

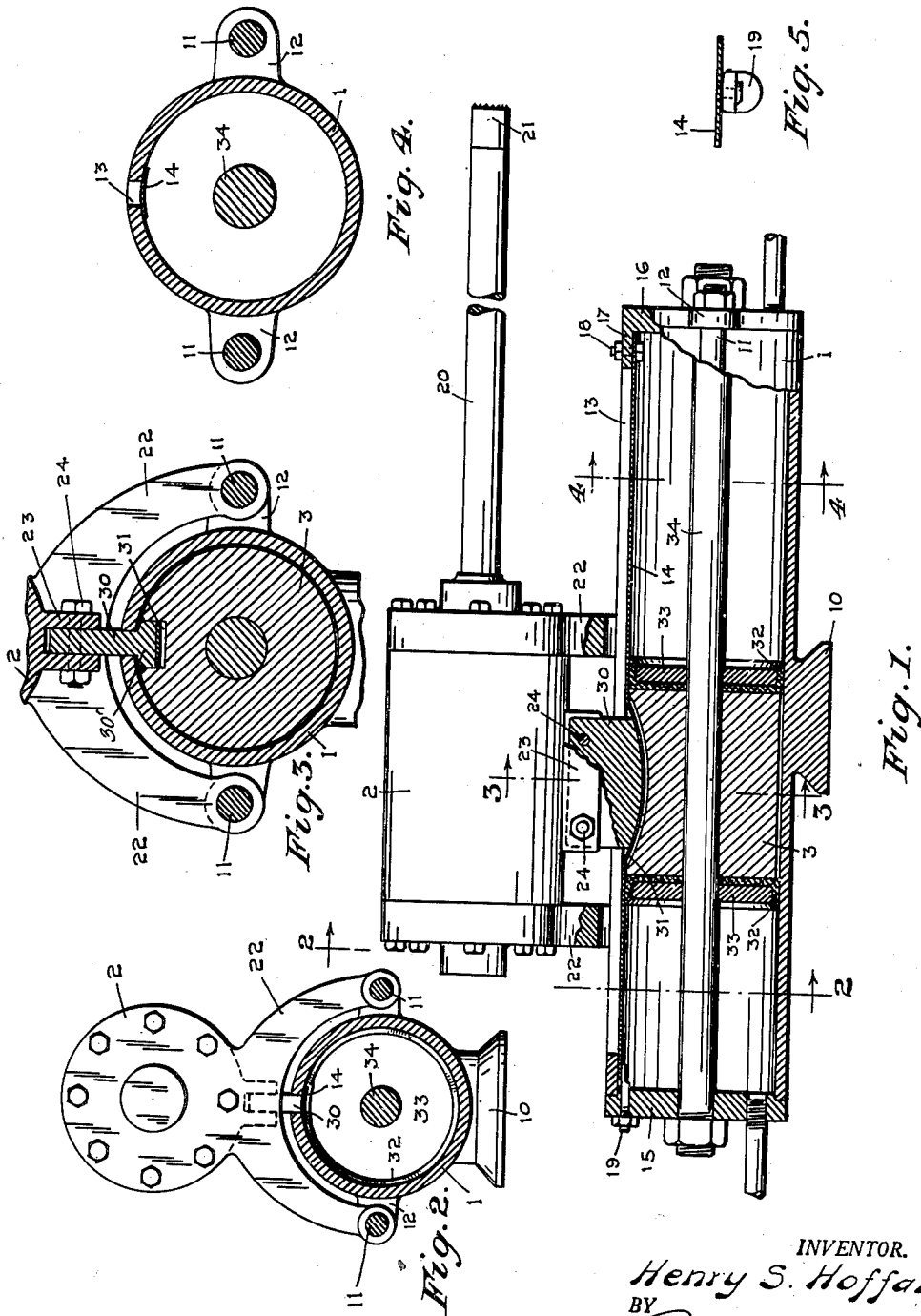
June 14, 1949.

