Oct. 7, 1941. C. M. NEAL ET AL 2,258,028

SPINNING MACHINE SPINDLE AND METHOD OF OPERATING SAME

Filed Jan. 19, 1938

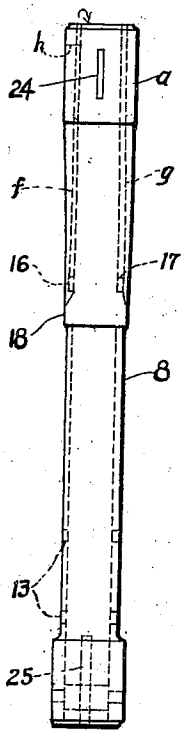


Fig. 2

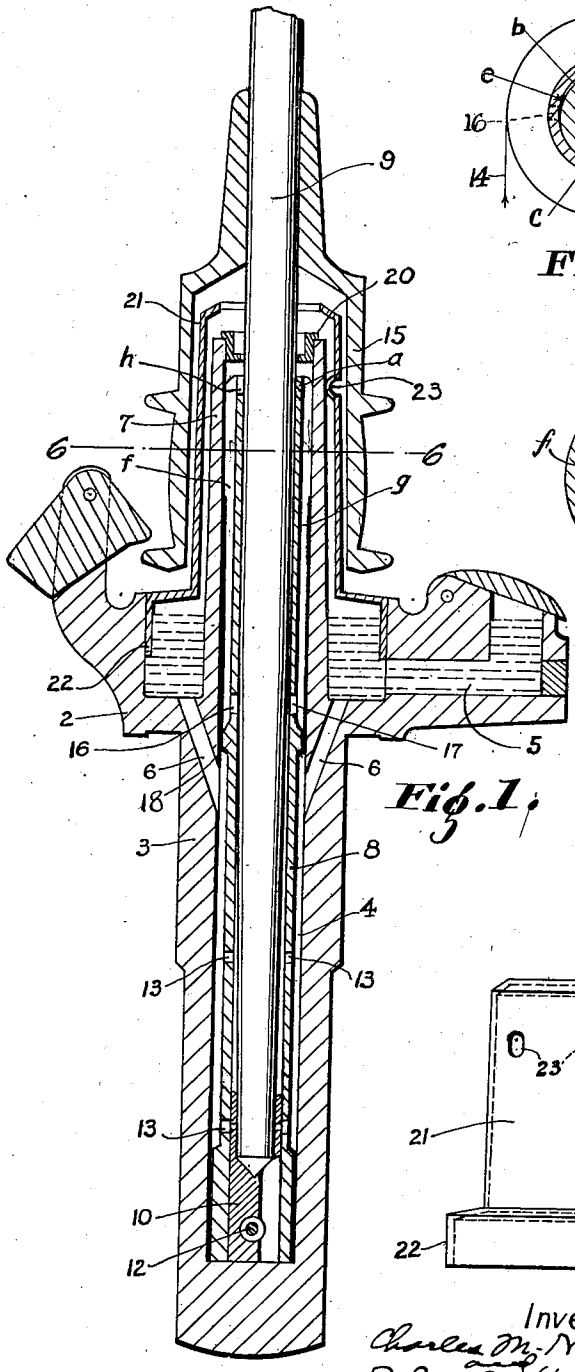


Fig. 1

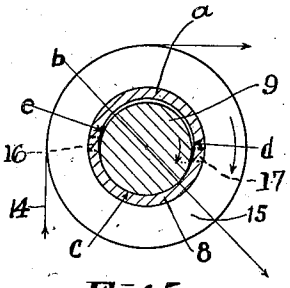


Fig. 5

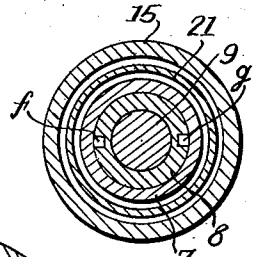


Fig. 6

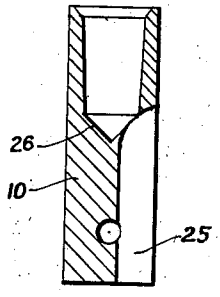


Fig. 3

Fig. 4

Inventor:
Charles M. Neal
and
John A. Kennedy,
By J. H. McGrady
their Atty.

