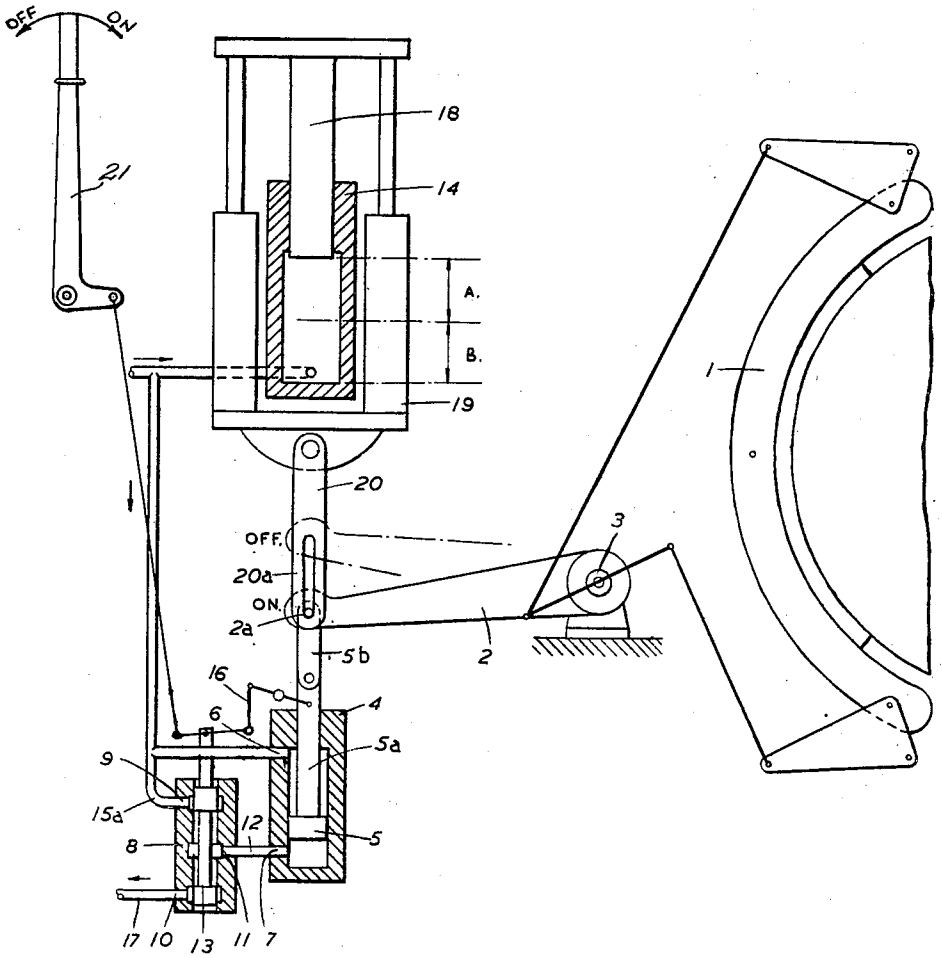
Dec. 13, 1949 W. T. BELL ET AL 2,490,941

FLUID PRESSURE BRAKE WITH EMERGENCY WEIGHT OPERATOR

Filed Sept. 24, 1946



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Patented Dec. 13, 1949

2,490,941

UNITED STATES PATENT OFFICE

2,490,941

FLUID PRESSURE BRAKE WITH EMERGENCY WEIGHT OPERATOR

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Application September 24, 1946, Serial No. 698,963
In Great Britain May 27, 1946

2 Claims. (Cl. 188—105)

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This invention relates to mechanical brake systems of winding engines, haulages, and other rotating machines.

It has been recognised for some time that the brakes used for winding engines and haulages have serious objections in the method of operation. The usual British practice is to employ either one or two pairs of brakes which are forced into contact with the breaking surfaces attached to the sides of the winding drum or drums by weights on the brake lever. The brake lever is connected with the brake engine piston, the movement of which is controlled by the driver's operating lever. Normally the brakes are held on by the weights and to take the brakes off, the brake lever and weights are raised by pressure being applied under the brake engine piston, the medium for which may be steam, compressed air, or oil.

The application of the brakes to control the speed of the winding drum and to bring it to rest requires the raising and lowering of the weights. When the brake engine is operated with considerable inertia effect of the weights, with the consequential rebound, does not permit smooth action of application of the brakes, nor sensitive control of the speed of the winding drum.

The rapid application of the brakes by means of the falling weights, which are suddenly arrested in their movement, transmits serious shocks to the braking system, the winding ropes and to any man who may be riding in the conveyances. Various means are adopted to restrict the rate of application of the brakes to reduce the inertia effect of the falling weights. It is necessary, however, to remove any restriction to rapid application when approaching the limits of the wind.

The latest British mining regulations require safety protection devices to be fitted to winding engines to limit the speed of approach to the permanent landing at the bottom of the shaft when men are riding in the conveyances. The emergency operation of such protective devices requires the brakes to be applied very rapidly, and it is found in some cases that the orthodox weight applied brakes cannot meet the requirements, although the weights are permitted to fall without restriction.

