June 15, 1937. F. H. ARMSTRONG 2,083,981

MATERIAL BREAKING APPARATUS

Filed April 18, 1935

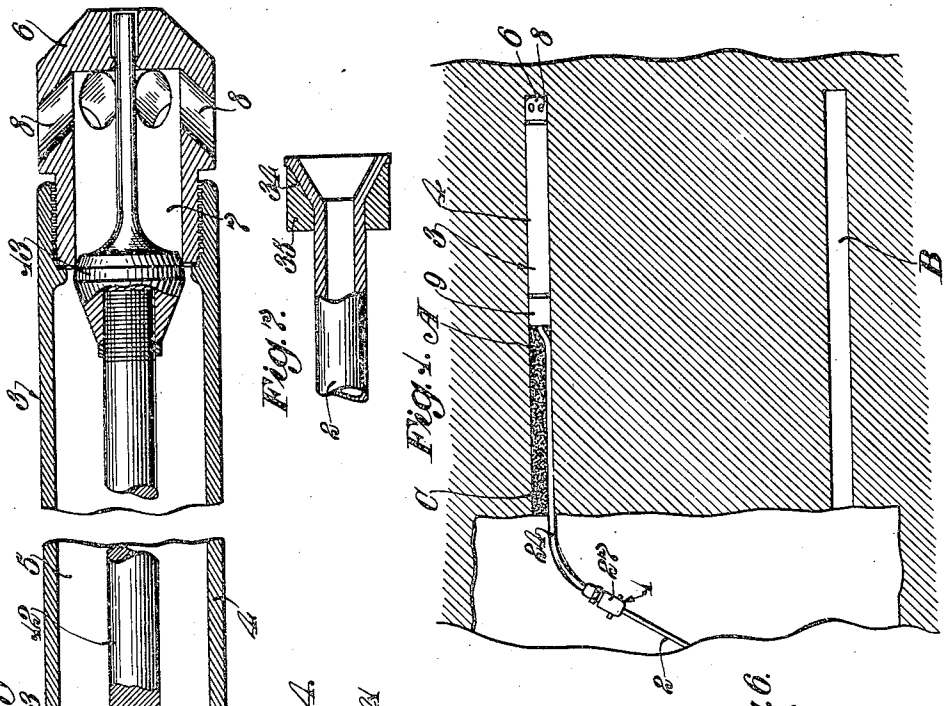


Fig. 1.

Fig. 1a.

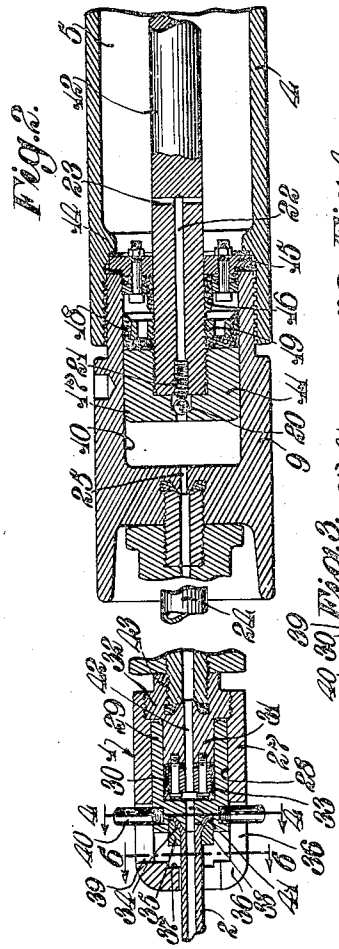


Fig. 2.

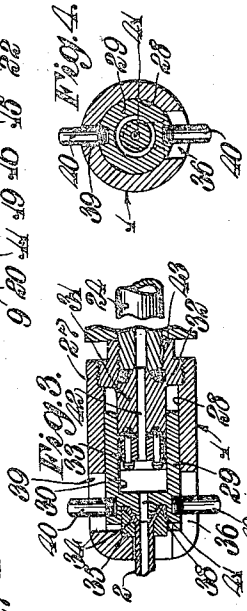


Fig. 3.

