United States Patent

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[72] Inventors **Alexander Andreevich Pavlichenko**
Kvartal 37, Korpus 11, kv. 5;
Andrei Yakovlevich Frolov, 11 Parkovaya
44, Korpus 3, kv. 119, both of Moscow,
U.S.S.R.

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[31] **1251349**

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[54] **ARRANGEMENT TO SEAL THE SHAFT OF A DRILLING FACE ENGINE**
1 Claim, 1 Drawing Fig.

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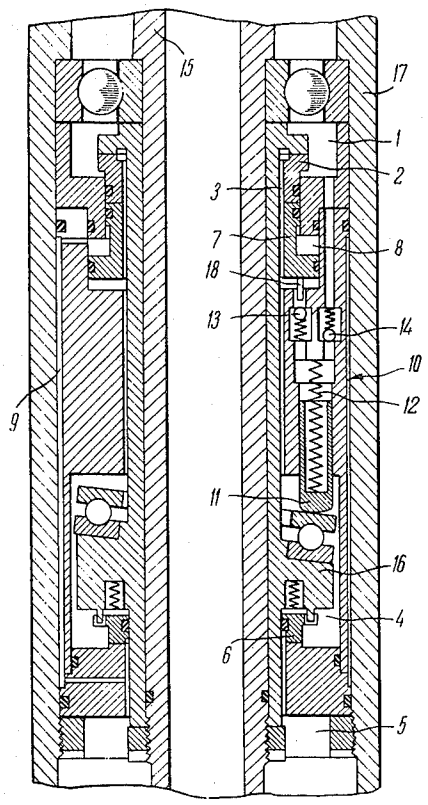
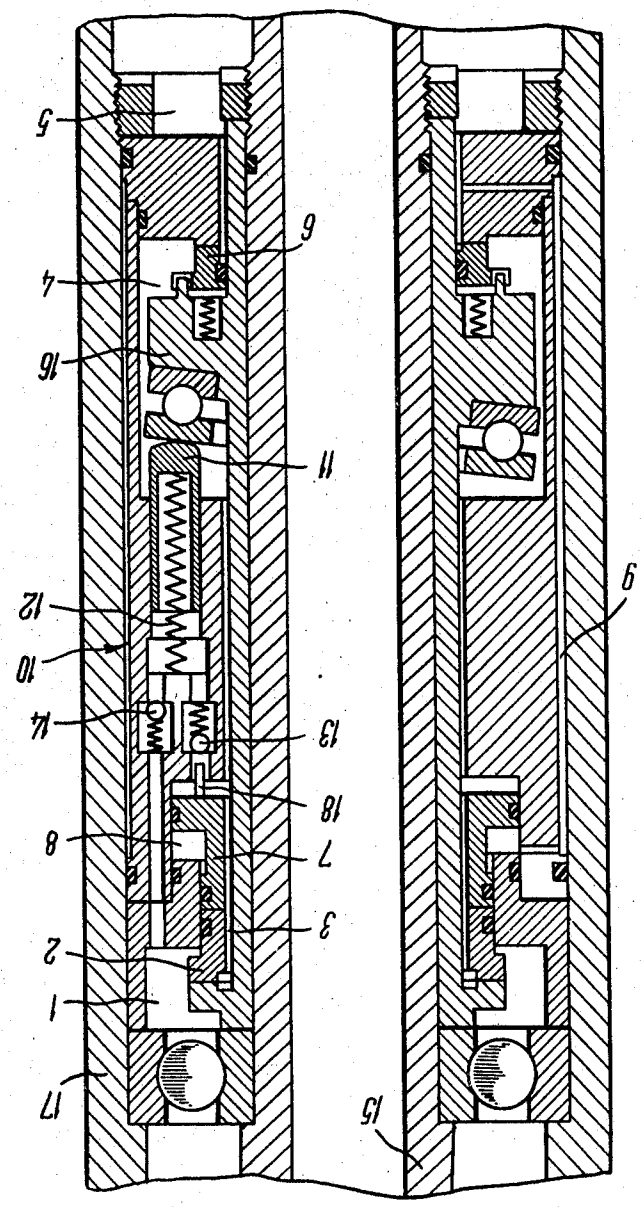
Primary Examiner—Carlton R. Croyle
Assistant Examiner—John J. Vrablik
Attorney—Waters, Roditi, Schwartz & Nissen

ABSTRACT: The present invention relates to sealing of shafts of mining face engines. The principal object of the invention is to eliminate the disadvantages of the known apparatus of this kind. To achieve this object it has a floating piston which compresses the face seal pair that opened under the effect of vibration, thereby restoring normal functioning of the seal.

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ARRANGEMENT TO SEAL THE SHAFT OF A DRILLING FACE ENGINE

The invention relates to sealing arrangements for shafts of mining face engines, and more specifically to electric face motors (in electrodrills) and hydraulic face engines (in turbodrills).

Employed currently to seal the shafts of electrodrills is a widely known arrangement, comprising a casing which together with the shaft forms an annular space divided by the end or face seal into high and low pressure spaces, said arrangement being fit to withstand pressures not exceeding 15 kg./cm.^{2}.