Patented Oct. 7, 1941

2,258,028

UNITED STATES PATENT OFFICE

2,258,028

SPINNING MACHINE SPINDLE AND METHOD OF OPERATING SAME

Charles M. Neal, Biddeford, and John A. Kennedy, Saco, Maine, assignors to Saco-Lowell Shops, Biddeford, Maine, a corporation of Maine

Application January 19, 1938, Serial No. 185,734

6 Claims. (Cl. 308—169)

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

As is well understood by those skilled in this art, a typical spindle structure includes a vertical spindle blade mounted in suitable bearings. These spindles are run at high speed, say in the neighborhood of 10,000 R. P. M., and even higher. Consequently, the problem of lubrication is an important one. In the usual arrangement the oil well is constructed to hold a supply of oil in contact with and submerging most of the bearing area. However, there is always a portion of the bearing surface near the upper end of the bolster which is not so submerged, and the supply of oil to this part of the bearing is assumed to be effected by capillarity aided, in some intangible and indefinite way, by the mechanical action of the blade as it vibrates more or less in the bearing. As the oil level in the base recedes, this upper portion of the bolster does not receive an adequate supply of lubricant, and it is a common experience to find evidences of this deficiency.

The present invention deals especially with this condition and it aims to devise a bearing structure in which these portions of the bearing surfaces above the gravity level of the oil will be positively supplied with lubricant, even in periods of relatively low level of the oil supply in the spindle base. A further object of the invention is to improve the circulation of oil in a bearing structure of this type with a view to producing better lubrication with the consequent attainment of higher speeds, reduction in the rate of wear and in the power required, and improvement in the load carrying ability of the spindle. It is also an object of the invention to accomplish these results without complicating the bearing structure and without adding materially to the expense of manufacture of it.

The invention involves both a novel method and also a novel spindle structure.

In general, it is proposed to effect the results above described by utilizing the normal motion of the spindle to increase the hydrostatic head of a portion of the oil and thus to lift lubricant to the upper end of the bearing where it will flow downwardly by gravity along the bearing surfaces and thus keep them constantly lubricated. We have discovered that when a spindle is running in a bearing in the usual way, there are points along the friction surface of the spindle at which substantial differences in hydrostatic pressure are created. These pressures normally serve no useful purpose, and the present invention utilizes them to produce the circulation above described.

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 drawing,

Figure 1 is a vertical, sectional view of a spindle structure embodying this invention, the upper end of the spindle being cut away;

Fig. 2 is a side view on a smaller scale of the bolster shown in Fig. 1;

Fig. 3 is a vertical, sectional view of the step which supports the lower end of the spindle;

Fig. 4 is a side elevation of an oil shield or guard forming a part of the structure shown in Fig. 1;

Fig. 5 is a diagrammatic view later to be referred to; and

Fig. 6 is a horizontal, sectional view through the blade, bolster and base extension at a level near the upper end of the bolster.

Referring first to Fig. 1, the construction there shown comprises a spindle base 2, similar in general shape to those heretofore used, this base being designed to rest on a spindle rail and having an extension 3 adapted to project through a hole in the rail and to be clamped thereon by a nut in the usual manner. While the shank is screw threaded for this purpose, such a construction has not here been shown since it is a well known expedient. Formed in the spindle base is an oil well 4 and a reservoir 5 for holding a surplus supply of oil, the latter being connected with the former through oil ducts 6—6. Also, integral with the base is the usual upright sleeve or extension 7, which projects upwardly for a considerable distance above the main body of the base. Mounted in the base 2 is a bolster 8 of a novel form designed to receive and support the spindle blade 9 in its operative position. The bolster itself is provided with a head portion *a* accurately machined to fit snugly into the sleeve 7 and the blade 9 has a good running fit with the bore of the upper portion of the bolster. Its weight and that of the load which it carries is supported by a step 10 in which the lower conical end of the blade fits, this step being secured in the lower end of the bolster by a pin 12. The latter end of the bolster rests directly on the bottom of the oil well 4. Holes, such as those shown at 13, drilled through the bolster permit

a free flow of oil from the oil well into the interior of the bolster so that in this construction, as in those commonly used heretofore, a gravity level is maintained inside the bolster equal to, or slightly higher than, that in the oil well.

