

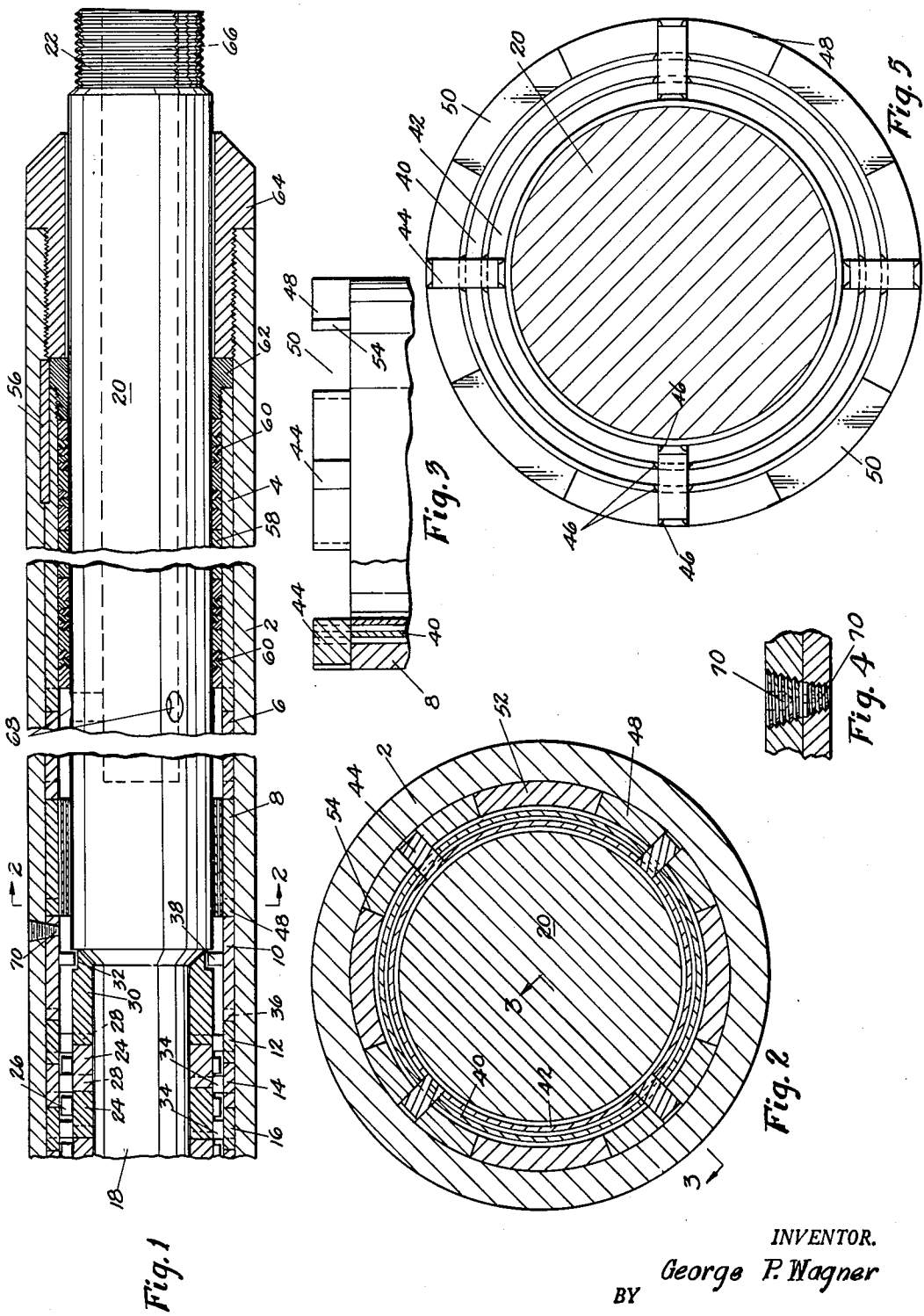
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OIL WELL DRILLING TURBINE SCREEN ASSEMBLY

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OIL WELL DRILLING TURBINE SCREEN ASSEMBLY

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The invention relates to oil well drilling turbines, and more particularly to a screen assembly for such turbines.

In an oil well drilling turbine, the turbine is located at the bottom of the drill stem and is operated by drilling mud pumped downwardly through the drill stem. The drilling operation grinds off pieces of rock which are carried upwardly by the drilling mud on the outside of the stem. The mud is used over and over. Despite all efforts to settle out all the particles and grit which are carried upwardly, some of these almost inevitably get through with the circulated mud and pass back downwardly. If a sufficient quantity of these particles accumulates in the turbine, there will be a grinding action which will wear out the turbine blades and also a tendency for this material to get into the bearings and wear out the bearings.

In addition, whenever pumping is stopped, there is likely to be a backward surge of drilling mud from the bottom of the well into the turbine, carrying with it particles of sufficient size to cause damage to the turbine blades if they get into the driving section of the turbine.