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2,473,430

PISTON COUPLING MECHANISM

Filed May 19, 1945



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UNITED STATES PATENT OFFICE

2,473,430

PISTON COUPLING MECHANISM

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Application May 19, 1945, Serial No. 594,653

2 Claims. (Cl. 121—9)

1

My invention relates to coupling mechanism, which may be employed, for example, in a rock drill feed arrangement for connecting to the drill a feed piston, movable lengthwise through a cylinder by the application of fluid pressure. My invention is, of course, applicable to fluid piston and cylinder drives used for other purposes.

My Patent No. 2,259,694, issued October 21, 1941, for a Diamond drill feed control, illustrates a representative feed mechanism for moving lengthwise rock drills of the diamond drill type, in which the cylinder housing the fluid actuated piston is located alongside the rotary drill motor. The coupling arrangement disclosed in that patent interconnecting the piston and motor has been found to have certain disadvantages, however, which are overcome by my present invention.

An object of my invention is to provide a short coupling which can directly interconnect drill mechanism, for example, and a feed piston received in a feed cylinder located alongside the drill mechanism. More specifically, the connecting element extends through a slot extending lengthwise of the feed cylinder. In effecting such connection it is a principal object to provide a simple and effective seal for such slot.

An additional object is to enable such cylinder sealing arrangement to be utilized with a piston subjected to fluid pressure on both sides of it, and which can travel substantially from end to end of the cylinder, so that its effective stroke will be substantially coextensive with the cylinder length. A further object is to construct such a seal so that it may be installed and removed easily and quickly, enabling the piston to be withdrawn from the cylinder for purposes of repacking whenever desired.

Still another object is to provide a novel cylinder assembly and piston guide arrangement which will withstand high cylinder pressures, yet which is extremely simple in construction, dependable and efficient in operation, and easy to install.

Other features of the embodiment of my invention which I now prefer will be discussed in the following detailed description and are shown in the accompanying drawing.

Figure 1 is a side elevation view of drill mechanism incorporating my invention, showing one wall of the cylinder and piston broken away along a diametral longitudinal plane.

Figure 2 is a view taken on line 2—2 of Figure 1, showing the drill mechanism in elevation and the cylinder in transverse section. Figure 3 is a fragmentary transverse sectional view through

2

the cylinder, piston, and coupling, taken on line 3—3 of Figure 1, and Figure 4 is a transverse sectional view through the cylinder taken on line 4—4 of Figure 1.

Figure 5 is a detail transverse sectional view through the sealing element, near its left end as seen in Figure 1.

It will be evident that a rock drill may be supported alongside a feed cylinder in various ways for movement of the drill relative to the cylinder. In my previous Patent No. 2,259,694, mentioned above, the drill motor was mounted on a saddle embracing the major portion of the periphery of the feed cylinder, as shown best in Figure 4 of that patent. An alternative supporting arrangement, illustrated in the accompanying drawings, also supports the drill from the feed cylinder.

The feed cylinder 1 may have integral with it the swivel mounting cone 10. Preferably at the side of the feed cylinder remote from this mounting cone is located the rock drill motor 2 which carries the drill rod 20 terminating in the bit 21, represented as of the diamond type. The drill motor, which customarily is driven by compressed air, although not necessarily so, rotates the drill rod 20 as the motor is fed forward, to the right in Fig. 1.

The drill motor 2 may be supported from the feed cylinder 1 by arched supports 22, each supporting one end of the drill, which straddle the feed cylinder to dispose their ends at its opposite sides, preferably substantially in a diametral plane of such cylinder. Rods 11, extending lengthwise along opposite sides of the cylinder, and carried by ears 12 projecting radially from opposite ends of the cylinder, pass through apertures in the ends of the arched supports 22. These rods serve both as supporting mechanism for mounting the drill motor, and guides for guiding its reciprocation lengthwise of the feed cylinder, substantially from end to end of it.

