July 6, 1965 L. J. MORIN 3,193,055

SAFETY BRAKE COMBINATION FOR PNEUMATIC DRILLS

Filed Jan. 16, 1962 2 Sheets-Sheet 1

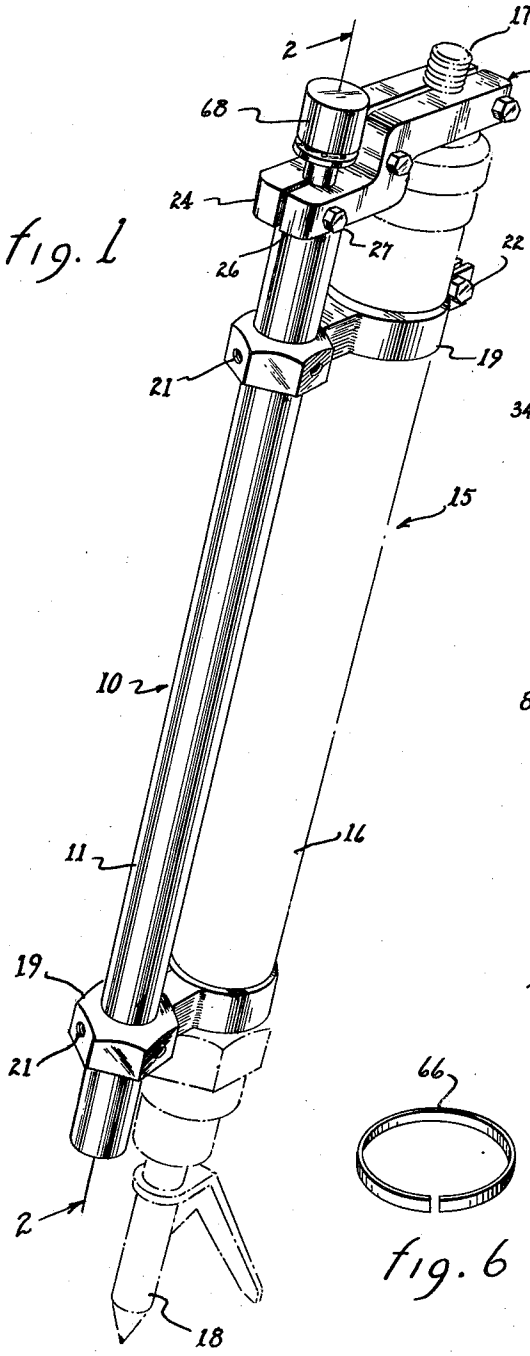


Fig. 1

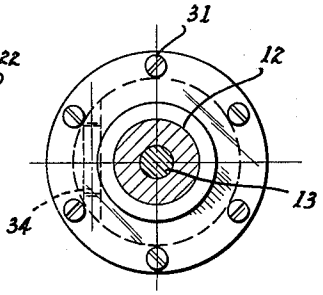


Fig. 3

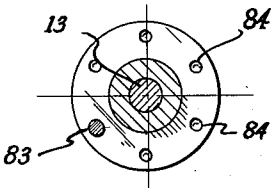


Fig. 4

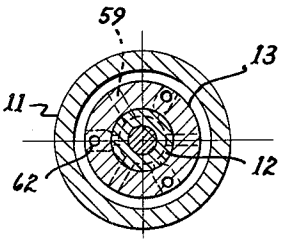


Fig. 5

Fig. 6

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SAFETY BRAKE COMBINATION FOR PNEUMATIC DRILLS

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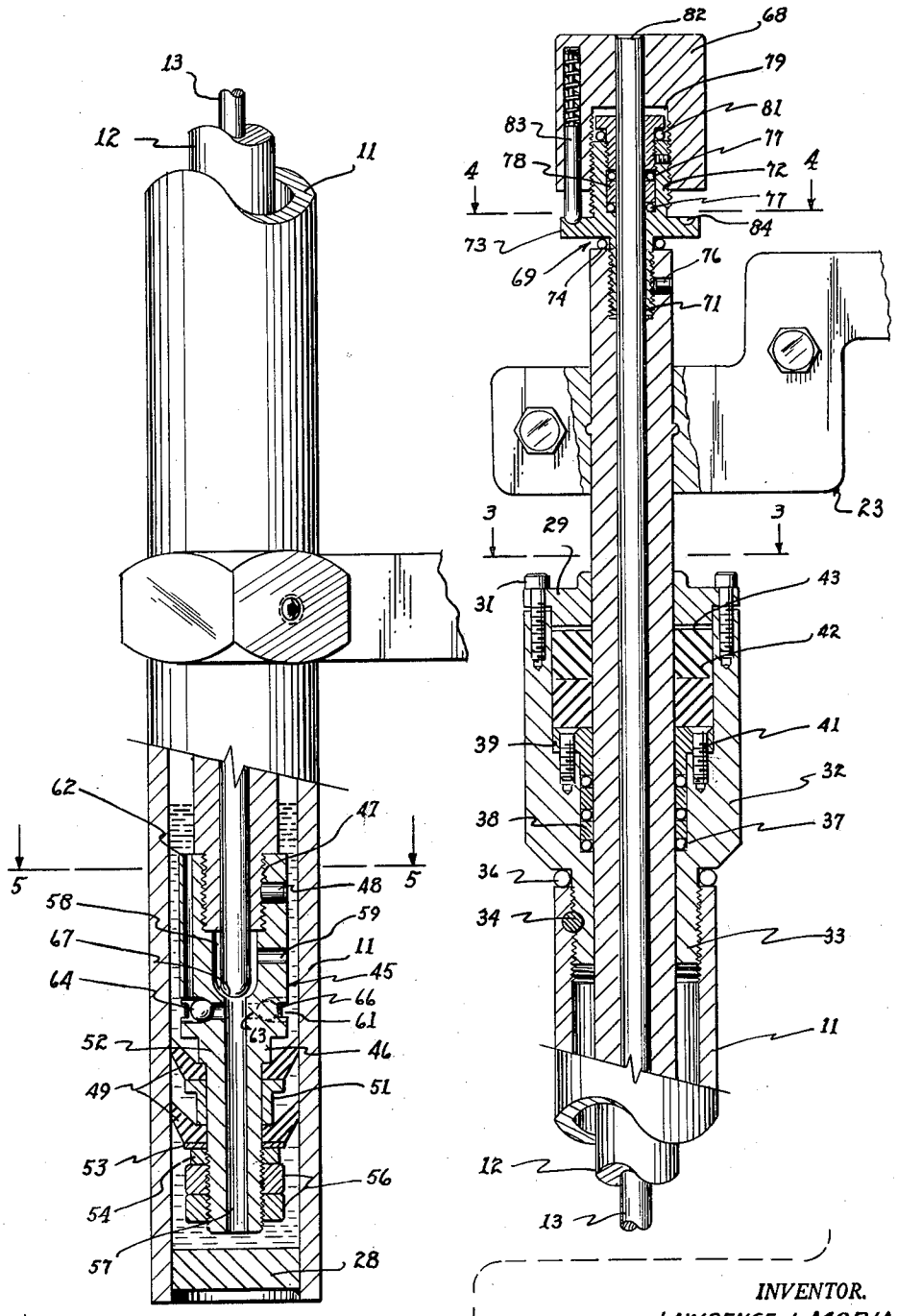


fig. 2

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United States Patent Office

3,193,055

Patented July 6, 1965

3,193,055

SAFETY BRAKE COMBINATION FOR PNEUMATIC DRILLS

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Filed Jan. 16, 1962, Ser. No. 166,529
4 Claims. (Cl. 188—96)

My invention relates to a safety brake combination for pneumatic drills. It relates more in particular to the safety braking of the reciprocating piston rod in a pneumatic drill of the type used in mining operations and frequently going by the name of "stinger" or "jack leg stinger."

While my invention may have various applications, I will describe it with reference to its use on jack leg stingers as employed in mining where the problem to which the present invention addresses itself has been particularly acute.

