Oct. 29, 1946. C. M. NEAL 2,410,388

OIL CIRCULATING SPINDLE

Filed Sept. 28, 1943

Fig. 1.

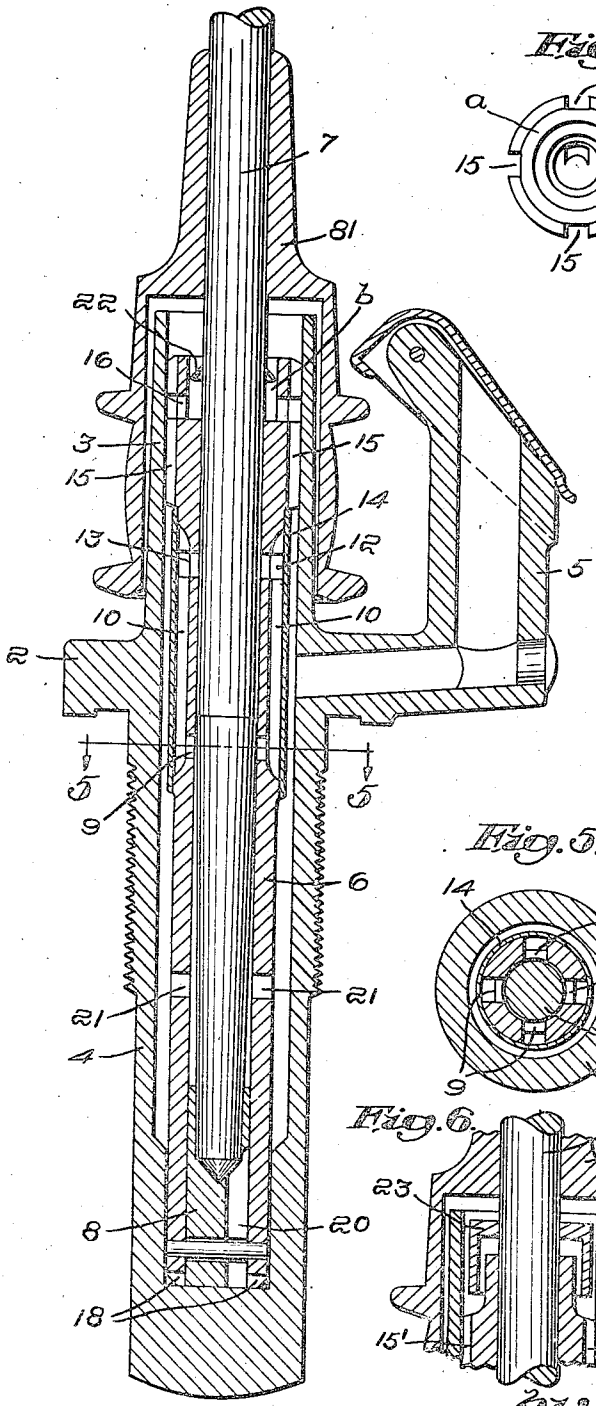


Fig. 3.

Fig. 2.

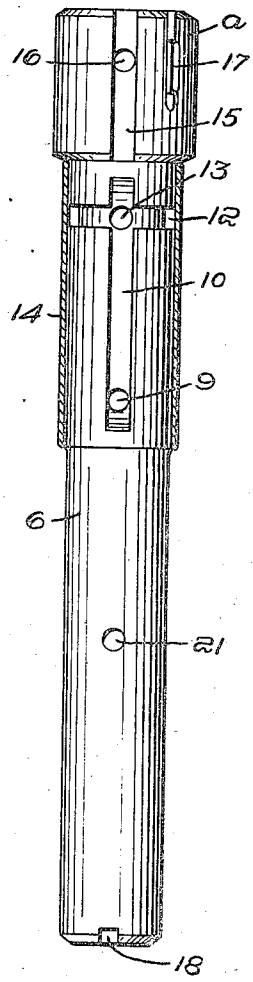
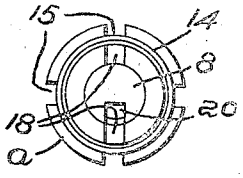


Fig. 5.

Fig. 6.

Fig. 4.



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OIL CIRCULATING SPINDLE

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6 Claims. (Cl. 308—169)

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This invention relates to spindle structures of the character used in spinning and twister frames, and is more especially concerned with the problem of lubricating the bearing surfaces of such structures.

