May 9, 1933. P. R. HORNBROOK 1,907,814

POWER CUT-OFF

Filed Feb. 24, 1930

Fig. 1

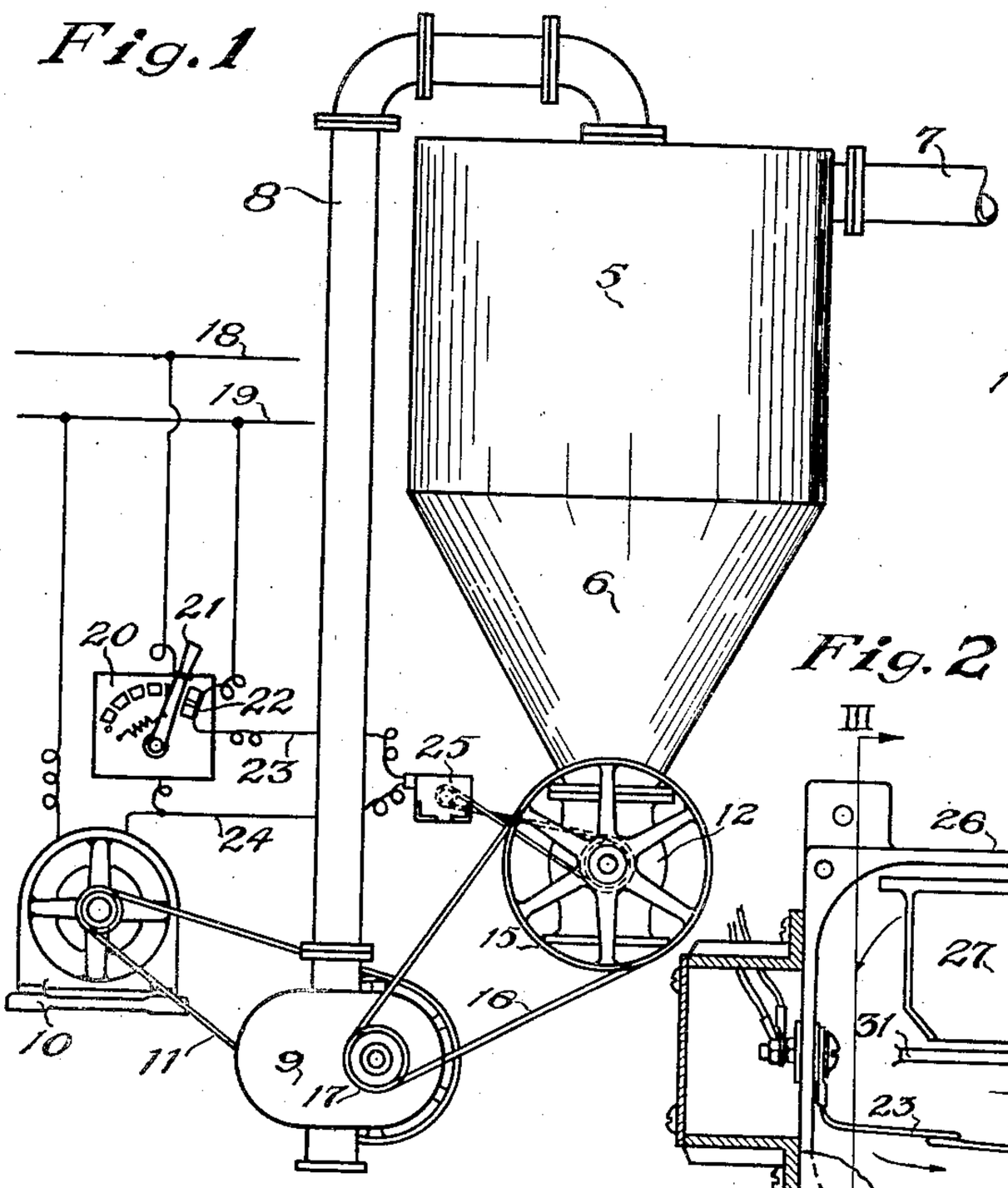


Fig. 5

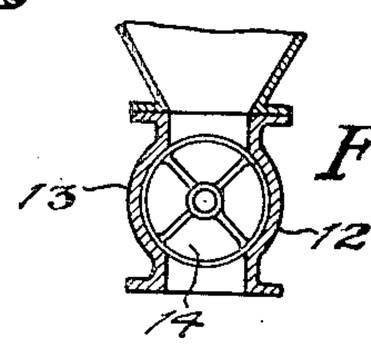


Fig. 2

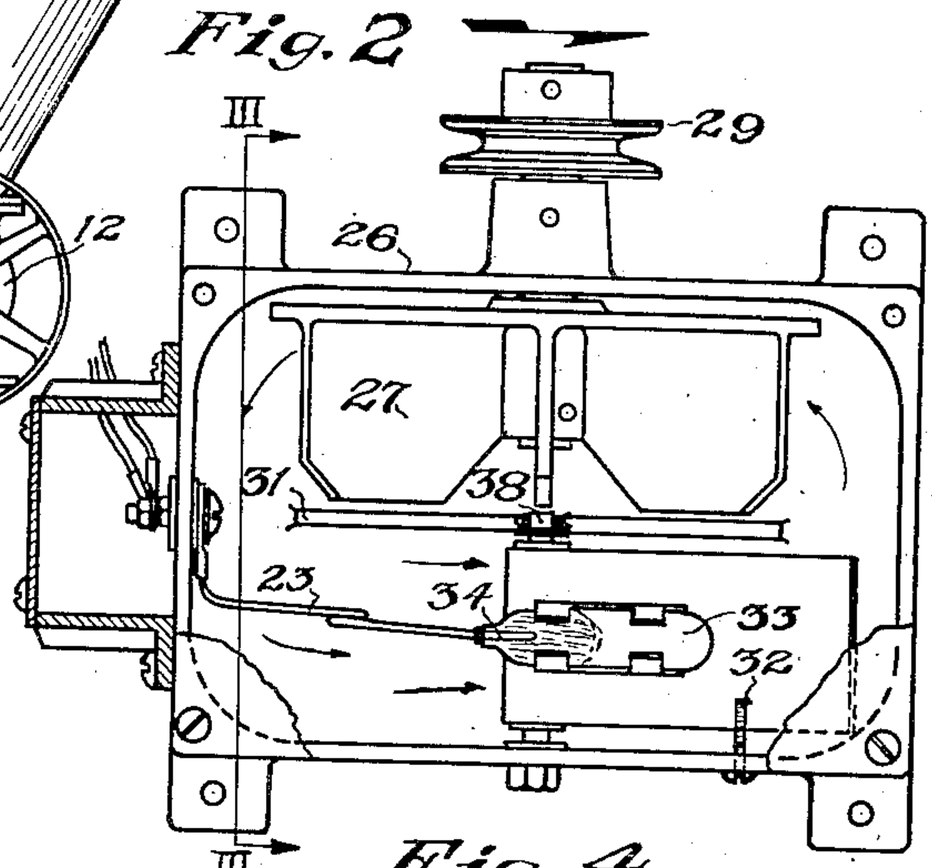


Fig. 3

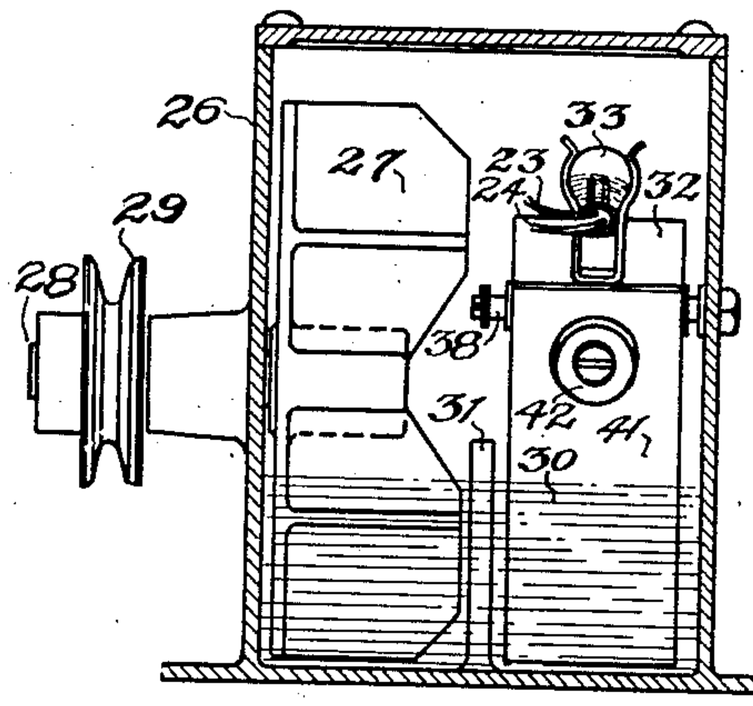
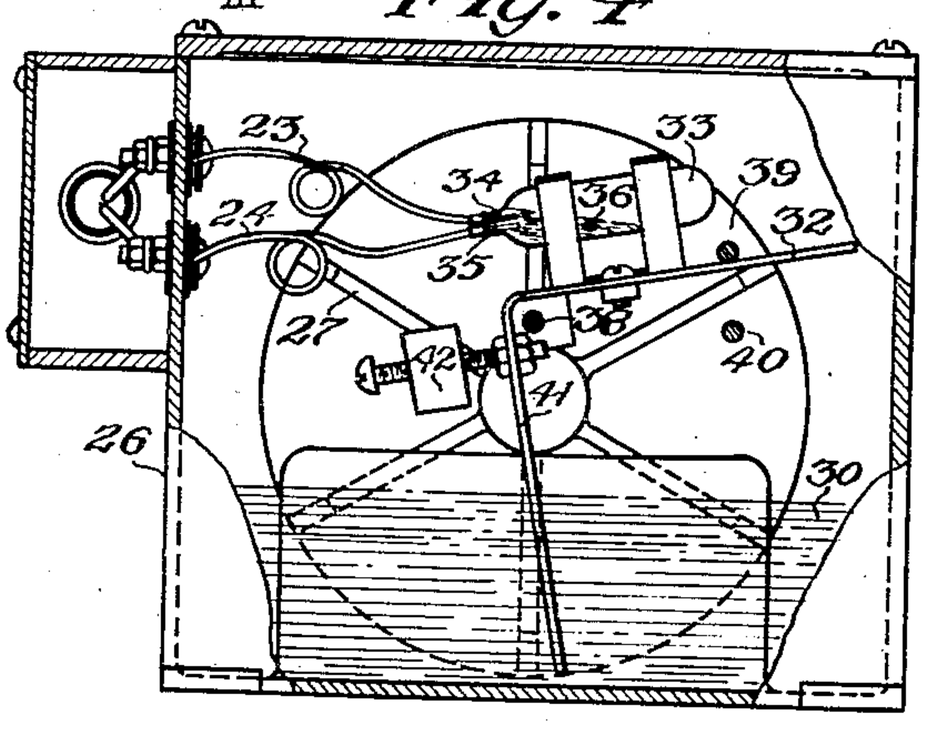


Fig. 4



INVENTOR
PHILIP R. HORNBROOK
BY
George B. Engelhart
ATTORNEY

Patented May 9, 1933

1,907,814

UNITED STATES PATENT OFFICE

PHILIP R. HORNBROOK, OF ALLENTOWN, PENNSYLVANIA, ASSIGNOR TO FULLER COMPANY, OF CATASAUQUA, PENNSYLVANIA, A CORPORATION OF DELAWARE

POWER CUT-OFF

Application filed February 24, 1930. Serial No. 430,533.

This invention relates to power cutoffs or mechanically operated switches for the purpose of stopping a driving motor when a driven machine or element thereof decreases in speed below a predetermined rate, or stops for more than a predetermined short interval.

The invention has particularly to do with a mechanically driven, dust-proof switch of simple construction and positive operation for the purpose of preventing harm to elements of a machine, or machines operating in combination, due to failure of one element to operate properly.

