinder-compartment 3a''.

On the other hand during the return of the hand-switch 17 from the position P into the position 0 the electromagnet 7k is switched off for a definite time which is sufficient to allow the valve 7a to open in consequence of the non-excitation of the electromagnet 7k. Since the closure of the valve 7a on the electromagnet 7k being switched in again in the position 0 of the hand-switch 17 can be accomplished only slowly in consequence of the retarding action of the damper 7d the driving liquid has sufficient time to return in the direction of the arrow 19 into the zero position the piston 3 and the drum 10 and also the apparatus to be adjusted before the valve 7a is completely closed again. The quick return into the zero position is facilitated by the valve 8a, which presents a passage with a large cross-section to the liquid flowing away from the cylinder compartment 3a'' towards the discharge reservoir 4.

The arrest of the piston 3 in the zero position, in which the electromagnet 12k is not excited, can be effected by means of a stop on the cylinder 3a, since the piston in this position is at the other end of its stroke.

My invention may also of course be carried out in details in a manner deviating from the example illustrated, a motor with a reciprocating piston being for example employed instead of the rotary piston motor shown in the drawing.

Having now described the nature of my invention I declare what I claim is:—

1. A hydraulic servo-motor for driving an element step by step and locking it in any desired step, comprising in combination a charging reservoir containing liquid under pressure, a cylinder, a piston in this cylinder for driving the apparatus to be adjusted, a discharging reservoir, distributing means for connecting said cylinder on both its ends alternately to said charging reservoir and to said discharging reservoir, means for controlling electrically said distributing means, a disc driven by said piston and having grooves corresponding in number and position to the individual positions of arrest of the apparatus to be adjusted, a pawl-like organ resting on said grooved disc and capable of engaging in the grooves of said disc, an electromagnet capable of acting when excited upon said pawl-like organ so as to bring it into engagement with one of the grooves of said grooved disc and thereby to arrest the driving piston and the pressure liquid, and means for exciting said electromagnet after the starting of the apparatus to be adjusted.

2. A hydraulic servo-motor for driving an element step by step and locking it in any desired step, comprising in combination a charging reservoir containing liquid under pressure, a cylinder, a piston in this cylinder for driving the apparatus to be adjusted, a discharging reservoir, distributing means for connecting said cylinder on both its ends alternately to said charging reservoir and to said discharging reservoir, means for controlling electrically said distributing means, a disc driven by said piston and having grooves corresponding in number and position to the individual positions of arrest of the apparatus to be adjusted, a pawl-like organ resting on said grooved disc and capable of engaging in the grooves of said disc, an electromagnet capable of acting when excited upon said pawl-like organ so as to bring it into engagement with one of the grooves of said grooved disc and thereby to arrest the driving piston and the pressure liquid, and controlling means driven by said piston for exciting said electromagnet at the instant at which the pawl-like organ moves to enter into the groove of said disc corresponding to the desired position and for maintaining this excitation until said driving piston is started again and manual means for switching off this excitation for a certain time when said piston is to be started again.

3. A hydraulic servo-motor for driving an element step by step and locking it in any desired step, comprising in combination a charging reservoir containing liquid under pressure, a cylinder, a piston in this cylinder for driving the apparatus to be adjusted, a discharging reservoir, distributing means for connecting said cylinder on both its ends alternately to said charging reservoir and to said discharging reservoir, means for controlling electrically said distributing means, a disc driven by said piston and having grooves corresponding in number and position to the individual positions of arrest of the apparatus to be adjusted, a pawl-like organ resting on said grooved disc and capable of engaging in the grooves of said disc, an electromagnet capable of acting when excited upon said pawl-like organ so as to bring it into engagement with one of the grooves of said grooved disc and thereby to arrest the driving piston and the pressure liquid, and controlling means driven by said piston for exciting said electromagnet at the instant at which the pawl-like organ moves to enter into the groove of said disc corresponding to the desired position and for maintaining this excitation until said driving piston is started again and manual means for switching off this excitation for a certain time when said piston is to be started again, a valve inserted between the cylinder of said driving piston and said charging reservoir and means for electrically controlling said valve so as to shut off the supply of liquid to said cylinder in all positions in which the apparatus to be adjusted remains stopped during a certain time.