It is the practice in mining to drill a relatively large number of holes into the face of a drift or stope preparatory to blasting. In drilling these holes the common method is to employ a so-called jack leg stinger which rests on the floor or a support raised from the floor, and which jack leg stinger is then moved over at an angle in the direction of the drift or stope into which the holes are to be drilled. Commonly, therefore, the holes are drilled at an angle and the tool is at an angle to the face in which the hole is being drilled, and the jack leg stinger is at an angle to the floor or raised support which takes it off the floor. While stingers may vary in detail of construction, they all have the characteristic that they are driven by compressed air and the tool-supporting shaft is reciprocated longitudinally of the stinger by a reciprocating piston. Because of this arrangement the tool is driven vertically with considerable force and in accordance with applicable mechanical principles the cylinder forming a part of the stinger is pushed in a reverse direction at the same force. If there is any slipping, therefore, of either the stinger or tool, the stinger shaft will be driven forwardly its full length and the stinger cylinder backwardly the same length, depending upon how slippage occurs, with consequent damage to equipment and frequent injury to workers. Attempts have been made to eliminate the hazard created by this condition, but they have not been successful because of the need to provide for full functional utility of the stinger equipment itself. In other words, suggestions heretofore made have been unsuccessful for various reasons, in part at least because they impaired the efficiency of the functioning drill equipment including the stinger.