The primary object of the present invention is to provide an arrangement for avoiding damage to the turbine blades and to the bearings, which might be caused by such particles.

A further object of the invention is to provide an arrangement of this nature which is simple in construction, sturdy and durable.

Still another object of the invention is to provide, in an arrangement of this type, an easily replaceable screen within the turbine.

A further object of the invention is to provide a turbine arrangement in which any accumulation of such particles within the turbine can be readily eliminated without disassembling the turbine.

In general, the invention contemplates the provision, in an oil well drilling turbine having the shaft, cooperating stator and rotor blades between the shaft and the casing, and a bore in the lower end of the shaft with openings into the casing, of a space within the casing around the shaft between the blade section and the lower bearing, above which bearing are located the openings into the bore. Within an intermediate part of this space is arranged a screen. The openings into the shaft bore communicate with the space below the screen, and a plug opening is provided into the space above the screen through the casing wall.

The screen according to the invention is formed by concentric lengths securely held within the casing in spaced relation to each other and to the shaft.

Further objects and advantages of the invention will appear more fully from the following description, especially when taken in conjunction with the accompanying drawings which form a part thereof.

In the drawings:

Fig. 1 is a cross-section through a portion of a turbine operating oil well drill embodying my invention;

Fig. 2 is a cross-section on the line 2—2 of Fig. 1;

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Fig. 3 is a side elevation, partly in section on the line 3—3 of Fig. 2, of the upper portion of the screen ring;

Fig. 4 is a detail view of the fluid inlet and outlet; and Fig. 5 is a top plan view on a larger scale of the screen

or strainer.

The invention is applicable to an oil well drilling turbine of the type shown in my prior application S. N. 729,613, filed February 17, 1947, now Patent No. 2,646,962. In that application, there is described a turbine arrangement in which the shaft, to which the bit is to be attached is arranged within a casing formed of a sleeve made up of a plurality of separate parts and a unitary outer cover surrounding this sleeve and slidable thereover.

In the arrangement shown herein, there is a cover or outer casing member 2 which extends substantially the length of the turbine drilling unit. Within this is a sleeve formed of a plurality of sections. These include a bearing section 4, a strainer or screen section made up of parts 6, 8, 10 and a turbine section made up of parts 12, 14, 16, etc. Within this sleeve turns a shaft having a smaller portion 18 and a larger portion 20 at its lower end, and having a lower extension 22 threaded to receive a drill bit.

Keyed on shaft section 18, or otherwise secured thereto so as not to rotate with respect to it, are a plurality of rotor rings 24 having blades 26. These rings are interlocked, in the manner shown in the application referred to above, by projections 28 on each ring fitting into notches in the succeeding ring. At the bottom of this turbine blade section is a ring 30 which at its lower end has a reduced portion 32, forming with the enlargement 20 of the shaft a notch for receiving a projection to be described below.

The stator rings 12, 14, 16 have stator blades 34. It will be noted that the stator and rotor blades are arranged alternately along the length of the unit, or in other words that the stator blades are spaced and the rotor blades located in the places between the stator blades. The stator rings also have projections 36 each engaging in notches in the nearest succeeding ring, these projections and notches being similar to those described below in connection with the strainer sleeve part.

The sleeve part 10 has a projection 38 engaging in the notch 32. This serves to prevent relative longitudinal movement between the shaft and the sleeve. Part 10 is also interlocked with the lowest stator ring 12.

Part 10 is interlocked with part 8 which is the strainer part. This is shown in more detail in Figs. 2, 3 and 5. Part 8 includes a comparatively thick ring section which is of the same thickness as sleeve parts 6 and 10. Within this ring section are two thin ring sections 40 and 42, spaced from each other and from the ring section 8, and likewise spaced from the shaft section 20. These parts are held together at each end by blocks 44 which are set into notches in the ends of the ring sections 8, 40 and 42. The blocks are secured to the ring sections by welding as indicated at 46. Thus the various rings are held in assembled, spaced relation with one another.

The ends of the outer ring 8 have peripherally spaced axially extending projections 48 leaving between them notches 50. The sleeve section 10 has mating projections 52 engaging in these notches. It will be noted that the sides 54 of the notches and projections are radial to the axis of the shaft. The result is that, when the two parts are assembled together, not only is relative rotary movement between the parts prevented but also radial movement. Thus when any two sleeve parts are assembled together their outer surfaces are continuously aligned with one another.

Sleeve part 6 is similarly interlocked with sleeve part 8, and bearing part 4 is interlocked with part 6. Bearing part 4 is also keyed to the outer casing 2 as at 56. The

bearing part includes a bearing portion 58, this being for example a bronze bearing sleeve which engages the shaft to support it axially within the sleeve, and packings 60. The parts of the bearing may be held within the sleeve in any suitable way, as by nuts 62 threaded in the lower end of the sleeve.

The whole sleeve formed of these sleeve sections is held within the outer casing 2 by a nut 64 threaded in the lower end of the outer casing 2.

