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L. JANISCH

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CONTROLLER

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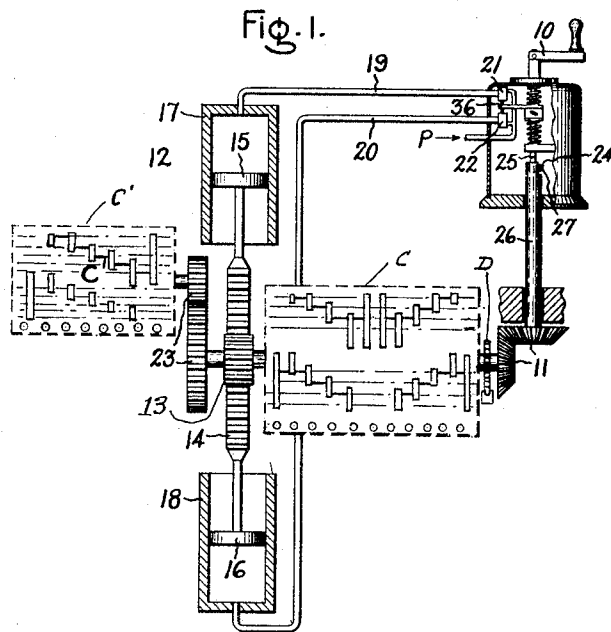


Fig. 2.

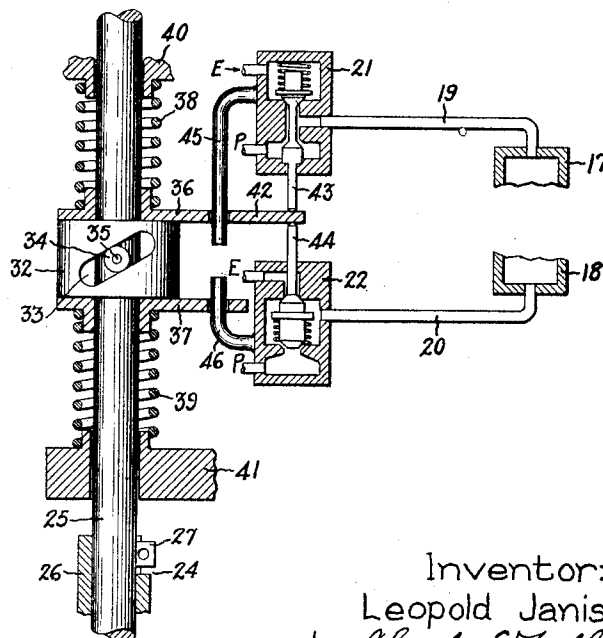
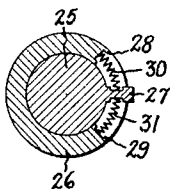


Fig. 3.



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CONTROLLER

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This invention relates to controllers, and more particularly to manually operated electric circuit controllers adapted for use in railway control, in battery control, or in transformer regulator control or the like where the controller is to be operated step by step through a series of positions.

In heavy duty service it is necessary that the controller be relatively large and of sturdy and rugged construction in order successfully to carry the large currents and at the same time it is important that the controller be accurately stopped at the termination of each step. With such heavy duty controllers the manual operation thereof becomes quite difficult and requires considerable manual strength with a resulting likelihood of improper or inaccurate operation thereof.

One of the principal objects of the present invention is to overcome this difficulty by providing an auxiliary power operating mechanism to assist in the manual operation of the controller.

Briefly, in accordance with the preferred form of the present invention this is accomplished by combining the hand operated driving mechanism for the controller with an auxiliary power operating mechanism consisting of two pressure pistons rigidly connected together by a rack gear which is connected to drive the manually operated controller. The arrangement is such that the controller can only be rotated by the simultaneous operation of the hand operated driving mechanism and the pneumatic auxiliary operating mechanism. The operation of the pneumatic auxiliary operating mechanism is controlled by valves which are arranged to be operated automatically upon operation of the manual operating handle. The distribution of pressure between the two pressure cylinders of the auxiliary pneumatic operating mechanism can be controlled directly through valves arranged to be mechanically operated upon movement of the manually operated controller handle, or if desired by means of electromagnetically operated valves having control contacts arranged to be operated by the manually operated controller handle.

