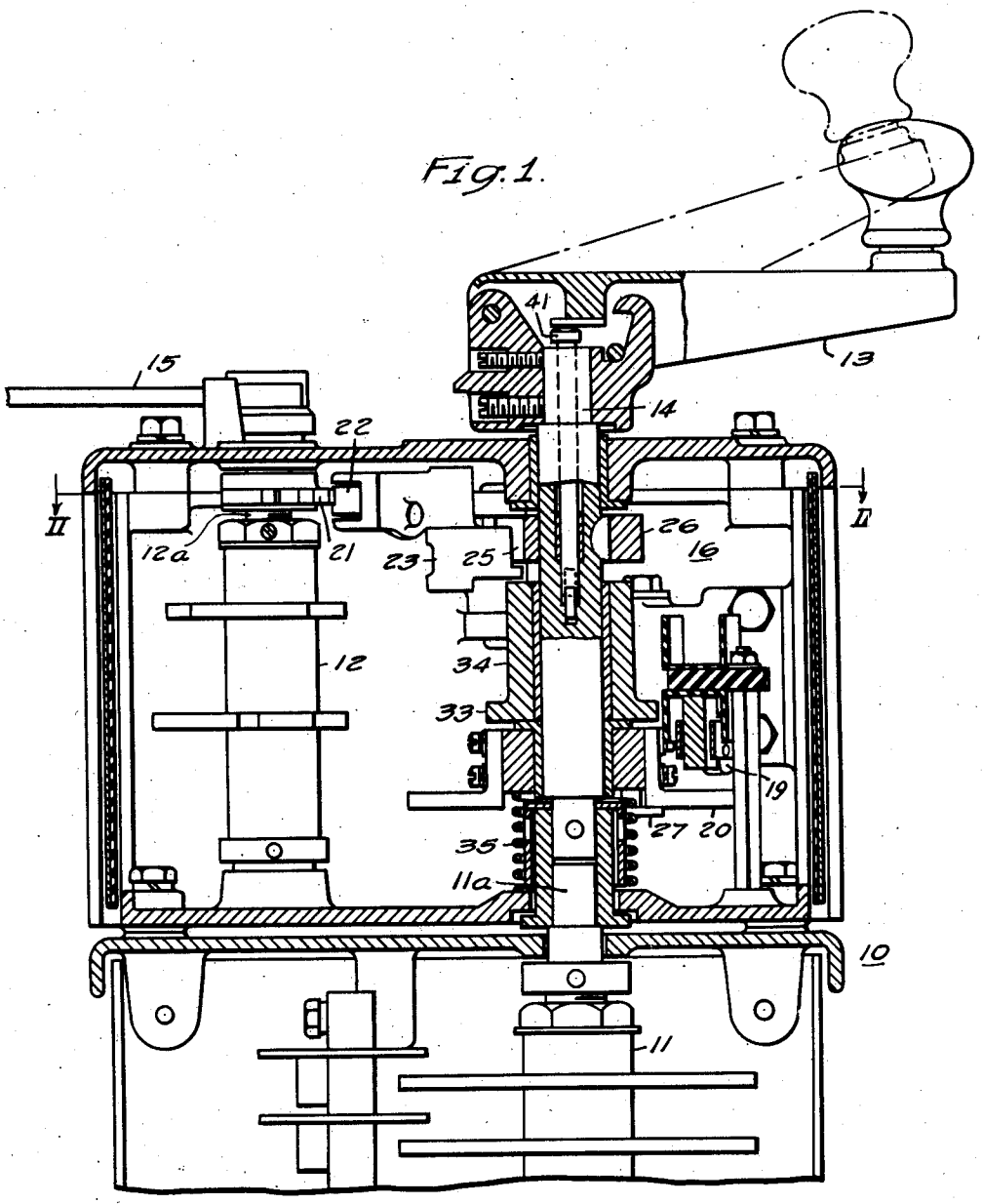
June 21, 1949. H. C. KRAPF 2,473,889

CONTROLLER

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Fig. 1.



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Fig. 2.