The principal object of my invention is accordingly the provision of improved means for braking the actuating shaft of pneumatic drills of the type identified.

Another object is to provide an improved air leg brake combination.

A further object is the provision of an improved safety brake for a jack leg stinger which will not impede the drilling function of such stinger in normal use.

A still further object is the provision of an improved brake combination for the purpose described which is relatively light in weight and which adds relatively little percentage-wise to the total weight of the drill combination.

Other specific objects and features of the invention will be apparent from the following detailed description taken with the accompanying drawings, wherein:

FIG. 1 is a perspective view showing the safety brake of the present invention associated functionally with a jack leg stinger, the jack leg stinger being shown in broken lines;

FIG. 2 is an enlarged fragmentary sectional view

partly in elevation to show structural features, and with the figure broken in two parts to accommodate it to the size of the official drawing sheet;

FIG. 3 is a transverse sectional view taken on the line 3—3 of FIG. 2 looking in the direction of the arrows;

FIG. 4 is a transverse sectional view taken on the line 4—4 of FIG. 2;

FIG. 5 is a transverse sectional view taken on the line 5—5 of FIG. 2, and

FIG. 6 is a perspective view showing a detail of the ball check valve-retaining ring.

The safety brake device of the present invention is indicated generally in FIG. 1 by the reference character **10**, and it utilizes an outer cylinder **11**, a piston rod **12** and valve stem **13**, as shown particularly in FIG. 2. The safety brake device **10** is adapted to be functionally associated with a stinger indicated generally by the reference character **15** and having an outer cylinder **16** within which the piston assembly (not shown) is longitudinally reciprocable to longitudinally reciprocate a shaft **17**. The stinger **15** may be of any usual type and size and the safety brake device of the present invention is modified slightly so far as may be necessary to accommodate it to the particular stinger with which it is employed. The stinger shown in the drawings is of a type known as the Gardner Denver, but equipment devices of the same kind are made by others. The stinger has the usual chicken leg support **18** designed, of course, to permit its being supported at an angle and leaned in the direction of a face in which holes are to be drilled vertically without slipping.

The cylinders **11** and **16** are secured together by a pair of cylinder clamps **19**. These clamps may be of various types, but they should be so constructed that they will firmly hold the "safety jacket," as my device may be called, to the jack leg stinger with which it is to be associated. In the drawings I show the clamps as having a relatively solid hexagonal portion into which the cylinder **11** fits fairly sungly with positive attachment provided for by means of Allen type set screws **21**. The clamps are shown split to pass around the cylinder **16** and they may be clamped to the cylinder **16** by nuts and bolts **22**, one of which appears in the drawing.

A piston rod clamp indicated generally by the reference character **23** comprises the parts **24** and **26** clamped together around the piston rods **12** and **17** by bolts **27**. As indicated by the right hand side of FIG. 2 the rods may have exterior rings fitting in annular recesses in the clamp members **24** and **26** to avoid any possible slippage between the piston rod and piston rod clamps.

Before referring to further details of the safety brake combination of the present invention I wish to point out that the function obtained is to permit normal actuation of the jack leg stinger in accordance with the particular kind of face against which the drilling is occurring, and to permit free return movement of the jack leg stinger piston under all circumstances, but to limit the movement of the jack leg stinger beyond that normally required for functional operation so that, if there should be any slippage, the jack leg stinger will not be forceably elongated beyond its functional movement in drilling, so that in this way violent expansive movement of the drill and/or stinger foot is prevented and injury to equipment and personnel avoided.

Referring now particularly to FIG. 2, the cylinder **11** is closed at its bottom by a plug **28** welded in position so that no leakage can occur. It is closed at its top by a cap **29** held in position by cap screws **31**. The cap screws **31** are anchored in a piston rod stuffing box frame **32** having a bottom extension **33** threaded into the top

of the cylinder 11, as shown particularly in FIG. 2. An anchoring pin 34 has a press fit in a hole drilled generally tangent to the pitch line of the threads between the cylinder 11 and the portion 33, the anchoring pin 34 then being pushed into position in the general manner shown in FIG. 3.

The piston rod stuffing box assembly is, of course, so designed and assembled that hydraulic fluid in the cylinder 11 will not leak out. One seal is provided by an O-ring 36 placed between the end of the cylinder 11 and shoulder on the stuffing box frame 32. Within the stuffing box I provide three O-rings 37 in contact with the piston rod 12 separated by seal rings 38, and the entire assembly held down by a retainer 39 held in position by machine screws 41. Above the retainer 39 and between such retainer and the cap 29 there is suitable annular packing 42 which may, for example, be Johns-Manville interlocked packing. A suitable thickness of shim 43 may be placed between the cap 29 and the packing 42.