In general the invention comprises a container in which a paddle wheel is arranged to be driven externally from a part of a rotating device which must be kept in operation to prevent injury to another part of the apparatus. The paddle wheel causes a flow of oil or other fluid in a continuous circuit around the lower portion of the container. A movably supported switch is provided with a vane or similar element projecting into the path of the fluid, whereby the switch may be held in the desired position due to the pressure of the fluid against it.

In the preferred embodiment of my invention, the switch is of the mercury tube type and its support is arranged within the container and pivoted to move within desired limits. The paddle wheel may be suitably driven by a belt to keep the oil in circulation and the switch in closed position, for instance, during operation. In this case, the circuit is preferably closed through the contacts of the switch to the controlling device of a motor which operates the apparatus or an element of it.

If the speed of rotation of the element from which the paddle wheel is driven decreases, but remains within safe limits, the switch may be kept in closed position and likewise be kept closed if the driving element stops momentarily. If, however, the speed falls below a safe limit, or the device stops for more than a short interval, the momentum of the fluid will decrease sufficiently to cause the switch to move to its open position due to the decrease in pressure against the vane. If the paddle wheel stops momentarily, the momentum of the oil will keep the switch in closed position for short intervals.

In order to cause the switch to return to open position when the speed of the moving element decreases below a safe limit, or stops for longer than a safe interval, but to keep the switch closed for intermediate higher speeds and shorter stoppages, I have provided a movable counterweight for the support, so that the switch may be adjusted to operate when the rate of flow of the fluid decreases correspondingly.

My invention may be used in combination with conveying apparatus in which the material to be transported is handled by separate conveying or feeding devices, having a common or separate driving motors. In this arrangement, a momentary stoppage or a decrease in speed of one of the conveying elements may not cause harm, but a stoppage for a longer interval, or a decrease below a certain speed might cause mechanical damage to other elements, overflow of material or a dust nuisance. In this case the power cutoff in accordance with my invention is driven by an element, the proper operation of which is essential to the operation of the related apparatus. The switch may be connected to a warning signal or arranged to interrupt the operation of a motor driving the apparatus or related equipment.

For a better understanding of my invention, reference is made to the accompanying drawing, in which:

Fig. 1 is a diagrammatic illustration of a conveyor for handling grain or similar material by suction in which my invention is embodied;

Fig. 2 is a plan view of the switch with the cover removed;

Fig. 3 is a vertical section through the switch on line III—III of Fig. 2.

Fig. 4 is a side elevation of the switch with the side walls of the container and outlet broken.

Fig. 5 is a section through the feeder at the discharge end of the hopper.

Referring to the drawing and first to Fig. 1, the invention is shown in combination with a pneumatic conveyor for handling grain or

similar material. The grain is drawn into a collector 5 having a hopper bottom 6, through a conduit 7, the collector being exhausted through pipe 8 by the exhauster or pump 9. The exhauster is indicated as being driven by a motor 10 through a belt 11.

Grain accumulating in the collector is continuously discharged by an air lock feeder 12, comprising a casing 13 and a cylindrical rotor 14, provided with pockets to receive and discharge the grain during rotation of the cylinder.

The feeder 12 may be driven by an independent motor, or as shown by means of the pulley 15, belt 16 and a pulley 17 on the exhauster 9.

The motor control circuit may include the usual feeders 18 and 19 and the motor control switch 20. When the switch lever 21 is in closed position it is held in place by electro-magnets 22. The electro-magnets are included in a circuit 23 and 24 and the power cutoff switch 25, to be described in detail hereinafter.

The power cutoff switch comprises a casing 26, in which a paddle wheel 27 is driven through an external shaft 28 and pulley 29, suitably belted to the feeder shaft. Below the level of the shaft 28, the casing is provided with a quantity of oil or other liquid 30, which flows in a continuous circuit around the interior of the lower portion of the casing 26 and is deflected by the baffle 31. The support 32 serves as a base for a mercury switch 33 of usual construction and which is provided with contacts 34 and 35 to which the leads 23 and 24 are connected. In the present embodiment of the invention, the switch 33 is shown in its closed position through the mercury 36 to complete the circuit through the electro-magnets 22 to keep the motor control 20 in closed position.