4. A hydraulic servo-motor for driving an element step by step and locking it in any desired step, comprising in combination a charging reservoir containing liquid under pressure, a cylinder, a piston in this cylinder for driving the apparatus to be adjusted, a discharging reservoir, distributing means for connecting said cylinder on both its ends alternately to said charging reservoir and to said discharging reservoir, means for controlling electrically said distributing means, a disc driven by said piston and having grooves corresponding in number and position to the individual positions of arrest of the apparatus to be adjusted, a pawl-like organ resting on said grooved disc and capable of engaging in the grooves of said disc, an electromagnet capable of acting when excited upon said pawl-like organ so as to bring it into engagement with one of the grooves of said grooved disc and thereby to arrest the driving piston and the pressure liquid, and controlling means driven by said piston for exciting said electromagnet at the instant at which the pawl-like organ moves to enter into the groove of said disc corresponding to the desired position and for maintaining this excitation until said driving piston is started again and manual means for switching off this excitation for a certain time when said piston is to be started again, a valve inserted between said cylinder of said driving piston and said charging reservoir, an electromagnet capable of acting when excited upon said valve so as to close it, a damper connected to the armature of said electromagnet so as to retard its closing action and means for electrically controlling said electromagnet.

5. A hydraulic servo-motor for driving an element step by step and locking it in any desired step, comprising in combination a charging reservoir containing liquid under pressure, a cylinder, a piston in this cylinder for driving the apparatus to be adjusted, a discharging reservoir, distributing means for connecting said cylinder on both its ends alternately to said charging reservoir and to said discharging reservoir, means for controlling electrically said distributing means, a disc driven by said piston and having grooves corresponding in number and position to the individual positions of arrest of the apparatus to be adjusted, a pawl-like organ resting on said grooved disc and capable of engaging in the grooves of said disc, an electromagnet capable of acting when excited upon said pawl-like

organ so as to bring it into engagement with one of the grooves of said grooved disc and thereby to arrest the driving piston and the pressure liquid, and controlling means driven by said piston for exciting said electromagnet at the instant at which the pawl-like organ moves to enter into the groove of said disc corresponding to the desired position and for maintaining this excitation until said driving piston is started again and manual means for switching off this excitation for a certain time when said piston is to be started again, a valve arranged between said cylinder of said driving piston and said distributing means and presenting a passage of contracted cross-section to the liquid flowing towards said driving piston and a passage of large cross-section to the liquid flowing in the opposite direction.

6. A hydraulic servo-motor for driving an element step by step and locking it in any desired step, comprising in combination a charging reservoir containing liquid under pressure, a cylinder, a piston in this cylinder for driving the apparatus to be adjusted, a discharging reservoir, distributing means for connecting said cylinder on both its ends alternately to said charging reservoir and to said discharging reservoir, means for controlling electrically said distributing means, a disc driven by said piston and having grooves corresponding in number and position to the individual positions of arrest of the apparatus to be adjusted, a pawl-like organ resting on said grooved disc and capable of engaging in the grooves of said disc, an electromagnet capable of acting when excited upon said pawl-like organ so as to bring it into engagement with one of the grooves of said grooved disc and thereby to arrest the driving piston and the pressure liquid, and controlling means driven by said piston for exciting said electromagnet at the instant at which the pawl-like organ moves to enter into the groove of said disc corresponding to the desired position and for maintaining this excitation until said driving piston is started again and manual means for switching off this excitation for a certain time when said piston is to be started again, said driving piston and its cylinder being formed as a rotary piston motor.

HENRI PIEPER.