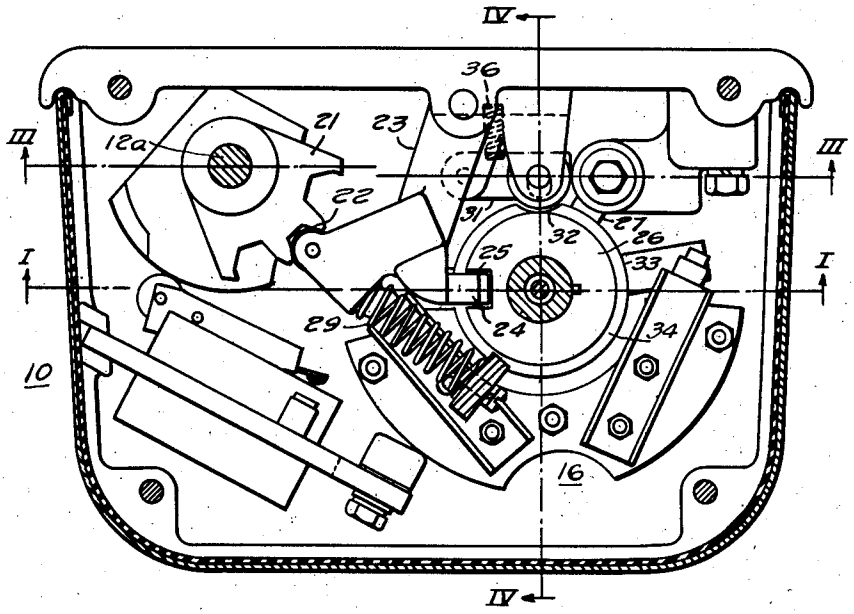
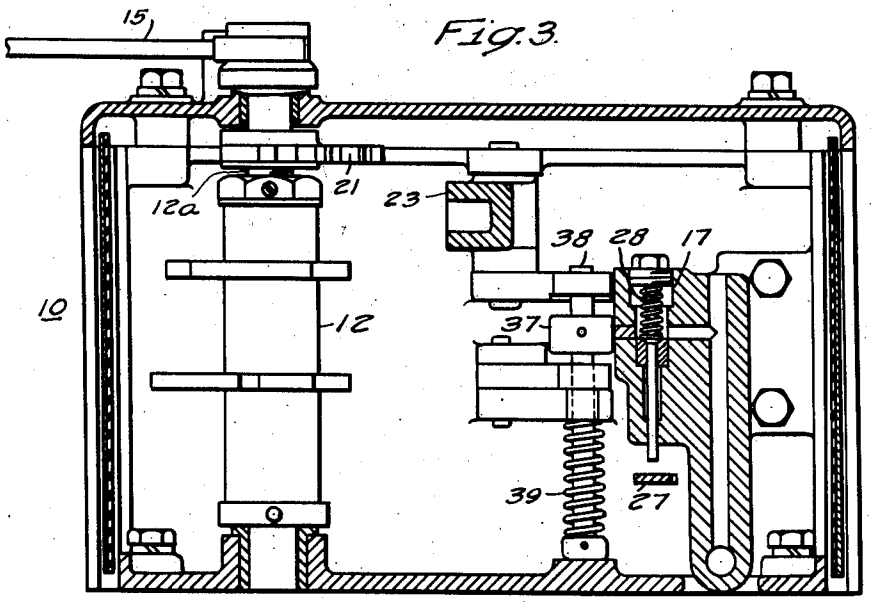


Fig. 3.



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Fig. 4.

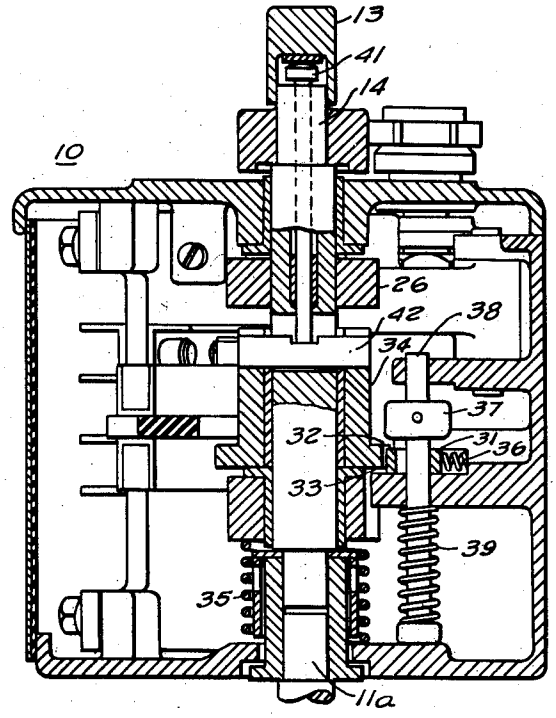
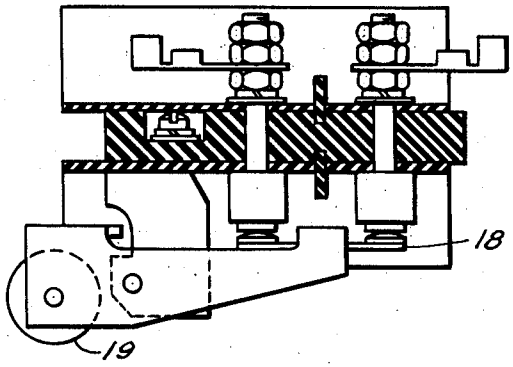


Fig. 5.