As above stated, we have found that when the spindle is in operation in the usual manner relatively high hydrostatic pressures are created in the oil at some points between the bolster and the spindle blade, while substantially lower pressures exist at other points separated from the high pressure areas by a relatively short circumferential distance. A typical condition is illustrated diagrammatically in Fig. 5. Here, the blade 9 is shown as being revolved in a clockwise direction by the tape 14 running in contact with the whirl 15 in a typical hook-up. The resultant of the components of the tape pull is indicated by the arrow *b*. It would naturally be assumed that this force would produce a maximum pressure of the spindle against the friction bearing surface of the bolster in line with the arrow. This, however, is not the case, the area of maximum pressure being in about the region indicated by the arrow *c*. There is, of course, a film of oil constantly present between the blade and the bolster and a region of high pressure is created in such a film in the area immediately behind said point of maximum pressure, while another area of very low pressure exists at a diametrically opposite point. These areas of high and low pressure are indicated in a general way at *d* and *e* in Fig. 5. It should be observed, also, that these pressure differences exist in spindles and bolsters of the common smooth surfaced types, no special construction being required to create them.

The present invention utilizes these pressure differences to create a circulation of oil over the friction surfaces of the bolster and blade above the gravity level of oil in the bolster. For this purpose an oil outlet port 16, Fig. 1, is provided in the bolster at a high pressure area, such as that indicated at *d*, Fig. 5, and an inlet port 17 is located at a low pressure area, as, for example, in the neighborhood of the point *e*, Fig. 5. Thus oil will be drawn in through the latter port and forced out through the former. These ports 16 and 17 open directly into the lower ends of vertical grooves or oil ducts *f* and *g* formed in the outer surface of the bolster. Below the ports the oil space is substantially closed by the tapered shouldered portion 13, Fig. 2, of the bolster. Consequently, the oil forced out through the port 16 by the pressure created by the motion of the spindle flows upwardly through the groove *f* to the top of the bolster where it overflows, through the notch *h*, into contact with the surface of the spindle blade. Part of this oil flows downwardly along the surface of the blade thus lubricating the friction surface of the bolster and finds its way back to the level of the ports 16 and 17. The surplus flows through the groove *g* back into the inlet port 17 for recirculation.

The location of the ports 16 and 17 with reference to the clearances maintained between the blade and the bolster is important. The particular blade shown is like those heretofore used and is provided with an upper tapered portion on which the whirl 15 is forced, this portion terminating between the upper end of the bolster and the lower part of the whirl shank. From this level to a point just above the ports 16 and 17 the surface of the blade is cylindrical, but from the latter point it tapers uniformly to its lower conical end. We have found that the most satisfactory conditions for creating the circulation of oil above described are maintained when the ports 16 and 17 are located in the neighborhood of one-quarter of an inch below the lower end of the cylindrical part of the blade. In this region a clearance of in the neighborhood of three or four-thousandths of an inch is maintained normally between the blade and the bolster, and this produces ample pressure differences to create the circulation of oil necessary to lubricate the friction surfaces at the upper end of the bolster. However, it is entirely possible to raise or lower the position of these ports with reference to the taper of the spindle and still produce good results. The most satisfactory conditions, however, are obtained with a clearance of less than fifteen thousandths of an inch.

It should be noted that in addition to the oil which flows into the port 17 from the groove *g*, oil also is fed to the blade in the neighborhood of these ports due to the gravity flow produced through the ports 13 into the interior of the bolster, the entire portion of the bolster and the blade in and below the oil reservoir 5 being constantly maintained submerged in oil.