The support 32 is pivoted at 28 and moves between the stops 39 and 40. The switch is held in its closed position by pressure of the oil 30 against the vane 41. A counterweight 42 serves to counterbalance the weight of the switch and its support and also to make the switch responsive to various oil pressures. When the support is substantially in balance, a very slow movement of the oil will move the switch into closed position, and as the weight is moved inwardly toward the support, more rapid oil flow is necessary to move the switch.

The operation of the apparatus is as follows: When the circuit to the motor 10 is closed through the switch 20 and the apparatus is brought to operating speed, the paddle wheel 27 causes the oil to flow in the direction of the arrows shown in Fig. 2. The pressure of the oil against the vane 41 tilts the latter and completes the circuit through the electro-magnets 22 to hold the switch 21 in closed position during normal operation.

Should the speed of rotation of the feeder 12 decrease due to drive trouble or entrance of foreign material, but continue to discharge the grain fast enough to prevent the accumulation of increasing quantities in the hopper 6, there would be no necessity for stopping the motor 10. Likewise the exhauster 9 should be kept in operation if there is only a momentary stoppage of the feeder. In either case the rate of flow of the oil 30 will provide sufficient pressure against the vane 41 to maintain the switch 33 in closed position. By adjusting the counterweight inwardly to the proper point, the switch can be adjusted to open when the feeder 12 stops or decreases in speed below a safe or desired rate.

Although I have shown and described the apparatus with a single motor for driving two related driven devices, it is to be understood that independent drives can be used and that the operation of one of the elements can govern the operation of a number of others. I have shown the device in a direct current circuit, for simplicity, but the switch can be used equally well to control alternating current motors, as it may be placed in the stop button circuit of magnetic starters or in the low voltage circuit of manually operated starters.

I claim:

1. A switch comprising the combination of a container, a paddle wheel within the container and having a drive shaft extending through a wall thereof, a quantity of liquid within the lower portion of the container to be set in motion in a continuous course by the paddle wheel, a pivotally mounted support, an electric switch secured to the support and means to move the support comprising a vane extending downwardly into contact with the liquid.

2. A switch comprising the combination of a container, a paddle wheel within the container, having a drive shaft extending through a wall of the container, a quantity of fluid within the lower portion of the container to be set in motion in a continuous course by the paddle wheel, a pivotally mounted support having a vane extending downwardly into the course of the fluid to move the support by pressure of the fluid and a switch mounted upon the support and actuated by movement thereof.

3. A switch comprising the combination of a container, a paddle wheel within the container, having a drive shaft extending through a wall of the container, a quantity of liquid within the lower portion of the container to be set in motion in a continuous course by the paddle wheel, a pivotally mounted support having a vane extending downwardly into the course of the liquid to move the support by pressure of the moving liquid, an adjustable counterweight arranged on the support to regulate its movement in accordance with predetermined pressures and

an electrical switch mounted on the support and actuated by movement thereof.

4. A switch comprising the combination of a container, a paddle wheel within the container, having a drive shaft extending through a wall of the container, a quantity of liquid within the lower portion of the container to be set in motion in a continuous course by the paddle wheel, a pivotally mounted support having a vane extending downwardly into the course of the liquid to move the support by pressure of the moving liquid, an adjustable counterweight arranged on the support to regulate its movement in accordance with predetermined pressures and a switch of the mercury tube type mounted on the support and actuated by movement thereof.

5. A switch comprising the combination of a container, a quantity of liquid within the lower portion of the container, externally driven means within the container for moving the liquid in a continuous course therein, a pivotally mounted support, an electric switch of the mercury contact type secured to the support, the support having an element extending downwardly into the course of the liquid and responsive to the pressure of the moving liquid to move the support to close the switch, and means to regulate the movement of the support in accordance with predetermined pressures to cause the switch to move to open position after the speed of rotation of the externally driven means falls below a desired rate.

In witness whereof I have signed this specification.

PHILIP R. HORNBROOK.