The shaft 20 has a bore 66 therein opening at the lower end, and holes 68 communicating with this bore. There may be two or more holes in each set, and several sets may be spaced along the shaft if desired. The holes, however, are located above the upper packing member 60 and below the strainer sleeve section 8, and opposite sleeve part 6. Sleeve part 10 and the outer casing have aligned holes therethrough which may be closed by threaded plugs 70.

It will be seen that the arrangement thus provides a space between the sleeve and the shaft, this space having the screen 8 at an intermediate point, having the openings and plugs 70 above the screen and having the holes 68 below the screen. This space is located between the turbine formed by blades 26, 34 and bearing 58 which closes off the space between the casing and the shaft at its lower end.

With such an arrangement, it is possible to overcome one of the great difficulties encountered in the drilling of the oil well by a turbine. No matter what care is exercised, a certain amount of rock in pieces of moderate size is bound to be pumped along with the oil well pumping fluid. In addition, whenever the operation of the pumps is stopped there is a tendency for the fluid in the bottom of the well to flow in a reverse direction upwardly through the bore of the shaft and into the turbine. It is of course possible to eliminate a certain portion of this material by the use of suitable screens. However, a certain amount of it is bound to get to the drilling tool. The present invention makes it possible to eliminate this collected material without the necessity of disassembling the turbine unit. Whenever the turbine is lifted from the well, the plug 70 is removed and fluid is circulated by a pump up through bore 66, the top of the turbine being shut up. This will result in washing out any particles collected above the screen 8 through the hole provided by removal of plug 70. If now fluid is introduced at plug 70 and allowed to flow down through the screen and through holes 68 and bore 66, any material collected below the screen 8 will likewise be removed. It is therefore possible to eliminate these particles, which otherwise might result in serious damage to the blades and the bearings, at periodic intervals without taking the turbine apart.

While I have described herein one embodiment of my invention, I wish it to be understood that I do not intend to limit myself thereby except within the scope of the claims hereto or hereinafter appended.

I claim:

1. In an oil well drilling turbine, a casing, a shaft mounted to turn in the casing, said shaft having a bore therein, cooperating turbine blades on said shaft and casing, said shaft and casing having a space therebetween on one side of said turbine blades, means between the casing and shaft closing the end of said space remote from the turbine blades, a screen in an intermediate part of said space, said shaft having an opening therein connecting the part of the space on the side of the screen remote from the turbine blades to the bore, said casing having an opening therethrough into the part of the space on the side of said screen nearest the turbine blades, and removable means for closing said last opening.

2. In a device as claimed in claim 1, said space closing means comprising a bearing for said shaft.

3. In a device as claimed in claim 1, said screen comprising a plurality of spaced concentric rings.

4. In an oil well drilling turbine, a casing composed of an inner sleeve and an outer cover concentric therewith, said sleeve being formed of a plurality of sections, means interlocking successive sections against rotation with respect to one another, means operatively engaging the cover and at least one of said sections to lock said section against rotation with respect to the cover, said sleeve sections including, from one end to the other, a stator section having inwardly directed spaced stator blades, a screen section and a bearing section, a shaft within said sleeve section concentric therewith, said screen section being radially spaced from the shaft and said bearing section including a bearing engaging the shaft, a screen carried by an intermediate part of the screen section extending between the sleeve screen section and the shaft, said shaft having rotor blades secured thereon in the spaces between the stator blades, said shaft having a bore therein opening on the side of said bearing remote from the first end of the sleeve section and being provided with a hole communicating with said bore and opening opposite the screen section on the side of the screen remote from the first end of the sleeve section, said screen section and cover having aligned openings therethrough in the part of the screen section on the side of the screen nearest the first end of the sleeve section, and removable means for closing said openings.

5. In a device as claimed in claim 4, said screen including at least one ring secured to the screen section and radially spaced from the screen section and the shaft.

6. In a device as claimed in claim 5, a packing at the side of the bearing near the first end of the sleeve section extending between the bearing section and the shaft, so as to provide a sealing structure between the bearing and the shaft, said hole being located immediately adjacent said packing on the side thereof nearest the first end of the sleeve section.

7. In a device as claimed in claim 4, a packing at the side of the bearing near the first end of the sleeve section extending between the bearing section and the shaft, so as to provide a sealing structure between the bearing and the shaft, said hole being located immediately adjacent said packing on the side thereof nearest the first end of the sleeve section.

8. In an oil well drilling turbine, a casing, a shaft mounted to turn in the casing, said shaft having a bore therein, cooperating turbine blades on said shaft and casing, said shaft and casing having a space therebetween on one side of said turbine blades, means between the casing and shaft closing the end of said space remote from the turbine blades, and a screen in an intermediate part of said space and occupying all of such part of the space between the casing and the shaft, said shaft having an opening therein connecting the part of the space on the side of the screen remote from the turbine blades to the bore, said screen terminating short of each end of the space and comprising a plurality of spaced concentric rings, the spaces between the rings being open at each end of the screen.

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