To obtain quicker operation some braking systems incorporate springs to assist the falling weights, whilst others have a pressure supply combined with the falling weights to obtain the necessary speed of application. In both cases the inertia of the weights is still present to some extent, and failure of the springs due to fatigue or breakage, or failure of the pressure supply, would again impose the full effect of the falling weights on the system.

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Large proportions of the accidents with winding machinery are due to the operator inadvertently applying power in the wrong direction when approaching the limits of the wind. The protective gear, therefore, to be effective, requires very quick acting brakes, and the brake system should be as free from inertia as possible.

To eliminate the use of falling weights, a combination of weights and springs, or a combination of weights with pressure medium to normally effect the braking, and to provide a positive power operated brake system with a maximum speed of application thus eliminating the objections and limitations above described, and to provide a safe operating system in any circumstances was the object of our British Patent No. 540,921.

According to the said British Patent No. 540,921, the brake lever, without weights, is connected to the movable member of a double acting pressure operated device, such as a brake engine, the device on one side of the movable member being connected directly to a pressure medium supply, and on the other side through a control valve to the pressure medium supply, in such a manner that a constant pressure in the direction of brakes "on" is applied directly to the movable member, and pressure can be admitted through the control valve to the other side of the movable member to overcome the constant pressure to move the brakes to the "off" position, means being also provided to cause the brakes to be applied if any failure or loss of the pressure takes place.

In one example described in said British patent, employing oil as the pressure medium and employing an accumulator to which oil is delivered at a predetermined pressure by pumps to provide a constant supply as is usual in the case of brakes which are applied by falling weights.

Referring to the accompanying drawing which is more or less diagrammatic the brake 1 is of usual construction operated to the "on" position by depressing the free end of the brake lever 2 mounted on the brake operating shaft 3, and to the "off" position by raising the free end of the brake lever 2.

At the end of the brake lever 2, which is without weights, is located a brake engine 4 consisting of a closed cylinder in which works a piston 5, the piston rod 5a for which is extended and is pivotally connected through a link 5b to the end

of the brake lever 2. The brake engine 4 is double acting, that is there is an inlet 6 to the top and an inlet 7 to the bottom of the cylinder.

Adjacent the brake engine 4 is a control valve 8 of usual construction having an inlet 9 near one end, and exhaust outlet 10 near the other end and a central outlet 11 connected by a pipe 12 to the bottom inlet 7 to the brake engine 4. The plunger 13 of the control valve 8 is operated by the action of the driver's operating lever 21 to which it is mechanically connected.

The accumulator 14 is connected by a pipe 15 to the top inlet 6 of the brake engine 4, and said pipe 15 is connected by a branch pipe 15*a* to the inlet 9 of the control valve 8, whereby the pressure supply from the accumulator 14 is applied through the pipe 15 to the top side of the piston 5, thereby applying a constant pressure in the direction of brakes "on" whenever pressure is available from the accumulator 14, and when the control valve 8 is operated by movement of the plunger 13 to admit pressure from the branch pipe 15*a* to the pipe 12 connecting the central outlet 11 of the valve 8 to the bottom inlet 7 in the brake engine 4 the pressure is admitted to the underside of the brake engine piston 5 to raise same and lift the brake lever 2 to take the brakes "off" by virtue of the larger area of piston available, to overcome the constant pressure on the top side of the piston 5.

In order to guard against the remote possibility of the pressure medium leaking past the piston 5 when it is in the brakes "on" position, which leakage may tend to take the brakes "off," the piston 5 of the brake engine 4 is connected by means of a mechanical follow-up 16 or compensating linkage with the plunger 13 of the control valve 8. By suitably proportioning this follow-up gear 16 the control valve 8 will be slightly open to exhaust from the brake engine 4 through the outlet 10 and exhaust pipe 17, when the driver's lever is in the brakes "on" position, permitting any leak past the piston 5 to escape freely.

It is essential that with any failure or loss of the pressure supply the brakes 1 must "fall to safety," i. e. they must be positively applied.

One method described in said British Patent No. 540,921 for this purpose comprises a weighted rockably mounted safety lever adapted to co-act with the brake lever, a closed cylinder having a piston connected to the safety lever, a pipe from the pressure supply leading to the underside of the piston, a safety valve in said pipe adapted to be held closed by the pressure and to open on reduction of pressure, a pipe in the pressure line by-passing said valve, and a non-return valve in the by-pass pipe, all so arranged that so long as full pressure is available and the safety valve closed the piston supports the safety lever in its raised position, but when the pressure falls below a predetermined pressure the safety valve opens to release the pressure in the cylinder and allow the safety lever to fall and press the brake lever downwards to apply the brakes.

The object of the present invention is to dispense with the separate safety weight engine and improve the apparatus.

