Nov. 10, 1959 W. L. G. HEUSNER 2,912,211

MINE PROP

Filed July 8, 1957

FIG. 1

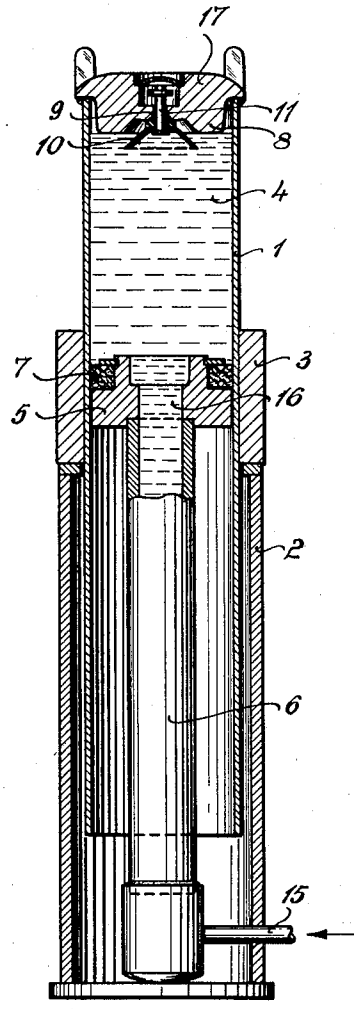


FIG. 2

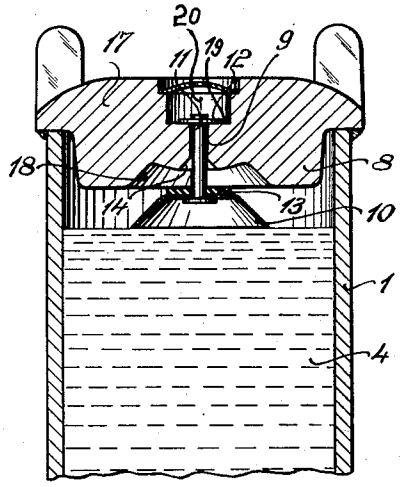
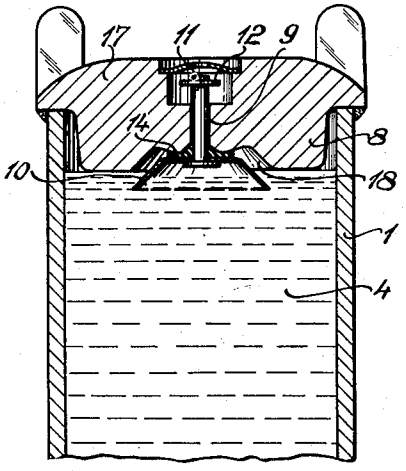


FIG. 3



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MINE PROP

Wilhelm L. G. Heusner, Bochum-Weitmar, Germany, assignor to Herman Schwarz K.G., Wattenscheid, Germany

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6 Claims. (Cl. 248—354)

In connection with the construction of mines, mine shafts, galleries etc. in underground mining it is common practice to employ supporting means such as mine props, movable supports and the like having two members movable relative to each other and held in their respective positions by friction. In addition thereto, there are to an ever increasing extent also employed two-part supporting means of which one part forms a cylinder adapted to receive liquid under pressure while a piston is movably arranged in said cylinder and connected with the other part of said supporting means.

The present invention concerns that group of supporting means in which the pressure chambers are filled with liquid during the actuation or operation only of said supporting means, whereas otherwise they merely contain air. If the hydraulic mechanism becomes effective only during a certain working operation, for instance when installing a mine prop, the said pressure chambers will only during the said operation be under liquid pressure and during the remaining time will be empty.

If liquid is introduced into the pressure chamber under pressure, the air in said pressure chamber will be compressed accordingly. It is, however, not desired that the pressure chamber in addition to the compressed liquid also contains a cushion of compressed air. The employed pressures frequently amount to several hundred atmospheres above atmospheric pressure. If the walls of the pressure chamber should tear or burst, considerable explosion-like damages could occur if larger quantities of air under high pressure were enclosed in the pressure chamber.

It is, therefore, an object of the present invention to provide supporting means of the above mentioned type which will overcome the drawbacks outlined above.

It is another object of this invention to provide an improved shut-off valve for use in connection with the pressure chamber of supporting means, such as mine props, in which the pressure chamber contains air only when the supporting means is out of operation and is filled with liquid when the supporting means is in operation.