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UNITED STATES PATENT OFFICE

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CONTROLLER

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7 Claims. (Cl. 200—5)

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My invention relates, generally, to controllers and, more particularly, to controllers of a type suitable for controlling the operation of electric locomotives.

Locomotives for operation underground usually have to be as low in height as possible. Since the mining operations are moving farther away from the mine shaft or entry, heavier locomotives operating at higher speeds are required in order to maintain production schedules. Because of these conditions, mine operators look favorably upon equipment which helps to reduce accidents to both material and personnel.

The deadman's handle, which has been utilized for years on rapid transit systems and subways, has been proposed to increase safety conditions. However, this device as previously constructed is not suitable for use on controllers for mining locomotives because of the increased height of the controllers.

An object of my invention, generally stated, is to provide a controller which is low in height, simple in construction and efficient in operation.

A more specific object of my invention is to provide a simplified and improved mechanical interlock between the deadman's handle, the main drum, the reverse drum and the air brake application valve of a controller.

Other objects of my invention will be explained fully hereinafter or will be apparent to those skilled in the art.

In accordance with one embodiment of my invention the reverse drum of a controller is so interlocked with the deadman's device that the reverse drum cannot be operated unless the deadman's device is in the "off" position and the main drum can be locked with the handle depressed in the "off" position by placing the reverse drum in the neutral position. Also the handle of the main drum is locked in the "off" position until the handle is depressed and the handle is locked in the released position until the main drum is returned to the "off" position.

For a fuller understanding of the nature and objects of my invention, reference may be had to the following detailed description, taken in conjunction with the accompanying drawings in which:

Figure 1 is a view, partially in section and partially in elevation, of a portion of a controller embodying my invention, the section being taken along the line I—I of Fig. 2;

Fig. 2 is a view, in section, taken along the line II—II of Fig. 1;

Figs. 3 and 4 are views, in section, taken along

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the lines III—III and IV—IV, respectively, of Fig. 2, and

Fig. 5 is a view, partially in section and partially in elevation, of a set of auxiliary contact members disposed in the controller and actuated by the deadman's device.

Referring to the drawings, and particularly to Fig. 1, the structure shown therein comprises a portion of a controller 10 having a main drum 11 disposed on a shaft 11*a* and a reverse drum 12 disposed on a shaft 12*a* rotatably disposed therein. The main drum shaft 11*a* may be rotated by means of a handle 13 which is pivotally secured to an extension 14 of the shaft 11*a*. The reverse drum shaft 12*a* may be rotated by a handle 15 which is secured to the upper end of the shaft 12*a*.

As explained hereinbefore, a deadman's device 16 is provided in order to prevent accidents to the equipment and operating personnel. In order to insure foolproof operation of the controller the reverse drum 12 must be so interlocked with the deadman's device that the reverse drum cannot be operated unless the deadman's device is in the "off" position.

The deadman's device is operated by vertical motion of the handle 13. When the handle 13 is depressed to the horizontal position, a brake application valve 17 (Fig. 3) is closed, thereby releasing the air brakes on the locomotive. Control contact members 18 (Fig. 5) are also closed when the handle 13 is in the horizontal position in order that the power switches in the main motor circuit (not shown) can be operated.

As will be explained more fully hereinafter, the handle 13 can be depressed to the horizontal position only when the main controller drum 11 is in the "off" position. When the controller is in the "off" position and the handle depressed, the interlock between the main and the reverse drums is released and the reverse drum can be operated. If the reverse drum is actuated to the neutral position the handle 13 is locked in the depressed position and the main drum 11 is locked in the "off" position. The handle 15 may be removed from the reverse drum shaft 12 to prevent the reverse drum from being operated. This action permits the controller to be utilized on tandem-connected locomotives and insures that the two or more locomotives can be operated only from the controller on the primary unit.