Preferably the pneumatic auxiliary operating mechanism for the controller is arranged to operate on the balanced air principle, that is, the valves normally connect the two pressure cylinders to the compressed air supply line and operation of each valve serves to cut off the corresponding cylinder from the compressed air line and exhaust the cylinder to the atmosphere. Upon the deenergization of the electromagnetically operated valves or upon the release of the mechanically operated valves the valve automatically reverses and connects the corresponding cylinder of the pneumatic operating mechanism again with the compressed air supply line so that it will immediately be filled with compressed air to arrest further operation of the rack gear.

In order to provide a slight initial movement of the manually operated control handle for controlling the auxiliary pneumatic driving mechanism when the controller is to be operated or stopped, a lost motion connection is provided between the manual operating handle and the controller itself. In this way the control valves of the auxiliary pneumatic operating mechanism will be operated by the slight initial movement of the control handle so that the pneumatic operating mechanism and the control handle can function simultaneously to effect operation of the controller. Likewise, in stopping operation of the controller the relative movement between the operating handle and the controller itself permits the control valves to be operated to effect the stopping of the pneumatic device. The auxiliary pneumatic operating mechanism is so proportioned with reference to the controller that alone it does not exert sufficient power to operate the controller, but can only do so when manual pressure is simultaneously applied on the manual operating handle of the controller by the operator. In this way a very quick and accurate stopping of the pneumatic operating mechanism is obtained.

In the accompanying drawing illustrating a preferred embodiment of the present invention Fig. 1 shows diagrammatically the general arrangement of the manual operating

handle and the auxiliary pneumatic operating mechanism for the controller, while Fig. 2 illustrates a preferred form of mechanism for mechanically operating the control valves of the auxiliary pneumatic operating mechanism by the movement of the manual operating handle, and Fig. 3 is a sectional view showing the manner in which the lost motion connection is established between the manual operating handle and the controller in order to permit a slight relative movement of the handle in starting and stopping of the controller.

In Fig. 1, the controller C is shown diagrammatically and may be of the rotatable drum or cam type which is arranged to be operated by means of the manual operating hand 10 connected to drive the controller through the bevel gears 11. The controller C likewise is connected to be driven by the auxiliary pneumatic operating mechanism 12 through the agency of the pinion 13 and the rack gear 14. The pistons 15 and 16 of the pneumatic mechanism are connected to the opposite ends of the rack gear 14 and reciprocate within the pressure cylinders 17 and 18. Operating pressure is supplied from the pressure supply line P to the cylinders 17 and 18 through the pipes 19 and 20 under the control of the valves 21 and 22 respectively. If desired a secondary drum or cam type controller C' may be connected to the main controller C by the spur multiplying gears 23 arranged so that the secondary controller C' is revolved several times for each revolution of the main controller C. With such an arrangement of the controllers C and C' manual operation thereof alone would be very difficult, if not impossible, in case the controllers are designed for heavy duty service.

In order to provide a slight initial movement manual operating handle 10 is connected to drive the bevel gears 11 through a lost motion connection 24. This connection, as shown more clearly in the sectional view of Fig. 3, is arranged so that the shaft 25 to which the operating handle 10 is fixed, operates loosely within the hollow shaft 26, to which one of the bevel gears 11 is secured. The shoulder 27 extending from the handle operating shaft 25 operates between the fixed abutments 28 and 29 on the hollow shaft 26 preferably with the springs 30 and 31 interposed on either side of the shoulder 27.

The mechanism shown in Fig. 2 is provided for effecting operation of the control valves 21 and 22 upon the slight initial movement of the manual operating handle in either direction and to permit the valves to return to their normal biased positions in which they are shown upon release of the operating handle. This mechanism comprises a movable disk 32 provided with an inclined slot 33. The disk 32 is loosely mounted upon the shaft 25 which carries the

roller 34 on the pin 35 which latter is rigidly secured to the shaft 25. The two disks 36 and 37 surround the shaft 25 on opposite sides of the slotted disk 32 and are pressed against the disk 32 by the compression springs 38 and 39 extending from the fixed abutments 40 and 41, which preferably form the bearings for the shaft 25. The disk 36 has a projecting arm 42 extending between the operating spindles 43 and 44 for the control valves 21 and 22. The disk 36 is provided with a suitable hole for receiving the stationary guide pin 45 which serves to prevent rotation of the disk 36, while at the same time permitting unrestrained axial movement of the disk 36 along the shaft 25. Likewise the disk 37 is provided with an opening for receiving the stationary guide pin 46 for the same purpose.