Fig. 4.

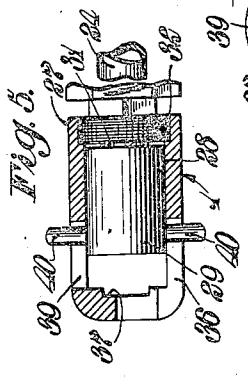


Fig. 5.

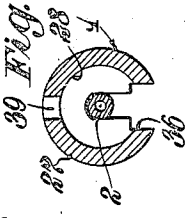


Fig. 6.

Inventor:
Frank H. Armstrong.
by Louis B. Wilson.
Atty.

Patented June 15, 1937 2,083,981

UNITED STATES PATENT OFFICE

2,083,981

MATERIAL BREAKING APPARATUS

Frank H. Armstrong, Michigan City, Ind., assignor, by mesne assignments, to Safety Mining Company, Chicago, Ill., a corporation of Illinois

Application April 18, 1935, Serial No. 17,081

10 Claims. (Cl. 285—143)

This invention relates to material-breaking apparatus, and more particularly to an improved detachable connection for the supply line of a material-breaking shell of the type wherein highly compressed gas is employed as a material-breaking medium.

An object of this invention is to provide an improved detachable connection for a compressed gas supply line. Another object is to provide an improved detachable connection wherein the pressure of the gas in the supply line is employed for maintaining an effective seal between the separable parts. Yet another object is to provide an improved quick detachable connection for a compressed gas supply line which may be readily released while, when in closed position, maintaining an effective seal between the separable parts. A still further object is to provide an improved detachable connection between the pipe sections of the high pressure gas supply line for a material-breaking shell of the type wherein highly compressed gas is employed as a material-breaking medium, the separable parts being maintained tightly sealed by the pressure of the gas in the line during flow of gas to the shell. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawing there is shown for purposes of illustration one form which the invention may assume in practice.

In this drawing,—

Fig. 1 is a diagrammatic sectional view showing the improved material-breaking apparatus in operative relation with respect to the material to be broken down,

Fig. 2 is a view in longitudinal section of the illustrative form of the improved quick detachable connection and its associated material-breaking shell,

Fig. 3 is a view in longitudinal section of the improved detachable connection, showing the parts in closed relation,

Fig. 4 is a cross sectional view taken on line 4—4 of Fig. 2,

Fig. 5 is a view showing the parts in released position with the gas supply line disconnected therefrom,

Fig. 6 is a cross sectional view taken on line 6—6 of Fig. 2,

Fig. 7 is a detail view showing the attaching end of the gas supply line.

In this illustrative embodiment of the invention the improved quick detachable connection, generally designated 1, is shown associated with the gas supply line 2 of a material-breaking shell, generally designated 3, of the type wherein highly compressed gas is employed as a material-breaking medium.

The gas shell 3 is of the same general character as that disclosed in my copending application Serial No. 718,175, filed March 30, 1934, shown in Fig. 12, and comprises a tubular container 4 having a chamber 5 for receiving a charge of material-breaking pressure. Threadedly secured within the inner end of this container is a discharge cap 6 having an axial discharge orifice 7 communicable with the pressure chamber 5 and connected through a series of radial discharge openings 8 with the shell exterior. Threadedly secured within the outer end of the container 4 is a control cap 9 having a control chamber 10 containing a reciprocable control piston 11. The piston rod 12 of the control piston extends axially within the pressure chamber 5 and has secured to its inner end a control valve 13 for closing the communication of the discharge orifice 7 with the pressure chamber 5 during charging of the latter. Positioned between the inner end of the control cap 9 and an internal annular shoulder 14 formed within the container, is a heavy steel plate or disc 15 to which is secured a hat leather 16 surrounding and adapted to seal on the exterior surface of the valve rod 12 which passes therethrough. The control piston 11 is in this instance in the form of a steel plunger 17 having secured thereto a cup leather 18, the cup leather held in position on the plunger by a keeper 19 threaded on the piston rod. A suitable ball check valve 20 with check spring 21 is provided in the plunger 17 as a means for permitting the flow of high pressure gas from the control chamber 10 at the outer side of the control piston into the main chamber 5 of the shell, but preventing flow in the reverse direction, this check valve controlling the flow of pressure fluid through an axial passage 22 formed in the control rod and connected by radial passages 23 with the pressure chamber 5. A supply line pipe section 24 is secured within the control cap 9 and is connected by an axial passage 25 with the control chamber 10 at the outer side of the control piston, and this supply connection communicates through the connection 1 and the pipe section 2 with a suitable source of high pressure gas. The supply pipe section 24 permits the introduction of high pressure gas into the control chamber 10 at the outer side of the control piston and this results in axial movement of the