In Patent No. 2,258,028, issued to this applicant and another, an oil circulating spindle structure is disclosed which has proved in practice to be exceptionally satisfactory. An important advantage of it is that in periods of low oil level in the oil well the circulation maintained by the rotation of the spindle blade itself forces an ample supply of lubricant into the upper end portion of the spindle blade bearing which is very likely to run dry if a good level of oil is not maintained in the well. Because of the high speed at which these spindles are operated, a good supply of lubricant to all parts of the friction surfaces of the bolster and the blade is essential to satisfactory operation, and the ability of spindles made in accordance with said invention to take care of themselves during periods of scanty oil supply is a very important practical advantage.

The present invention aims further to improve and perfect spindle structures operating on the same principle as that disclosed in said patent, with a view particularly to reducing the expense of manufacture of them and devising a construction in which the control of the oil flow to the upper part of the bolster will be relatively independent of the design and dimensions of the spindle base; or, in other words, to effect such control by the construction of the bolster itself and its relationship to the blade mounted in it.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawing, and the novel features will be particularly pointed out in the appended claims.

In the accompanying drawing:

Fig. 1 is a vertical, sectional view of those parts of a spindle structure with which this invention is more especially concerned, and illustrates a preferred embodiment of this invention;

Fig. 2 is a side elevation of the bolster shown in Fig. 1 but with the sleeve portion thereof in section;

Figs. 3 and 4 are top and bottom views, respectively, of the bolster shown in Fig. 2;

Fig. 5 is a transverse, sectional view on the line 5—5, Fig. 1; and

Fig. 6 is a fragmentary, vertical sectional view of the parts at the upper end of the bolster illustrating a modification.

Referring first to Fig. 1, the construction there

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shown comprises a spindle base 2, essentially like those in common commercial use, this base having a body portion designed to rest on, and to be secured to, a spindle rail, and including, also, a tubular extension 3 projecting upwardly from said body portion, and a well section 4 extending downwardly therefrom. The usual filling tube or nozzle 5 extends laterally from the body part 2.

Mounted in this spindle base is a bolster 6 of novel form in which the upright spindle blade 7 is supported for rotation around its own axis. For this purpose the bolster is equipped with a step bearing 8 supporting the lower end of the blade, and it is also provided with a smooth internal bearing surface having a good running fit with that portion of the blade below the shank of the whirl 81 and down to a region somewhat below the body section 2 of said base where the blade begins to taper toward the lower end that rests in the step.

As clearly shown in the drawing, the lower portion of the bolster is of substantially uniform inside and outside diameters, but at the upper end of this section the bolster body is provided with a circumferential series of holes or ports 9 drilled radially through its wall. The outer ends of these ports open respectively into vertical grooves or channels 10 formed in the outer surface of the bolster body. In this instance there are four such ports and four grooves or channels, and the latter lead into a common circumferential groove 12 with which another set of radial ports 13 communicate, the latter being like the ports 9 and preferably of the same number.

This entire section of the bolster body in which the grooves and ports are formed is encircled by a sleeve 14 which preferably has a pressed fit with the part of said body that it surrounds so that functionally it forms an integral part of the body but is structurally separate from it.

Above the sleeve 14 the bolster is made of larger diameter to provide a head section *a*, and this part of the device is vertically slotted, as indicated at 15, each slot communicating with a radial port 16 which opens into a section *b* of the bore of the bolster that is made larger than the remaining portion of said bore. This head end of the bolster also carries the usual key 17 which fits into a groove (not shown) in the bore of the extension 3 and holds the bolster against rotative movement.

When this bolster is mounted in its operative position, as shown in Fig. 1, with the spindle in it, and the latter is revolving, the oil well 4 will customarily be filled to a level, say, half way up

the sleeve. At the bottom of the blade 7 problem of lubrication is not ordinarily troublesome because it is always submerged in oil. The bolster fits rather loosely in the lower end of the well so that oil flows down around it into the cross slot 18 formed in the bottom of the bolster and then upwardly through the slot 20 which breaks into the friction surface of the step 8. Rotation of the blade creates a circulation of this oil up through the step and out one of the other of the ports 21 which is ample to keep the step bearing well lubricated.

The lubricating problem arises chiefly in connection with the matter of preventing the bearing surfaces in the head *a* of the bolster and the cooperating friction surfaces of the blade 7 in contact therewith from running dry when the oil level becomes low.

In the construction shown this problem is solved by the port and channel arrangement of the bolster above described, and the relationship between this member and the spindle blade.