Each of the controlling valves 21 and 22 is of the normal "on" type, that is, the valves are biased to the position in which pressure is admitted from the pressure supply line P to the pipes 19 and 20 connected with the cylinders 17 and 18, as indicated in Fig. 2. Upon operation of each valve from the biased position in which it is shown the pressure line P is cut off from the corresponding cylinder and the cylinder is connected to the exhaust conduits E. In this way the pressure of the opposing pistons may be unbalanced in reverse directions.

The operation of the controller is as follows: The handle 10 is normally maintained with the shoulder 27 on the handle operating shaft 25 midway between the abutments 28 and 29 on shaft 26 by the springs 30 and 31. Thus upon manual operation of the handle 10 in the clockwise direction relative movement between the shaft 25 and the shaft 26 occurs. This initial relative movement of the control handle 10 permits the roller 34 to raise the disk 32 by operating in the inclined slot 33. This results in moving the disk 36 axially along the shaft 25 so as to operate the control valve 21 from its normal "on" position to exhaust the pressure from the cylinder 17. Thus the unbalanced pressure in the opposite cylinder 18 becomes effective to supply power to assist the operator in effecting operation of the controller C. As previously pointed out, where the controller C is designed for heavy duty service with large contacts and heavy spring pressure, the manual operation thereof alone would be extremely difficult without additional assistance to the operator. This is particularly true where the secondary controller C' is connected through the multiplying gearing 23 to be rotated several times for each revolution of the main controller C. At the same time the additional force supplied by the pneumatic operating mechanism is insufficient to effect operation of the controllers C and C' without some driving force being

supplied through the operating handle 10. Thus with the simultaneous application of manual pressure on the operating handle 10 and pneumatic pressure on the piston 16, the controllers may be readily operated through their respective series of positions with only a nominal amount of work required of the operator.

In order quickly to stop operation of the controllers it is only necessary to release the pressure on the operating handle 10. Thereupon the spring 31 moves the manual operating shaft 25 to return the shoulder 27 to its mid position between the abutments 28 and 29. This results in the return of the roller 34 to its mid position in the inclined slot 33 of the disk 32, thereby lowering the disk 36 and returning the control valve 21 to its biased position. Immediately pressure is admitted from the pressure supply line P into the cylinder 17 to restore the balance between the pressure pistons 15 and 16.

The operation of the controllers in the reverse direction is accomplished in substantially the same manner by manual operation of the controller handle 10 in the counterclockwise direction. In this case the initial movement between the operating shafts 25 and 26 serves to lower the disk 36 and thereby operate the control valve 22 to exhaust pressure from the cylinder 18 in identically the same manner as previously described. Thereupon the unbalanced force of the pressure piston 15 combined with the force supplied through the operating handle 10 effects rotation of the controllers in the reverse direction. The quick stopping in the reverse direction is accomplished in substantially the same manner as previously described.

By having the operating handle 10 mechanically connected with the controller C the operator can readily feel the movement of the controller through its successive control positions. In this way the operator is enabled to stop the controller quickly and accurately when it has reached the desired position simply by releasing the pressure on the operating handle 10. In order to facilitate the feeling of the controller positions by the operator, a starwheel device may be provided on the controller C in accordance with the usual practice, although with a large size heavy duty controller, the engagement of the successive contacts serves substantially the same purpose.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, an electric circuit controller having a movable switch member adapted to be operated step by step each way through a series of circuit controlling positions, a manual operating handle mechanically connected to drive the switch member between said positions, an opposing piston balanced air pressure operating mechanism for

the switch member having insufficient force upon unbalancing the pressures on the pistons thereof to operate the switch member independently of said manual operating handle, and separately operable control valves for the balanced air pressure operating mechanism biased to maintain the pressures balanced on the piston, and means for operating the valves selectively upon movement of the manual operating handle in opposite directions to exhaust the air pressure from a corresponding piston and thereby allow the opposing piston to assist in driving the switch member between said position.