To effect movement of the drill motor 2, a feed piston 3 is received within the feed cylinder 1, and coupled to the drill motor by a connecting plate 30 secured to or integral with the piston. This plate projects from the piston outward through a slot 13 extending lengthwise of the feed cylinder over substantially its entire length, and its outer end is received between projections 23 formed on the body of drill motor 2. Bolts 24 pass through such projections and interconnecting plate 30 to complete the coupling.

The problem of sealing slot 13 in the wall of cylinder 1, through which connecting plate 30 projects, is solved very effectively by my construc-

tion, to prevent escape of fluid under pressure within the cylinder spaces at opposite ends of piston 3, whether such fluid be gas or liquid. The sealing means which I employ for this purpose include a metal strip or tape 14, of a width appreciably greater than the width of slot 13, perhaps twice as great, which is disposed within the cylinder underlying the slot and in registry with it. As shown in Figure 5, this strip in relaxed condition preferably is planar, but when it is subjected to the pressure of the fluid within the cylinder it is curved transversely by being pressed tightly against the inner surface of the cylinder wall to conform generally to the wall curvature, and to bridge across slot 13.

Sealing strip 14 does not move lengthwise with piston 3 as it reciprocates within the cylinder 1, but remains stationary, being stretched tightly between the end plates or heads 15 and 16 of the cylinder. In order to enable the piston to be removed from the cylinder and again inserted, at least one end of slot 13 must be able to be opened. Such end is shown at the right of Figure 1, closed by a lug 17, which may be formed integral with the cylinder head 16. Strip 14, it will be noted, is long enough to extend to the inner face of such head, so that it assists in sealing any crack between the cylinder wall and the edges of the slot-closing lug. This end of the sealing strip is secured to the lug by a bolt 18, and its other end is attached to cylinder head 15 by a bolt 19 extending lengthwise of the cylinder and riveted, or otherwise permanently secured, to such end of the strip.

Because connecting plate 30 projects through slot 13, and strip 14 covers this slot, it would be supposed that these two elements would conflict, and that the sealing strip would interfere with reciprocation of the piston lengthwise within the feed cylinder. Such conflict is avoided, however, by forming a groove 31 in one side of the piston, extending lengthwise of it, to receive the sealing strip. Such groove is of rectangular cross section, and its chordwise width is slightly greater than the width of the sealing strip, to afford adequate clearance for it. If the depth of this groove were only approximately as great as the thickness of the sealing strip, no opportunity would be afforded for securing connecting plate 30 to the piston.

Instead of the bottom of the piston groove 31 being linear, it is concave lengthwise of piston 3, and the groove ends preferably are spaced slightly from the piston's ends. The inner edge of connecting plate 30 has a transverse flange 30' integral with it, so that such plate is of T-bar section. The width of this flange is substantially equal to the width of groove 31, and its face is convex, complementary to the concavity of the piston groove. Such connecting flange fits snugly into the piston groove with its convex face spaced from the bottom of the groove just slightly more than the thickness of sealing strip 14. When in this position the flange shoulders lie substantially in continuation of the cylindrical surface of the piston. With the flange 32 of the connecting plate thus received in the piston groove 31 the exposed corners of such flange are welded, brazed, or similarly secured to the piston so that the piston and connecting plate form an integral assembly.

Circular packing cups 32 are secured to each end of piston 3 by retainer plates 33. The cylinder assembly is completed by a tie rod 34 which passes axially through the piston and both cylin-

der heads 15 and 16. Nuts threaded on each end of the rod hold the cylinder heads firmly against their respective ends of the cylinder wall.

In assembling the mechanism described the connecting plate 30 will be secured on piston 3, and retainer plates 33 will be fastened to each end of the piston over the sealing cups 32. The right end of sealing strip 14, bolt 19 having been secured to its left end, will now be passed through the passage formed in the bottom of groove 31 beneath the connecting plate flange 30'. The right end of this strip will then be secured by bolt 18 to the lug 17 of cylinder head 16.