As explained fully in the patent above referred to, when the blade revolves in the bolster the tape pull on the whirl 81 holds the blade against one side of its bearing surface in the bolster, and creates an area of maximum pressure, the exact position of which will depend upon the direction of rotation of the blade and the direction of the tape pull. Consequently, there will be created in the oil film between the surface of the blade and the inner surface of the bolster, a region of relatively high pressure at one side of said bearing, and, at a diametrically opposite point, a region of very low, or even negative, pressure. One of the ports 9 will be located in this region of maximum pressure while another will be positioned in the region of low pressure.

Consequently, when the spindle is running, oil will flow in through one of the ports 21 into contact with the spindle blade and will be forced out of that port 9 at which a high pressure is maintained. As this operation continues, the oil so ejected is forced up the groove or duct 10 with which the oil port communicates and into the header groove 12. The latter groove fills with oil and while some of it flows down the duct 10 opposite to that in which it has ascended, the pressure, nevertheless, is sufficient to force additional oil in through certain of the ports 13 and upwardly along the surface of the blade 7 to a point above the bearing surface of the bolster. The result is that the oil flows outwardly through the ports 16 at the top of the bearing surface of the bolster and down the grooves 15, returning outside the bolster to the oil well, from which it is later recirculated. This action is facilitated by the fact that the clearance between the blade and the bolster in the region between the two sets of ports 9 and 13 is made very small, only sufficient for good operation.

The circulation just described continues so long as the spindle remains in operation and until such time as the oil level falls below the ports 9. It will be evident, however, that long before this time, with an ordinary spindle and bolster construction, the blade would have run dry. Thus those surfaces of the blade and the cooperating inner surfaces of the bolster, from the level of the ports 9 up to the extreme upper end of the bearing area of the bolster, are kept constantly supplied with circulating oil until the oil supply in the well has become abnormally depleted. This is allowed to happen only very rarely

indeed, so that any substantial danger of the spindle running dry is definitely avoided.

There seems to be practically the same tendency to create high and low pressures in the oil film at opposite sides of the blade in the region of the ports 13 that exists in the neighborhood of the lower ports 9. And the pressures created at both these areas cooperate to force oil upwardly above the level of the ports 13 to the top of the bearing surface of the bolster. Under some conditions of low oil level the action appears to be that the pressure created in the neighborhood of the lower ports 9 forces the oil up to the header groove 12 where the additional pressure produced in this region forces the oil the remaining distance through the bolster bore to the overflow ports 16.

It should be observed that in this spindle the control of the oil by those parts of the apparatus utilized in feeding lubricant to the upper portion of the bolster bearing surface above the normal level of the oil in the spindle base, is dependent upon the construction of the bolster and its relationship to the blade, but is quite independent of the conditions outside the bolster, so long as those conditions are maintained suitable for the normal operation of any spindle. The clearances above referred to are not materially different from those commonly maintained in a good spindle of the orthodox form, that immediately above the level of the ports 9, where the lower taper of the spindle ends, being customarily in the neighborhood of three or four thousandths of an inch. That is, there is that much difference between the outside diameter of the spindle blade and the inside diameter of the bearing in the bolster. So long as this clearance is satisfactory from an operating standpoint, it will be suitable for the purposes of this invention. It should also be observed that because the sleeve 14 is either pressed or shrunk on the bolster, it tightly closes the outer edges of the duct 10 and the groove 12 so that these oil passages are, from a functional standpoint, formed internally of the bolster structure.

In order to prevent the oil from climbing the blade to any height substantially above the drain ports 16, a tapered collar 22, Fig. 1, is pressed tightly on the blade in the chamber *b* where it throws off, by centrifugal action, any oil that comes in contact with it and definitely limits the height to which the oil can ascend.

Good results have also been obtained by modifying the construction at the upper end of the bolster in the manner illustrated in Fig. 6 where the ports 13 of Fig. 1 are omitted and the section *a* of the bolster is extended up to the full height of that illustrated in the latter figure, but the bearing surface runs to the top of the bolster instead of terminating at the level of the drain port 16, as in Fig. 1. Immediately above the upper end of the bolster shown in Fig. 6 an inverted cup-shaped piece 23, having a pressed fit on the blade 7', is installed, where it stops the upflow of oil along the surface of the blade and reverses this flow, with the result that the oil is thrown off the lower edge of the cup centrifugally against the inner surface of the spindle base extension 3', and flows down the inner walls of the bore of the base to the oil well. In other respects this construction operates like that previously described.