2. In combination, a rotatable circuit controller having a plurality of definite angular circuit controlling positions, a rotatable manual operating handle for driving the controller between said positions and having a lost motion mechanical connection therewith, an opposing piston balanced air pressure operating mechanism for the switch member having insufficient force upon unbalancing the pressures on the pistons to operate the switch member independently of said manual operating handle, separate control valves for the balanced air pressure operating mechanism biased to maintain the pressure balanced on the pistons, and means for operating the valves selectively upon the initial rotary movement of said manual operating handle in either direction relative to the controller due to said lost motion connection to exhaust the air pressure from a corresponding piston and thereby allow the opposing piston to assist in driving the switch member between said position.

3. In combination, a controller having a plurality of definite angular circuit controlling positions, a rotatably mounted manual operating handle mechanically connected to drive the controller in each direction between said positions through a lost motion connection, an auxiliary power operating mechanism for the controller comprising a pair of opposing normally balanced air pressure operated pistons mechanically connected to drive the controller in a direction dependent upon the unbalancing of the air pressure on the pistons, a pair of oppositely disposed control valves for unbalancing the pressure on said piston in reverse direction, and mechanism associated with the manual operating handle and having a member extending between said pair of oppositely disposed control valves for selectively operating one of said valves upon rotation of the handle to take up said lost motion connections in one direction and the other of said valves upon rotation of the handle to take up said lost motion connection in the opposite direction.

4. The combination of a rotatable circuit controller operable each way through a series of definite angular circuit controlling positions, a manual operating handle having a

- shaft mechanically connected to drive the controller between said positions through a lost motion connection therewith, an auxiliary power operating mechanism for the controller comprising a pair of opposing normally balanced air pressure operated pistons each providing a less amount of power than is required to operate said controller upon exhaustion of the pressure from the opposing piston, a pair of oppositely disposed control valves for unbalancing the pressure on said pistons in reverse direction and normally biased to maintain the pressure on the piston balanced, an operating mechanism for said valves including a member extending between the pair of oppositely disposed control valves and means associated with said operating handle for operating the member in one direction to selectively operate one of the control valves upon operation of the manual control handle to take up said lost motion in one direction and to operate the member in the other direction to selectively operate the other of said control valves upon operation of said control handle to take up said lost motion in the other direction.
5. The combination of a rotatable circuit controller having a series of definite operating positions, a rotatably mounted manual operating handle having a shaft mechanically connected to rotate the controller each way through a lost motion connection therewith, an auxiliary pneumatic operating mechanism for the controller comprising a pair of opposing normally balanced air pressure operated pistons, each providing upon exhaustion of the air pressure from the other a less amount of power than is required to operate said controller, control means for said mechanism including a pair of oppositely disposed control valves disposed in opposing spaced relation adjacent the shaft of said manual operating handle, each of said valves being biased to admit pressure to a corresponding piston, and valve operating mechanism having a rotatable member associated with said shaft and movable relatively thereto and a cooperating non-rotatable member extending between the said control valves and operable in a corresponding direction upon the initial movement of the operating handle in each direction to operate the corresponding control valve to exhaust the pressure from the corresponding piston whereby the pressure on the pistons is unbalanced in the direction corresponding to the direction of operation of said control handle.
6. The combination of a rotatable circuit controller operable each way through a series of positions, a manual operating handle therefor, mechanical connections providing a lost motion between the controller and the operating handle upon operation thereof in each direction, an auxiliary pneumatic operating mechanism for the controller comprising a pair of balanced opposing pressure operated pistons interconnected through rack and pinion gearing with the controller, a separate control valve normally biased to admit operating pressure to each piston, and mechanical means for operating a corresponding one of the valves upon the initial operation of the manual operating handle in each direction to render the other pressure piston effective to drive the controller comprising a non-rotatable member movable axially along the shaft of the operating handle in a direction dependent upon the direction of rotation of the handle.
- In witness whereof, I have hereunto set my hand this 22nd day of May, 1928.
- LEOPOLD JANISCH.