The next step is to insert the piston 3 into cylinder 1, at the same time passing the projecting portion of connecting plate 30 into the open right end of cylinder slot 13. When the piston is in place in the cylinder, the rod 34 may be passed through the cylinder and the central aperture of the piston. Cylinder head 16 is next placed on the right end of the cylinder, as seen in Fig. 1, with its lug 17 closing the end of slot 13. The other cylinder head 15 may now be put in place with bolt 19 and rod 34 passing through their respective apertures in it.

The cylinder assembly is secured firmly together by tightening the nuts on opposite ends of rod 34 to draw the cylinder heads 15 and 16 toward each other. Sealing strip 14 may next be tensioned the desired amount by screwing up the nut on bolt 19. This bolt, it will be noted, is located sufficiently close to the margin of cylinder head 15 so that the sealing strip lies against the cylinder wall, and consequently, even before fluid under pressure is admitted to the cylinder, the sealing strip will assume a somewhat transversely curved shape, as shown in Figure 4. When such fluid is supplied to the spaces within the cylinder at each end of the piston the sealing strip will be pressed tightly against the cylinder walls along the margins of slot 13, and piston sealing cups 32 will also be flared outwardly against the cylinder walls, to embrace closely the strip 14, as shown in Figure 2.

If the pressure of the fluid in opposite ends of the cylinder is unequal, piston 3 will be driven away from the high pressure end and toward the low pressure end, sliding along sealing strip 14. Although beyond each end of the piston this strip is curved transversely, the intermediate portion passing through piston groove 31 beneath the connecting plate flange 32 will be bowed inward lengthwise, but will be flat transversely, each section changing its curvature from transverse to lengthwise as the piston groove 31 moves over the strip, and resuming its transverse curvature as the piston groove passes beyond each such section. The slot 13 will not be sealed over such intermediate portion, but no fluid can leak through it at this point, because a seal is effected around the strip at both ends of the piston by the cups 32, in the manner shown in Figure 2 and discussed above.

With the cylinder and piston mechanism completely assembled in this manner guide rods 11 may be passed through the ears 12, which may be formed on the cylinder heads 15 and 16, and through the arcuate supports 22 of the drill motor 2. When the projections 23 of the air motor have been secured to the connecting plate 30 by bolts 24 the coupling and cylinder assembly will be completed for operation.

I claim as my invention:

1. A piston coupling mechanism comprising a cylinder having a slot through its wall extending

5

lengthwise thereof, said slot throughout its depth and length being of uniform width, a piston head fitting within said cylinder for reciprocation lengthwise thereof, connecting means carried by said piston head and projecting outwardly therefrom through said cylinder wall slot, a bypass in one side of said piston head of substantially rectangular cross section and concaved lengthwise of the piston head, and a sealing strip within said cylinder having its ends affixed to the ends of said cylinder and located to cover said cylinder wall slot and extend through said bypass, said strip being normally of substantially rectangular cross section and capable of flexing transversely by virtue of the pressure of motive fluid within said cylinder to conform substantially to the curvature of the cylinder and engage the latter in fluid tight relation therewith.

2. A piston coupling mechanism comprising a cylinder having a slot through its wall extending lengthwise thereof, a piston head fitting within said cylinder for reciprocation lengthwise thereof, connecting means carried by said piston head projecting outwardly therefrom through said cylinder wall slot including a groove in one side of said piston head concaved lengthwise thereof, a sealing strip within said cylinder secured therein against longitudinal movement relative thereto and located to cover said cylinder wall slot and

6

extend through said groove, said strip being normally of rectangular cross section and capable of flexing transversely by virtue of the pressure of motive fluid within said cylinder to conform substantially to the curvature of the cylinder and engage the latter in fluid tight relation therewith and a sealing cup on each side of said piston capable of flaring outwardly by virtue of the pressure of motive fluid within said cylinder to press tightly against the cylinder wall and said strip in fluid tight relation therewith.

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