It is also an object of this invention to provide an improved shut-off valve for the purpose set forth in the preceding paragraph, which will automatically release the far major portion of air from the pressure chamber of the supporting means while the latter is in operation.

These and other objects and advantage of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

Fig. 1 is a vertical section through the longitudinal axis of a mine prop equipped with the shut-off valve according to the invention.

Fig. 2 illustrates on a larger scale than Fig. 1 the shut-off valve according to the invention in opened position.

Fig. 3 likewise illustrates the shut-off valve according to the invention but in closed position.

General arrangement

The shut-off valve according to the present invention is so designed that it brings about an equalization of the

air pressure in the pressure chamber and the atmosphere as long as the pressure chamber is filled with liquid below a certain value or level. As soon as the pressure chamber has been filled with liquid under pressure to a certain extent or up to a certain level, the valve automatically effectively shuts off communication of the pressure chamber with the atmosphere. The said value or level of the filling of the pressure chamber is so selected that only a relatively minor quantity of air will remain entrapped in the pressure chamber which even in highly compressed condition will not be dangerous at all if a tear should occur in the walls of the pressure chamber. Thus, the new shut-off valve arrangement according to the invention will safely and automatically avoid dangers of explosion.

In addition to avoiding the above mentioned danger, the employment of the new valve has the further advantage that due to the escape of air during the filling in operation of liquid under pressure, no work will be required for compressing the air which previously remained in the pressure chamber. Thus, considerable amount of energy will be saved.

For the sake of completeness, it may be added that it is known to equip liquid filled pressure chambers of mine props with valves for purposes of venting the pressure chamber. These valves, however, have to be actuated manually. Aside from the fact that such manual operation of these valves makes the handling of the mine props more complicated, it also includes a factor of unsafety inasmuch as considerable quantities of compressed air will remain in the pressure chamber if the manually operable valve is closed too early. On the other hand, if it is closed too late, liquid under pressure will escape which is highly undesirable. In contrast to these known arrangements, the valve according to the present invention operates automatically inasmuch as the valve according to the present invention shuts off the compression chamber against the escape of air and liquid under pressure automatically as soon as the compression chamber has been filled with liquid to a certain predetermined extent.

Structural arrangement

Referring now to the drawing in detail, the two-part mine prop shown in Fig. 1 comprises an upper mine prop part **1** which is telescopically adjustable in the lower mine prop part **2**. The locking mechanism which may be designed in any convenient manner, for instance similar to the type described in U.S. Patent 2,744,717, is designated with the reference numeral **3**. The interior **4** of the upper mine prop part **1** is designed as cylindrical pressure chamber. Slidably mounted in the cylinder is a piston **5** which is fixedly connected to the pipe **6** mounted on the lower mine prop part **2**. The liquid under pressure is fed into the pipe **6** through a conduit **15**, pipe **6** communicating through a bore **16** with the pressure chamber **4**. The piston **5** is furthermore equipped with a piston seal **7**. The pressure chamber **4** is closed by a lid **8** carrying the mine prop head **17**. The lid **8** is provided with a bore **9** through which a pressure equalization may be effected between the outer air or atmosphere and the pressure chamber **4**.

According to a preferred embodiment of the shut-off valve according to the present invention, the shut-off valve has the shape of a diving bell. This diving bell **10** is guided in such a way that it can move in the pressure chamber **4** in the direction of the longitudinal axis only of said pressure chamber. More specifically, the diving bell **10** is provided with a shank **11** extending into and guided by the bore **9** in the lid **8**. A pin **12** extends through the upper end of the shank **11** and is adapted to

rest on the bottom 19 of a recess 20 in the lid 8 when the diving bell 10 is not in contact with the pressure liquid in the pressure chamber 4. In other words, in such an instance, the diving bell is suspended in the lid by means of the pin 12.

The bottom side of the lid 8 is provided with a truncated cone-like recess the contour of which, substantially conforms to the outer contour of the diving bell 10. The top surface of the diving bell is provided with a soft seal 13 which when the diving bell is in its uppermost position, engages the bottom portion 14 of the lid 8 which bottom portion forms a valve seat.

It is thus evident that when the pressure chamber 4 is filled with liquid, the liquid level when reaching a certain height will engage the diving bell 10 to lift the same upwardly with the increasing filling of the compression chamber 4 so as finally to cause the diving bell 10 to press the seal 13 against the valve seat 14 thereby sealing the interior of the pressure chamber 4 safely against the outside. Thus, no further air which may be left in the pressure chamber can escape which, however, is immaterial inasmuch as the entrapped quantity of air is rather small. The entrapped air will then be compressed when the liquid pressure increases further to the pressure at which the two parts, the upper prop part and the lower prop part, are braced relative to each other. The fact that the diving bell is of a rather flat shape and that the bottom portion of the lid has a contour corresponding to the contour of the diving bell, further assures that the quantity of entrapped air will be only very small.