When the operator removes his hand from the deadman's handle 13, the grip end of the handle moves vertically to the position shown in the dot and dash lines of Fig. 1. In this position the elec-

trical contacts 18 are opened by a roller 19 being engaged by a portion 20 (Fig. 1) of the deadman's device which moves upwardly when the handle 13 is released, thereby deenergizing the switches in the main motor circuit and cutting off power from the motor. The deadman's brake application valve 17 is opened, thereby causing the air brakes to be applied. These conditions remain fixed until the main drum 11 is returned to the "off" position where the handle 13 can be depressed to release the brakes and establish the control circuit for closing the switches in the main motor circuit.

In order that the functioning of the foregoing apparatus may be more clearly understood, the operation of the deadman's device and the interlocking between the deadman's handle, the main drum, the reverse drum, and the air brake application valve will be described in more detail. As shown by the full lines in the drawings, the handle 13 is depressed, the main drum 11 is in the "off" position and the reverse drum 12 is in the neutral position. A star wheel 21 on the reverse drum shaft engages a roller 22 of an interlocking pawl 23, thereby holding an extension 24 of the pawl 23 in a slot 25 which is provided in a collar 26 of the deadman's device. An extension 27 of the deadman's device is released from the valve stem of the brake application valve 17, thereby permitting this valve to be closed by a spring 28, as shown in Fig. 3.

The extension 24 of the pawl 23 engages the collar 26 which is secured to the extension 14 of the main drum shaft 11*a* and prevents rotation of the handle 13. When the reverse drum 12 is actuated to one of the operating positions on either side of the neutral position, the roller 22 drops into a deeper slot in the star wheel 21. The extension 24 is removed from the slot 25 by a spring 29, thereby permitting the handle 13 and the main drum 11 to be rotated. As the drum is turned, a pawl 31 moves out of a slot 32 in a flange 33 of a sleeve 34 and slides along the outside of the flange 33. The sleeve 34 is slidably disposed on the shaft 14 but rotates with the shaft.

When the handle 13 is released a spring 35 forces all of the mechanism disposed below the collar 26, upwardly, and a spring 36 forces the pawl 31 underneath the flange 33 and prevents the handle 13 from being depressed again until the drum is returned to the "off" position. When the drum is returned to the "off" position, a roller 37 which is mounted on a shaft 38 is biased downwardly by a spring 39 into the slot 32 in the flange 33, thereby locking the main drum 11 in the "off" position until the handle 13 is depressed. When the handle 13 is depressed, a push rod 41, which is disposed in the shaft 14, engages a key 42, which extends through the shaft 14 and the sleeve 34, and forces the sleeve 34 downwardly against the spring 35, thereby releasing the flange 33 from the roller 37, as shown in Fig. 4.

From the foregoing description it is apparent that the interlocking mechanism provides for locking the main drum 11 in the "off" position with the deadman's device 16 in the depressed position by actuating the reversing drum 12 to the neutral position in which position the pawl 23 prevents rotation of the shaft 14 and also prevents the sleeve 34 from being forced upwardly by the spring 35, as shown most clearly in Fig. 1. The main drum 11 is locked in the "off" position by the roller 37 until the handle 13 is depressed to remove the roller 37 from the slot 32 by lowering the flange 33, as shown most clearly in Fig. 4. The handle 13 is locked in the released position by the pawl 31 until the main drum is returned to the "off" position to permit the pawl 31 to enter the slot 32, as shown in Fig. 2. The reverse drum is locked in either operating position by the star wheel 21 and the pawl 23, except when the main drum is in the "off" position.

Furthermore, as illustrated in the drawings, a deadman's device having a relatively low height may be assembled completely as a separate unit and applied to the top of a master controller which may be modified as desired without changing the deadman's device. In this manner the deadman's device may be applied to existing controllers which have been previously installed in service, or it may be applied to new controllers when they are constructed.

Since two or more sets of electrical contact members may be provided in the deadman's device, it may be utilized with power operated hydraulic brakes, one set of contact members being connected in the motor control circuit and the other set controlling the operation of a magnetically operated valve in the hydraulic brake system. As herein described, the operation of air brakes may be controlled by means of the air brake release valve provided in the deadman's device. When power brakes are not provided on a locomotive, the deadman's device may be used simply to cut off power from the main motors when the handle is released.