In connection with the fact that used recently for the drilling work are hydromonitoring bits, which under certain conditions provide for a substantial increase in the drilling speed and a reduction by as much as 2 to 3 times of bit consumption per well, the pressure on the seal of the mining face engine amounting to 80—100 kg./cm.^{2}.

Also known in the prior art are hydraulically relieved end or face seals applied for the work at such high pressures.

However, in view of severe fluctuations in the pressure of a flushing fluid, and the strong vibration to which the electrodrills are subjected in the well, these known end seals employed under high pressures do not function satisfactorily since they are rapidly worn, or their packing end pairs are said to be "opened."

The object of the present invention is to create an arrangement to seal the shaft of mining face engines, which would permit sealing the rotating shafts at large pressure drops with a high degree of reliability in operation.

This object is achieved owing to the fact that in the arrangement to seal the shaft of drilling face engines, which arrangement comprises a casing forming together with the shaft an annular space divided by the face seal into high and low pressure spaces, according to the invention, in said annular space on the side of the low pressure space a second face seal is mounted so that a chamber is formed between the latter and the first seal, wherein a plunger pump is fixed capable of pumping oil that leaks from the high pressure space into this chamber, back to the high pressure space.

It is advisable to place in this chamber a floating annular piston between the pump and the seal of the high pressure space, which piston would open the suction valve of the pump when the pressure in the chamber drops, and would press up the seal of the high pressure space when the pressure within the chamber rises with respect to that in the low pressure space.

It is also advisable that the plunger pump be driven by the shaft of the drilling engine through a bevel washer.

Employment of the present invention results in an increased efficiency of drilling by hydromonitoring bits, and a rapid increase in the work period of mining face engines between their inspections. The invention is further exemplified with an embodiment thereof and an appended drawing, which is a longitudinal section of the arrangement to seal the shaft of mining face engines according to the invention.

A gauge pressure of the order of 100 kg../cm.^{2} acting in space 1 is directly taken up by the hydraulically relieved end seal 2. The oil leaking through this seal comes via channel 3 into chamber 4 separated from the low pressure space 5 by the second (additional) end seal 6, and an annular piston 7, space 8 above being through channel 9 connected to the low pressure space 5.

The oil that leaked from the high pressure space 1 into chamber 4 through seal 2, is fed back to the high pressure space 1 by a plunger pump 10 which consists of plunger 11, spring 12, suction valve 13, and pressure valve 14.

Pump 10 is driven by shaft 15 with the aid of a bevel washer 16 fixed on this shaft of the mining face engine.

The arrangement is enclosed outside by casing 17, and inside—by shaft 15.

When oil is pumped out from chamber 4, the pressure therein dropping with respect to pressure in space 5, the annular piston 7 moves down and by pin 18 fixed thereon opens the suction valve 13. It results in the pump starting "idle work," i.e. stopping the oil feed from the chamber to the high pressure space. As the pump stops the oil feed, the annular piston is forced up by the oil coming through the end seal 2. The short upward displacement of the annular piston ends with a new oil feed by pump 10, whereupon the annular piston 7 again goes down.

Thus the annular piston 7 performs oscillatory movements during which pump 10 evacuates oil from chamber 4 to the high pressure space 1 or alternately works "idly."

In case of normal operation of the relieved end seal 2 oil leakage from the high pressure space 1 into chamber 4 is rather insignificant. But cases of a sudden "opening" of this end seal are possible. It may result from strong vibration of the arrangement due to the redistribution of contact pressure in the clearance of the packing pair of end seal 2. In case seal 2 is "opened," oil rapidly fills chamber 4, and the annular piston 7 is forced upwardly. In the beginning of the upward movement of the annular piston 7 pump 10 starts feeding oil into the high pressure space 1, and in the extreme top position of the annular piston 7 the latter compresses the opened packing pair of the end seal 2, the normal operation of this seal being thus restored.

In all the cases of the arrangement operation pressure in chamber 4 with respect to the low pressure space 5 remains low (during the tests it did not exceed 3 kg./cm.^{2}).

The constantly maintained low pressure drop at the second face seal 6 ensures stable operation of this seal with a minimum oil leakage to the low pressure space.

The proposed arrangement has been stand-tested at a pressure drop of 100 kg./cm.^{2}. Within 200 hours of work oil the amount of leakages remained negligible (less than 20 cm.^{3} of oil per 24 hours of work). After the disassembling and inspecting of the components only a slight running-in wear was found, which permits considering the present arrangement to be considered sufficiently efficient.

What we claim is:

1. An arrangement for sealing the shaft of a drilling face engine, comprising; a casing encompassing said shaft to form an annular space; a first face seal dividing said annular space into high and low pressure spaces; a second face seal being mounted in said annular space at the low pressure space side thereof so as to define a chamber between said first and second face seals; a plunger pump including a suction valve mounted in said chamber, said pump being adapted to pump oil leaking from said high pressure space into said chamber back to said high pressure space; and a floating piston being located in said chamber intermediate said pump and said first face seal, said floating piston being adapted to open the suction valve of said pump when pressure in said chamber drops and to press up said first seal when pressure in said chamber rises respective to the pressure in the low pressure space.