It will be evident from the foregoing that this invention eliminates the necessity of an accurate fit of an intermediate part of the bolster in the

base, which was required by the earlier construction; simplifies the manufacture of those parts essential to the desired control of the flow of oil; and ensures an adequate supply of oil to the blade at the region most likely to run dry, even with an abnormally scant supply of oil in the spindle base.

In the bolster construction shown, there are four intake ports communicating, respectively, through individual vertical channels with the groove or header 12, from which oil flows through the four ports 13 to the surface of the spindle blade. This construction has the advantage of operating in any circumferential positional relationship to the blade or to the spindle base because at least one of the ports 9 will be at a high pressure area while an opposite port will be at a low pressure area; thus no particular pains need be taken in positioning the bolster in a predetermined relationship to the direction of the tape pull.

While I have herein shown and described a preferred embodiment of my invention, it will be evident that the invention is susceptible of embodiment in other forms without departing from the spirit or scope thereof.

Having thus described my invention, what I desire to claim as new is:

1. In a spindle structure for spinning and twister frames, the combination of a spindle base having an oil well therein, an upright spindle blade mounted in said well, a bolster in said base supporting said blade in its operative position, said bolster having an outlet for the oil at a point at which a relatively high pressure is created in the oil between the blade and the bolster bearing surface due to the rotation of the blade, said bolster being provided with an internal channel for conducting the oil from said outlet along a path outside the internal bearing surface of the bolster to a point above the gravity level of the oil in said well but spaced widely from the top of the bolster and there delivering it to said surface.

2. In a spindle structure for spinning and twister frames, the combination of a spindle base having an oil well therein, an upright spindle blade mounted in said well, a bolster in said base supporting said blade in its operative position, said bolster having lower port means for the oil at a point at which a relatively high pressure is created in the oil between the blade and the bolster bearing surface due to the rotation of the blade, and a duct in said bolster for conducting oil upwardly away from said lower port means; upper port means, said port means being adjacent the upper and lower ends, respectively, of said duct, said duct being outside the bearing surface of said bolster but confined within the bolster and delivering said oil to said upper port means and to a point between the bearing surface of the bolster and the blade at a substantial distance above said lower port means and above the gravity level of the oil in said well, said point being widely spaced from the top of

the bolster, the fit between said blade and bolster below said point being so close as to cause the pressure so created in the oil to force it substantially to the top of the bearing surface of the bolster, and the clearance between said blade and said bolster above said point being sufficient to permit said flow of the oil to the top of said bearing surface.

3. A bolster for spinning and twister spindles comprising an elongated tubular body constructed and shaped to receive and support a smooth surfaced spindle blade for rotation around its own axis, said body having intake and delivery ports located one above the other and spaced apart by a substantial distance, for conducting oil to and from the bearing surface of the bolster, and a duct in said bolster connecting said ports and spaced from both the inner and outer surfaces of the bolster to confine the flow of oil from one port to the other, said delivery port being spaced widely from the top of the bolster.

4. A bolster for spinning and twister spindles comprising an elongated tubular body constructed and shaped to receive and support a smooth surfaced spindle blade for rotation around its own axis, said body having intake and delivery ports located one above the other and spaced apart by a substantial distance for conducting oil to and from the bearing surface of the bolster, a channel formed in the outer surface of said body and connecting said ports, said upper port being located a substantial distance from the top of the bolster and a sleeve tightly enclosing the part of said body in which said ports and said channel are formed.

5. A bolster for spinning and twister spindles comprising an elongated tubular body constructed and shaped to receive and support a smooth surfaced spindle blade for rotation around its own axis, said body having two sets of intake and delivery ports leading outwardly from the bore thereof with one of said sets spaced above the other by a substantial distance, a plurality of channels formed in the outer surface of the body portion of said bolster spaced circumferentially therearound where they connect the respective ports of the lower set with those of the upper set, said upper set being located a substantial distance from the top of the bolster and a sleeve fitting tightly on said body and enclosing the portion thereof in which said ports and said channels are formed, said sleeve closing the outer edges of said channels.

6. In a spindle structure according to preceding claim 2, a construction in which said lower port means comprises a plurality of circumferentially spaced ports and said upper port means comprises a plurality of circumferentially spaced ports, and a circumferential groove in said bolster connecting said upper ports whereby oil will be delivered to said upper ports regardless of the circumferential position of the bolster in said base.

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