At the upper end of the bolster there is some tendency for the oil to be thrown off by the high surface speed of the spindle blade in the form of a mist or vapor. Consequently, a pressed steel collar 20 is forced into the upper end of the stationary sleeve 7 and is provided with a hole which affords ample clearance for the blade but greatly reduces the escape of an oil mist from this part of the valve. That which does find its way out of the bearing is caught in the upper end of a shield or guard 21 also made of pressed steel and having an enlarged skirt or base portion 22 which fits snugly in that portion of the oil reservoir which immediately surrounds the extension 7. Lugs, such as those shown at 23, pressed inwardly from the body of the sleeve 21, bear against the outer surface of the extension 7 and hold the shield or guard in a concentric relationship to said extension.

The bolster is provided with the usual key 24 to fit into a slot in the upper end of the extension 7 and prevent rotation of the bolster with the blade. Also, a saw scarf 25 preferably is cut in one side of the step 10 where it just breaks through the conical bearing surface 26 for the lower end of the blade and affords an increased supply of oil to the bearing surface of the step.

It will be clear from the foregoing that the invention effectually overcomes the difficulty heretofore experienced in properly lubricating the friction surfaces of the spindle blade and the bolster above the gravity level of the oil in the spindle base. In addition, it creates a better circulation of oil over those surfaces which give the blade its lateral stability. Thus in a given spindle structure the superior lubrication can be utilized either to operate the spindle at higher speeds, to make it carry heavier loads, to reduce the power consumption, minimize wear, or to realize some combination of these advantages. While the oil pumping effect of the spindle might be increased by special constructions, these necessarily would involve additional manufacturing expense and we have found them to be unnecessary. Consequently, while a preferred embodiment of the invention has been herein shown and described, it will be evident that the invention may be embodied in other forms without departing from the spirit or scope thereof.

It will also be understood that while the spin-

dle shown has been referred to as a spinning machine spindle, essentially the same construction is used in spindles for twister frames, and the invention is equally applicable to both. Consequently, the reference to spinning machine spindles and to methods of operating such spindles in the claims should be understood to include twister spindles.

Having thus described our invention, what we desire to claim as new is:

1. In a spindle structure for spinning machines, 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 between the blade and the bearing surface therefor at which a relatively high pressure is created by the rotation of said blade, and means for conducting oil away from said outlet and along a path out of contact with said bearing surface and to a point on said surface considerably above the level of the oil in said well, said bolster also having an inlet for the passage of oil from said well to a point on said bearing surface at which a relatively low pressure is created in the oil by the rotation of said blade.

2. In a spindle structure for spinning machines, 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 it by the rotation of said blade, said bolster being provided with a channel for conducting the oil from said outlet away from the friction surface of the bolster to a point substantially above the level of the oil in said well and there delivering it to said surface.

3. A spindle structure according to preceding claim 1, in which the lower part of said blade is tapered and said outlet in the bolster opens on to the upper portion of said tapered surface.

4. A bearing structure according to preceding claim 1, in which the bolster is provided with one or more apertures to maintain the friction surfaces at the lower portion of the blade constantly submerged in oil from said well, said outlet being located in the upper portion of the area of the bolster which is so submerged, and the bolster being provided externally with a groove for conducting said oil to a point substantially at the upper end of the bolster.

5. In a spindle structure for spinning machines, the combination of a spindle blade, a bearing structure supporting said blade in an upright position and adapted to hold a supply of oil for lubricating the friction surfaces, said bearing structure having an inlet for conducting oil from said supply to the surface of the blade at a point where a low pressure is created by the rotation of the blade, and also having an outlet at a point between said blade and the lateral bearing therefor where a high pressure is created by such rotation, said bearing structure also having a passage for conducting oil out of contact with said blade from said outlet to a point on said blade approximately at the top of the bearing surface therefor.

6. In a spindle structure for spinning machines, the combination of a spindle base having an oil well therein, an upright spindle blade mounted in said well, a bearing supporting said blade laterally for rotation around its own axis, and means for leading oil away from a point in the bearing structure at said blade surface at which a high pressure is created by the rotation of the blade and conducting said oil outside the bearing surface for said blade while under the influence of said pressure to a part of said surface substantially at the top of said bearing and considerably above the gravity level of the oil in said structure.

CHARLES M. NEAL.
JOHN A. KENNEDY.