valve and plunger assembly to bring the valve 13 into firm sealing engagement with the end of the discharge cap 6 to close communication of the discharge orifice 7 with the pressure chamber 5. At the same time the high pressure gas flows from the control chamber 10, past the check valve 20 through the passages 22 and 23 into the pressure chamber 5. It is important to note that as the pressure builds up in the main pressure chamber 5, the high pressure gas is permitted to escape from the main chamber outwardly along the valve rod 12 into the space immediately at the inner side of the plunger 17, the hat leather 16 functioning merely as a check valve under these circumstances. In other words, the pressure of the charge in chamber 5 passing along the valve rod 12 tends to expand the hat leather from sealing engagement with the rod, thus permitting the passage of high pressure gas into the control chamber 10 between the disc 15 and the inner side of the control piston 11. It will be observed, however, that reversal of flow can not occur when the pressure in the control chamber 10 at the outer side of the control piston falls below the pressure trapped in the space mentioned at the inner side of the control piston. When a charge of desired value has been introduced into the main pressure chamber 5, the discharge is effected by venting the supply pipe 24 in a suitable manner to the atmosphere. This results immediately in the lowering of the pressure in the control chamber 10 at the outer side of the control piston, and bearing in mind that the pressure trapped in the space immediately at the inner side of the plunger is the same as that of the charge introduced into the pressure chamber 5, it is apparent that this reduction of pressure in the chamber 10 immediately results in axial movement of the valve and plunger assembly toward the left in Fig. 2. The initial opening of the release valve 13 naturally results in an immediate and extremely rapid drop in pressure within the pressure chamber 5, but it will be appreciated that the pressure trapped between the plate 15 and the inner side of the control piston will be maintained for a while, and so reclosure of the main discharge valve will be prevented. Thus, the compressed gas trapped in the control chamber at the inner side of the control piston serves to move positively the valve and plunger assembly toward open position and to maintain it in that position.

Now, referring to the improved detachable connection 1, it will be noted that the same herein is arranged between the supply pipe sections 2 and 24, and comprises a casing 27 having a bore 28 in which is slidably mounted a reciprocable cylinder 29. Contained in the bore 30 of the cylinder 29 is a stationary piston 31, herein formed integral with the detachable head 32 of the casing 27, and this piston carries a cup packing 33 for preventing leakage of high pressure gas past the piston 31. The inner terminal of the supply connection 2 is flared at 34 and has loosely mounted thereon a washer 35. The outer end of the casing is slotted at 36 to permit lateral insertion of the terminal end of the pipe section 2 and the washer 35 within the bore 28 of the casing 27 at the outer side of the cylinder 29 in the manner shown in Figs. 2 and 3, and the inner wall of the casing is recessed at 37 for receiving the washer 35. The outer surface of the cylinder 29 is provided with a conical projection 38 adapted to fit within the flared end of the pipe section 2, and when the parts are in closed position cooperates with the washer 35 in the tight clamping of the flared end of the pipe section 2 therebetween. As shown, secured within the opposite walls of the cylinder 29 and projecting outwardly through the slot 36 and an opposite, longitudinal slot 39 in the casing 27, are rod-like handles 40 for facilitating manual movement of the cylinder 29 in the casing 27. An axial passage 41 connects the interior of the pipe section 2 with the bore 30 at the outer side of the piston 31, while formed axially within the piston 31 is an axial passage 42 for connecting the bore 30 with the pipe section 24, the latter being threadedly secured at 43 within the casing head 32.