According to this invention, the separate safety weight engine is dispensed with and the accumulator is so constructed and arranged that it performs the dual purpose of providing the pressure medium for the normal operation of the brakes and also the necessary braking force for emergency operation of the brakes in the event of any failure of the pressure supply.

A convenient method, reference again being made to the accompanying drawings, is to employ a fixed accumulator 14 provided with a sliding ram 18 to which is attached the moving parts 19 or weights, thereby normally providing the pressure medium for supply to the brake system 4. The accumulator 18 is mounted in a suitable position above the brake engine 4 and the moving parts 19 or weights are coupled by a slotted link 20 or other lost-motion device, to the brake lever 2 by engaging the slot 20*a* of the link 20 with the pin 2*a* of the brake lever.

In normal operation of the brakes 1, that is when operating through the double-acting brake engine 4, the fall of the accumulator ram 18 is such that it does not impose any of the weight of the moving parts 19 on the valve lever 2, the slot 20*a* riding along the pin 2*a*. The accumulator 14 is suitably proportioned so that for a comparatively small movement sufficient of the pressure medium is displaced to give the full application of the brakes 1 through the double-acting brake engine 4.

In the event of pressure failing, the moving parts 19 or weights of the accumulator 14 continue to fall below their normal working range and through the upper end of the slot 20*a* of the link 20 engaging with the pin 2*a* of the brake lever 2, the weight of the moving parts 19 are thereby imposed on the brake lever 2 depressing same to the brakes "on" position, thus providing the necessary braking force.

Whenever pressure is available, the accumulator ram 18 with the moving parts 19 will work over the higher range of movement A without imposing its weight on the brake operating lever 2. Immediately pressure falls below that required to support the moving parts 19, whether the brakes are in the "off" or "on" position, the moving parts 19 will fall over the lower range of movement B to impose the braking force on the brake lever 2.

Emergency application of the brakes (other than failure of pressure) is brought about by the action of the operator, excessive speed of the rotating element or winding drum overtravel, or starting up in the wrong direction. In all these circumstances the brakes 1 are applied without the operation of the moving parts 19, and as already described, the only occasion on which the moving parts 19 will operate is on the failure of the pressure supply.

The means adopted for the emergency operation of the conventional weight applied brake in current practice can all be used in the system above described.

In the example described oil is used as the pressure medium.

What we claim as our invention is:

1. A brake system for winding engines and other rotating machines comprising a brake shoe, a lever for moving said shoe to and away from braking position, a brake engine having a cylinder and a piston reciprocably mounted therein, means including a piston rod extending through one end of the cylinder connecting said piston to the brake lever for actuating said lever, an accumulator having a cylinder, a fluid pressure supply conduit communicating with one end of the cylinder of the accumulator and the cylinder on the side of the piston from which the piston rod extends, a control valve including a housing having a piston slidably mounted therein, said valve hous-

ing having an inlet port at one end in communication with the fluid pressure supply conduit, an exhaust port at the other end of the housing and a port intermediate the ends of the housing communicating with the engine cylinder on the side of the engine piston opposite the piston rod; a valve plunger in said housing, a rod associated with said plunger to shift the plunger from a position to place the intermediate port in communication with the inlet port to a position to place the intermediate port in communication with the exhaust port, a plunger in the accumulator cylinder, weight means carried by the accumulator plunger urging the same into the cylinder and compressing fluid therein which in turn applies pressure on the engine piston urging the latter to brake on position, and a lost motion mechanical connection between the weights and the lever operable to transmit the weight of the weight means directly to the lever upon loss of fluid pressure in the system.

2. A brake system for winding engines and other rotating machines comprising a brake shoe, a lever for moving said shoe to and away from braking position, a brake engine having a cylinder and a piston reciprocably mounted therein, means including a piston rod extending through one end of the cylinder connecting said piston to the brake lever for actuating said lever, an accumulator having a cylinder, a fluid pressure supply conduit communicating with one end of the cylinder of the accumulator and the cylinder on the side of the piston from which the piston rod extends, a control valve including a housing having a piston slidably mounted therein, said valve housing having an inlet port at one end in

communication with the fluid pressure supply conduit, an exhaust port at the other end of the housing and a port intermediate the ends of the housing communicating with the engine cylinder on the side of the engine piston opposite the piston rod; a valve plunger in said housing, a rod associated with said plunger to shift the plunger from a position to place the intermediate port in communication with the inlet port to a position to place the intermediate port in communication with the exhaust port, a plunger in the accumulator cylinder, weight means carried by the accumulator plunger urging the same into the cylinder and compressing fluid therein which in turn applies pressure on the engine piston urging the latter to brake on position, a lost motion mechanical connection between the weights and the lever operable to transmit the weigth of the weight means directly to the lever upon loss of fluid pressure in the system, and a mechanical linkage between the engine piston and valve operable to shift the valve to a position to permit a slight discharge of fluid from the engine cylinder when the engine piston is in brake on position.

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