Since numerous changes may be made in the above-described construction, and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In a controller, in combination, a main shaft and an auxiliary shaft rotatably disposed side-by-side in the controller, a handle pivotally mounted on the main shaft and movable in a vertical plane and in a horizontal plane, switching means operated by movement of the handle in a vertical plane, spring-biased interlocking means actuated by the auxiliary shaft to prevent operation of said switching means by said movement of the handle under predetermined conditions, interlocking means rotated by the main shaft and cooperating with said spring-biased interlocking means to prevent rotation of the main shaft except when the auxiliary shaft is in a predetermined position and to prevent rotation of the auxiliary shaft except when the main shaft is in a predetermined position, and spring-biased means for preventing vertical movement of the handle except when the main shaft is in a predetermined position.

2. In a controller, in combination, a main shaft and an auxiliary shaft rotatably disposed side-by-side in the controller, a handle pivotally mounted on the main shaft and movable in a vertical plane and in a horizontal plane, switching means operated by movement of the handle in a vertical plane, spring-biased interlocking means actuated by the auxiliary shaft to prevent operation of said switching means by said movement of the handle under predetermined conditions, interlocking means rotated by the main shaft and cooperating with said spring biased interlocking means to prevent rotation of the main shaft except when the auxiliary shaft is

in a predetermined position and to prevent rotation of the auxiliary shaft except when the main shaft is in a predetermined position, spring-biased means for preventing vertical movement of the handle except when the main shaft is in a predetermined position, and additional spring-biased means for preventing rotation of the main shaft except when the handle is in a predetermined position.

3. In a controller, in combination, a main shaft and an auxiliary shaft rotatably disposed side-by-side in the controller, a handle pivotally mounted on the main shaft and movable in a vertical plane and in a horizontal plane, switching means operated by movement of the handle in a vertical plane, spring-biased interlocking means actuated by the auxiliary shaft to prevent operation of said switching means by said movement of the handle under predetermined conditions, interlocking means rotated by the main shaft and cooperating with said spring-biased interlocking means to prevent rotation of the main shaft except when the auxiliary shaft is in a predetermined position and to prevent rotation of the auxiliary shaft except when the main shaft is in a predetermined position, and spring-biased means for preventing vertical movement of the handle in one direction except when the main shaft is in a predetermined position.

4. In a controller, in combination, a main shaft and an auxiliary shaft rotatably disposed side-by-side in the controller, a handle pivotally mounted on the main shaft and movable in a vertical plane and in a horizontal plane, a sleeve slidably disposed on the main shaft but rotatable therewith, spring-biased means cooperating with said sleeve to prevent vertical movement of the handle in one direction except when the main shaft is in a predetermined position, and spring-biased interlocking means actuated by the auxiliary shaft to prevent said sleeve from sliding on the main shaft with vertical movement of the handle when the auxiliary shaft is in a predetermined position.

5. In a controller, in combination, a main shaft and an auxiliary shaft rotatably disposed side-by-side in the controller, a handle pivotally mounted on the main shaft and movable in a vertical plane and in a horizontal plane, a sleeve slidably disposed on the main shaft but rotatable therewith, spring-biased means cooperating with said sleeve to prevent vertical movement of the handle in one direction except when the main shaft is in a predetermined position, spring-biased

interlocking means actuated by the auxiliary shaft to prevent said sleeve from sliding on the main shaft with vertical movement of the handle when the auxiliary shaft is in a predetermined position, and valve means actuated by sliding movement of said sleeve.

6. In a controller, in combination a main shaft and an auxiliary shaft rotatably disposed side-by-side in the controller, a handle pivotally mounted on the main shaft and movable in a vertical plane and in a horizontal plane, a sleeve slidably disposed on the main shaft but rotatable therewith, spring-biased means cooperating with said sleeve to prevent vertical movement of the handle in one direction except when the main shaft is in a predetermined position, spring-biased interlocking means actuated by the auxiliary shaft to prevent said sleeve from sliding on the main shaft with vertical movement of the handle when the auxiliary shaft is in a predetermined position, and a spring-biased brake application valve actuated by sliding movement of said sleeve.

7. In a controller, in combination, a main shaft and an auxiliary shaft rotatably disposed side-by-side in the controller, a handle pivotally mounted on the main shaft and movable in a vertical plane and in a horizontal plane, a sleeve slidably disposed on the main shaft but rotatable therewith, spring-biased means cooperating with said sleeve to prevent vertical movement of the handle in one direction except when the main shaft is in a predetermined position, spring-biased interlocking means actuated by the auxiliary shaft to prevent said sleeve from sliding on the main shaft with vertical movement of the handle when the auxiliary shaft is in a predetermined position, and electrical contact members actuated by sliding movement of said sleeve.

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