In Fig. 1 the material-breaking shell 3 is shown positioned in a drill hole A formed in the material to be broken down, the drill hole being located, in this instance, above a horizontal kerf B cut in the material at the bottom of the mine wall. After the shell has been so positioned, with the supply pipe section 24 projecting outwardly from the drill hole, the hole may be suitably tamped at C. The terminal end of the supply connection 2 and the washer 35 are then inserted laterally through the slot 36 in the casing 27 of the detachable connection 1, and the operator grasps the handles 40 to move the cylinder 29 outwardly to bring the nose 38 into the flared end of the tubing 2 and to press the washer 35 into the recess 37 in the casing in the manner shown in Fig. 3. High pressure gas is then admitted to the supply pipe section 2, the gas flowing through the terminal end of the pipe section 2, through the axial passage 41 in the cylinder 29, to the bore 30 at the outer side of the piston 31, the high pressure gas acting on the outer end area of the bore 30 to hold the cylinder 29 tightly in the position shown in Fig. 3, thereby maintaining the flared end 34 of the pipe section 2 tightly clamped in sealing engagement between the washer 35 and projection 38. High pressure gas flows from the bore 30 through axial passage 42, pipe section 24, axial passage 25, past the ball check valve 26, and through passages 22 and 23 to the main pressure chamber 5 of the shell, the high pressure gas acting on the outer pressure area of the control piston to maintain the pressure release valve 13 tightly closed. When it is desired to effect release of the material-breaking pressure from the chamber 5, the supply of high pressure gas to the connection 2 is cut off and the pipe section 2 suitably vented to atmosphere; and as a result the pressure in the axial passages 41, 42, supply connection 24 and the control chamber 10 at the outer side of the control piston is substantially reduced. The pressure in the control chamber 10 at the inner side of the control piston acting against the opposing reduced pressure effects sudden movement of the plunger and valve assembly toward the left in Fig. 2, thereby opening wide the communication of the discharge orifice 7 with the pressure chamber 5; and as a result the charge of pressure in the chamber 5 is suddenly released into the material to be broken down. After the material has been broken down, and while the chamber 30 is not under pressure, the operator grasps the handles 40 of the detachable connection, and moves the cylinder 29 inwardly into the position shown in Fig. 2. The terminal end of the supply connection 2 may then be readily moved laterally through the slot 36 from the casing 27.

As a result of this invention, it will be noted that an improved detachable connection is provided for the supply line of a material-breaking shell of the type wherein a high pressure gas is employed as a material-breaking medium, the improved connection having embodied therein separable connections maintained sealed by the pressure of the gas in the line, and readily separable at will. It will be further noted that the improved detachable connection is of an extremely simple and rugged structure well adapted to withstand the high pressures encountered, comprising but a relatively few component parts. These and other uses and advantages of the improved material-breaking apparatus will be clearly apparent to those skilled in the art.

While I have in this application specifically described one form which my invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. A pipe coupling through which a fluid under high pressure flows comprising a casing to which one pipe section is secured, and having a chamber for receiving the flared terminal end of the other pipe section, and a plunger contained in said casing subjected to the high fluid pressure within the coupling for forcing the plunger toward and having a conical projection adapted to fit within the flared end of said pipe for maintaining a tight sealing engagement between said pipe sections.

2. A pipe coupling comprising a casing to which one pipe section is secured, and having a chamber for receiving the flared terminal end of the other pipe section, and a plunger contained in said casing and having a conical projection adapted to fit within the flared end of said pipe section for maintaining a tight sealing engagement between said pipe sections, said plunger actuated by the pressure of the fluid flowing through said pipe sections, and having formed therein a bore through which the pressure flows, a stationary piston secured to the casing and projecting within said bore, and packing means between said piston and the wall of said plunger bore subjected to the pressure of the fluid in said bore for maintaining a fluid tight seal.