At the bottom end of the cylinder 11 and attached to the piston rod 12 is a piston head assembly indicated generally by the reference character 45. This piston head assembly includes a frame portion 46, the top of which has internal threads 47 for attachment to external threads on a smaller diameter portion of the piston rod 12. This structure provides a shoulder on the piston rod which engages against the end of the piston head assembly frame 46 and provides for firm attachment. To hold the piston head assembly to the piston rod, however, I provide an anchoring pin 48 of suitable design.

When the safety brake device of the present invention is operating, the entire cylinder 11 is filled with oil and there is a controlled dash-pot type arrangement which permits the oil to move from one side of the piston head assembly to the other. The controls are such that when the piston head assembly is moving upwardly in the cylinder the flow is somewhat restricted in accordance with the setting of a control, but in which there is free return movement. The mechanism associated in part with the piston head assembly provides for the necessary functioning and control.

A pair of suction washers 49 are separated by a spacer 51, and the assembly comprising these two suction washers and spacer abut up against a shoulder 52. They are held against the shoulder by a relatively large diameter washer 53 urged upwardly by a lock washer 54, and the entire assembly secured in place by a pair of jam nuts 56. The suction washers are made of suitable material, such as relatively soft rubber, that their flared out peripheries will ride against the inside surface of the cylinder in the general manner of a so-called pump "leather" or "leather cup," as they are sometimes called, on a regular pump, which leather device, of course, also functions as a suction washer and permits movement of fluid between the cylinder and washer in one direction, but acts as a seal in the opposite direction. Looking at FIG. 2 it will be seen then, with this explanation in mind, that so far as the suction washers are concerned the piston assembly, and, of course, with it the attached piston head 12, can readily move downwardly but tends to seal against the inside of the cylinder when the movement is upwardly.

The suction washers 49, however, do not provide the basic control for the piston head assembly, but this control is accomplished with exactitude with still an additional construction. As the drawings show, the frame member 46 is provided with a central longitudinal opening 57 provided with an upper enlargement 58. A plurality of radial openings 59 connect the enlarged space 58 with the exterior of the piston head assembly above the suction washers 49. The frame 46 also has an annular recess 61 with which a plurality of vertical holes 62 and annular openings 63 communicate, the openings 63 providing a communication between the central longitudial opening 57 and the annular recess 61. The openings 63, however, are normally closed by ball valves 64 held in place by a retaining ring 66 (see FIG. 6). The arrangement of the ball valve 64 is such that when the cylinder head assembly is moved upwardly they will be retained on their seats and will restrict the flow of hydraulic fluid to them which will pass through the radial openings 59; but when the movement is downwardly, or on a return stroke of the piston rod and stinger rod shaft, hydraulic flow is unrestricted.

As the drawings also show, the valve stem 13 has a rounded bottom end 67 which functions as a valve with the shoulder formed between the central recess 57 and the enlarged portion 58. The extent to which the valve 67 is spaced from its seat, therefore, determines how freely hydraulic fluid will flow at this point, and it in turn is controlled by means of a valve stem adjusting nut 68. This valve stem adjusting nut 68 forms part of a top assembly including a valve stem stuffing box arrangement, which will now be described.

Referring to the top portion of the right hand side of FIG. 2, a frame for the valve stem stuffing box indicated generally by the reference character 69 has a downwardly extending skirt 71, an upwardly extending skirt 72, and an integral central disc-like portion 73. The skirt 71 is threaded and engages in the top internal threads on the piston rod 12, an O-ring 74 being interposed between the top of the piston rod 12 and the bottom of the portion 73. When the member 69 has been turned to proper position by threading its skirt 71 into the top threaded portion of the piston rod a set screw 76 is placed in position to hold the parts in permanent assembly. It will be seen from the drawings that the valve stem 13 extends through the stuffing box and, in general, the clearances are such as to permit a relatively free rotational movement of the valve stem with respect to the piston rod.

Within the shirt 72 and between its inside annular surface and the valve stem 13 I place a pair of O-rings 77 separated by a spacer 78 and with the entire assembly held together by a shouldered retainer 79 which is threaded into the upper part of the skirt 72. An O-ring 81 is disposed between the shoulder on the retainer 79 and the upper annular edge of the skirt 72. A suitable set screw, as shown, is provided between the skirt 72 and retainer 79 to hold the two firmly in the relation established during preliminary assembly thereof.