As indicated above, when the fluid operable actuating mechanism of the mine prop is out of operation, the diving bell 10 occupies the position shown in Fig. 2, only when pressure liquid is fed into the chamber 4 and has reached a level at which it begins to carry the diving bell, will the diving bell with a further rise of the liquid level be lifted upwardly until the seal 13 engages the valve seat 14. Only at this time, the compression proper of the liquid starts and at the obtainment of a certain high pressure will the upper prop part 1 be lifted into the desired position. The air within the diving bell and in the outer chamber 18 will then be subjected to the pressure prevailing in chamber 4 and its volume will be accordingly increased to a very small volume. Inasmuch as the same pressure prevails outside and inside the diving bell, deformations of the diving bell will not be encountered.

After the mine prop has been set to the desired height and after the locking mechanism has been made effective to maintain the upper and lower prop parts in their respective adjusted positions, the pressure liquid is released from chamber 4 through conduit 15. While this occurs, the diving bell 10 gradually moves downwardly and returns to the position shown in Fig. 2. Through the bore 9 between the walls thereof and shank 11 air will then again enter the chamber 4 and gradually fill the same.

It is, of course, to be understood that the present invention is, by no means, limited to the particular construction shown in the drawing but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. In combination with a high load supporting member having a cylinder adapted to receive liquid under pressure, and a piston extending thereinto, said cylinder and piston being movable relative to each other: a shut-off valve having an air vent and also comprising hydraulically operable means operable in response to a predetermined filling of said pressure chamber automatically to close off said vent.

2. In combination in a hydraulically operable mine prop having a pressure chamber adapted to be filled with actuating liquid: discharge control means including an air outlet passage arranged at the upper end of said pressure chamber and communicating with the atmosphere, and a valve member normally spaced from said outlet passage so as to allow air to pass from said pressure chamber through said passage into the atmosphere and vice versa, said valve member being designed as a float adapted to be engaged by said actuating liquid in said pressure chamber at a certain level of said actuating liquid and subsequently with increasing level to be lifted into position for closing said passage prior to the level of said actuating liquid reaching said outlet passage.

3. In combination with a hydraulically operable mine prop having a pressure chamber adapted to be filled with actuating liquid and closed by a lid: a valve system comprising a passage extending through said lid for establishing communication between the interior of said pressure chamber and the atmosphere, the lid area facing the interior of said pressure chamber and surrounding said passage forming a valve seat, and a float movable in axial alignment with said valve seat and provided with a sealing surface for engagement with said valve seat to thereby close said passage for interrupting communication between the interior of said pressure chamber and the atmosphere, said sealing surface being normally spaced from said valve seat but being movable to engage said valve seat for closing off said passage in response to a certain liquid level in said pressure chamber.

4. In combination with a hydraulically operable mine prop having a pressure chamber adapted to be filled with actuating liquid and closed by a lid: a valve system comprising a passage through said lid for establishing communication between the interior of said pressure chamber and the atmosphere, and a diving bell provided with a sealing surface and also with a stem extending with play through said passage and movably suspended on said lid to normally suspend said diving bell so that the sealing surface thereof is spaced from that bottom area of said lid which surrounds said passage, said diving bell forming a float adapted to be engaged by actuating liquid in said pressure chamber at a certain level of said liquid in said chamber and subsequently with increasing level of said liquid to be pressed against said bottom area to thereby cause said sealing surface to close said passage.

5. An arrangement according to claim 4, in which that bottom area of the lid which faces the outer surface of said diving bell is shaped in conformity with the contour of said diving bell.

6. In combination with a hydraulically operable mine prop having a pressure chamber adapted to be filled with actuating liquid and closed by a lid; a valve system comprising a passage extending through said lid for establishing communication between the interior of said pressure chamber and the atmosphere, the lid area facing the interior of said pressure chamber and surrounding said passage forming a valve seat, a float movable in axial alignment with said valve seat, a compressible seal mounted on the outer surface of said float for engagement with said valve seat, said compressible seal normally being spaced from said valve seat but being movable to engage said valve seat for closing off said passage in response to a certain liquid level in said pressure chamber.

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