3. A quick detachable connection for a high pressure gas line having separable pipe sections comprising a hollow casing having a slotted wall, a piston fixedly connected to one pipe section and to the casing to project into the interior of the latter, an enlargement formed on the other pipe section insertable into said casing through said slot, a plunger slidable on said piston and movable by the pressure in the line to clamp and seal the enlargement within the casing during gas flow, and packing means engaging the piston and plunger and subjected to the high pressure of the line for effecting a gas tight seal between the piston and plunger.

4. A quick detachable connection for a high pressure gas line having separable pipe sections comprising a hollow casing having a slotted wall, a piston fixedly connected to one pipe section and to the casing to project into the interior of the latter, an enlargement formed on the other pipe section insertable into said casing through said slot, a plunger slidable on said piston and movable by the pressure in the line to clamp and seal the enlargement within the casing during gas flow, and means for manually actuating said plunger upon discontinuation of said gas flow to disengage it from the said enlargement while the latter is still inserted in the casing.

5. A quick detachable connection for a high pressure gas line having separable pipe sections comprising a hollow casing having a slotted wall, a piston fixedly connected to one pipe section and to the casing to project into the interior of the latter, a flared end formed on the other pipe section and insertable into said casing through said slot, and means for clamping said flared end in tight sealing engagement within said casing comprising a washer engaging one side of said flared end, and a plunger slidable on said piston and movable by the pressure in the line into engagement with the other side of said flared end, and packing means engaging the piston and plunger and subjected to the high pressure of the line for effecting a gas tight seal between the piston and plunger.

6. A quick detachable connection for a high pressure gas line having separable pipe sections comprising a hollow casing having a slotted wall, a piston fixedly connected to one pipe section and to the casing to project into the interior of the latter, a flared end formed on the other pipe section and insertable into said casing through said slot, and means for clamping said flared end in tight sealing engagement within said casing comprising a washer engaging one side of said flared end, and a plunger slidable on said piston and movable by the pressure in the line into engagement with the other side of said flared end, said flared pipe end, washer, and plunger having mating conical surfaces, and packing means engaging the piston and plunger and subjected to the high pressure of the line for effecting a gas tight seal between the piston and plunger.

7. A quick detachable connection for a high pressure gas line having separable pipe sections comprising a hollow casing having a slotted wall, means for connecting one pipe section to the hollow casing, a flared end formed on the other pipe section and insertable into said casing through said slot, and means operated by the pressure in the line for entirely enclosing and tightly clamping the flared pipe end to seal the same within said casing.

8. A quick detachable connection for a high pressure gas line having separable pipe sections comprising a hollow casing having a slotted wall, means for connecting one pipe section to the hollow casing, a flared end formed on the other pipe section and insertable into said casing through said slot, means operated by the pressure in the line for entirely enclosing and tightly clamping the flared pipe end to seal the same within said casing, and manually operable means for breaking said seal upon discontinuation of said gas flow.

9. A quick detachable connection for a high pressure gas line having separable pipe sections comprising a hollow casing having a slotted wall, a piston fixedly connected to one pipe section and to the casing to project into the interior of the latter, a flared end formed on the other pipe section and insertable in said casing through said slot, and means operated by the pressure in the line for entirely enclosing and tightly clamping the flared pipe end to seal the same within said casing, said means including a plunger slidable

on the piston into engagement with said flared end.

10. A quick detachable connection for a high pressure gas line having separable pipe sections comprising a hollow casing having a slotted wall and a recess communicating with the slot, means for attaching one pipe section to the casing, an enlargement formed on the other pipe section, a washer bearing against one face of the said enlargement, said pipe enlargement and washer being insertable into the casing through said slot and positioned with the washer seated in said recess, and a plunger moved by the pressure in the line into engagement with the opposite face of the pipe enlargement to tightly seal the pipe section, said washer and plunger being shaped to entirely enclose the pipe enlargement.

FRANK H. ARMSTRONG.