The adjusting nut 68 has a bottom exteriorly threaded skirt which engages outer threads on the skirt 72 of the frame 69, such that when the adjusting nut 68 is turned it will move up and down vertically with respect to the entire assembly including the piston rod. The adjusting nut 68 is rigidly secured to the valve stem 13 at the top thereof by a weld portion 82, hence, by rotating the adjusting nut 68, the valve stem 13 may be raised or lowered and the position of the valve 67 with respect to its seat controlled. The adjusting nut 68 carries a positioning pin 83 spring-pressed downwardly and vertically in the direction of the disc-like portion 73. This disc portion has a plurality of top recesses 84 (FIG. 4) into which the bottom end of the positioning pin 83, which is rounded, is adapted to project. This produces a "click" action in that the positioning pin will drop into a recess and certain set positions of the valve stem can be recognized by the operator for the proper control of his mechanism.

Although the number of positions of the valve stem may vary, I indicate in the drawings a total of five positions in one of which the valve stem will be adjusted to closed position, and in the others of which it would be adjusted to successively larger openings of the valve 67 for different types of advance and for different types of work. At the first position after "closed," for example, the advance of the stinger permitted by the adjustment would be for "slow." In positions 2, 3 and 4 the actuation of the stinger tool would be "soft," "medium" and "hard" respectively, and at position 5 the device would be entirely open. The adjustments are controlled in accordance with the hardness characteristics of the material through which the

drilling is taking place. The purpose is to permit free forward movement of the stinger in accordance with its usual functioning, but to provide a brake when it has travelled forwardly a sufficient distance to accomplish its function in the particular environment in which the tool is working at a given time. In using the safety brake of the present invention, therefore, all that is necessary is to attach it to a hydraulic tool **15** in the manner shown in FIG. 1, adjust the nut **68** in accordance with the work being performed, and proceed in the ordinary way to accomplish the safe drilling of the multiple holes to which the operator is assigned. If at any time there is a slippage or any action where the tool and chicken foot are not firmly in place, there will be no unimpeded movement of the rod **17** such as to cause injury to equipment and personnel. The device of the present invention does not impede the free movement of the worker in any significant manner. In a jack rod assembly weighing one hundred and thirty pounds, for example, the device of the present invention will add approximately only six pounds. Those skilled in the art are aware of the fact that pneumatic tools of the type preferred to commonly have a handle at a point intermediate its ends, so that the tool can be carried by one hand in a balanced position. Under such circumstances the balance can be provided in the same manner for the safety brake of the present invention, and the entire manner of handling the tool is practically unchanged.

Those skilled in the art will understand that the present invention is not limited to the exact structural features shown, it being only necessary that a generally similarly functioning structure be provided. The tools shown in the drawings and described in the specification, therefore, are not limiting, and the scope of the invention is defined by the claims.

I claim:

1. A jack leg stinger safety brake comprising, a cylinder and a piston rod, a piston head connected to said piston rod, means defining a longitudinal opening extending through said piston head and having an enlarged portion to form a valve seat, means defining a radial opening communicating with said longitudinal opening for providing a fluid flow path through said piston head, a valve stem extending through said longitudinal opening, said valve stem formed to mate with said seat, means defining an annular recess below said valve seat communicating with said longitudinal opening, means defining a hole parallel to said longitudinal opening communicating with said annular recess to provide a second fluid flow path through said piston head, and a ball valve positioned with-

ing said annular recess to permit fluid flow in said second fluid flow path in only one direction.

2. A jack leg stinger safety brake comprising, a cylinder and a piston rod, a piston head connected to the piston rod, means defining a longitudinal opening extending through said piston head and having an enlarged portion to form a valve seat, means defining a plurality of radial openings communicating with said longitudinal opening to provide a fluid flow path through said piston head, a valve stem adjustably extending through said longitudinal opening, said valve stem terminating in a rounded tip formed to mate with said seat, means defining an annular recess below said valve seat communicating with said longitudinal opening, means defining a plurality of holes parallel to said longitudinal opening each communicating with said annular recess to provide a plurality of second fluid flow paths through said piston head, a plurality of ball valves positioned within said annular recess to permit fluid flow in said second fluid flow paths in only one direction.

3. The device defined by claim **1** having a suction washer mounted on said piston head and engaging the inside walls of said cylinder below said annular recess for permitting fluid flow past said piston head during a return stroke and preventing fluid flow past said piston head during a power stroke.

4. A device defined by claim **2** having a suction washer mounted on said piston head and engaging the inside walls of said cylinder below said annular recess for permitting fluid flow past said piston head during a return stroke and preventing fluid flow past said piston head during a power stroke.

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