Oct. 25, 1949. J. P. LAIRD 2,486,296

SPINDLE UNIT

Filed Aug. 15, 1947

FIG. 1.

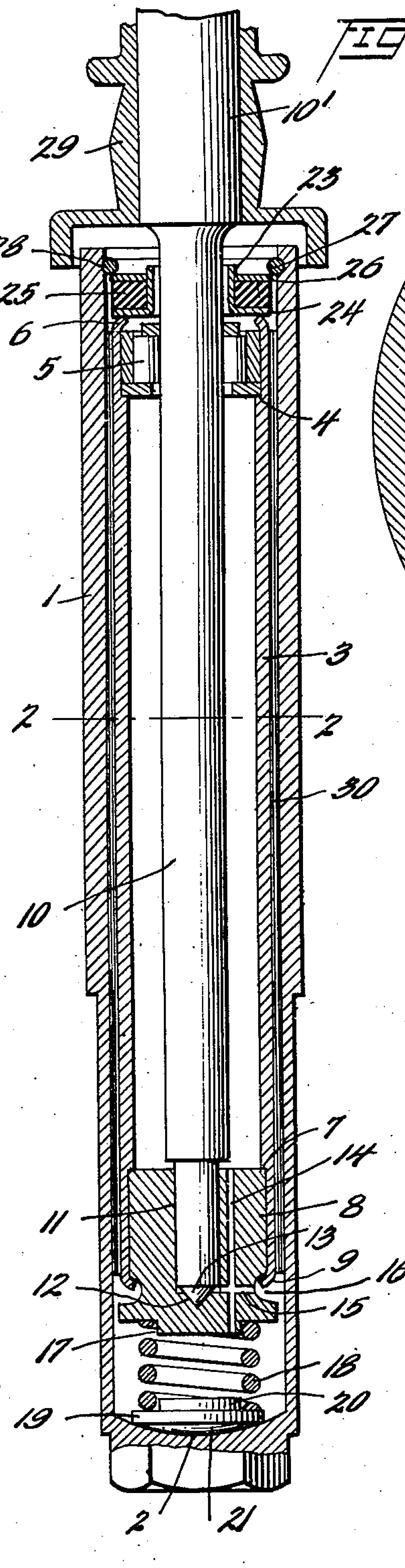


FIG. 2.

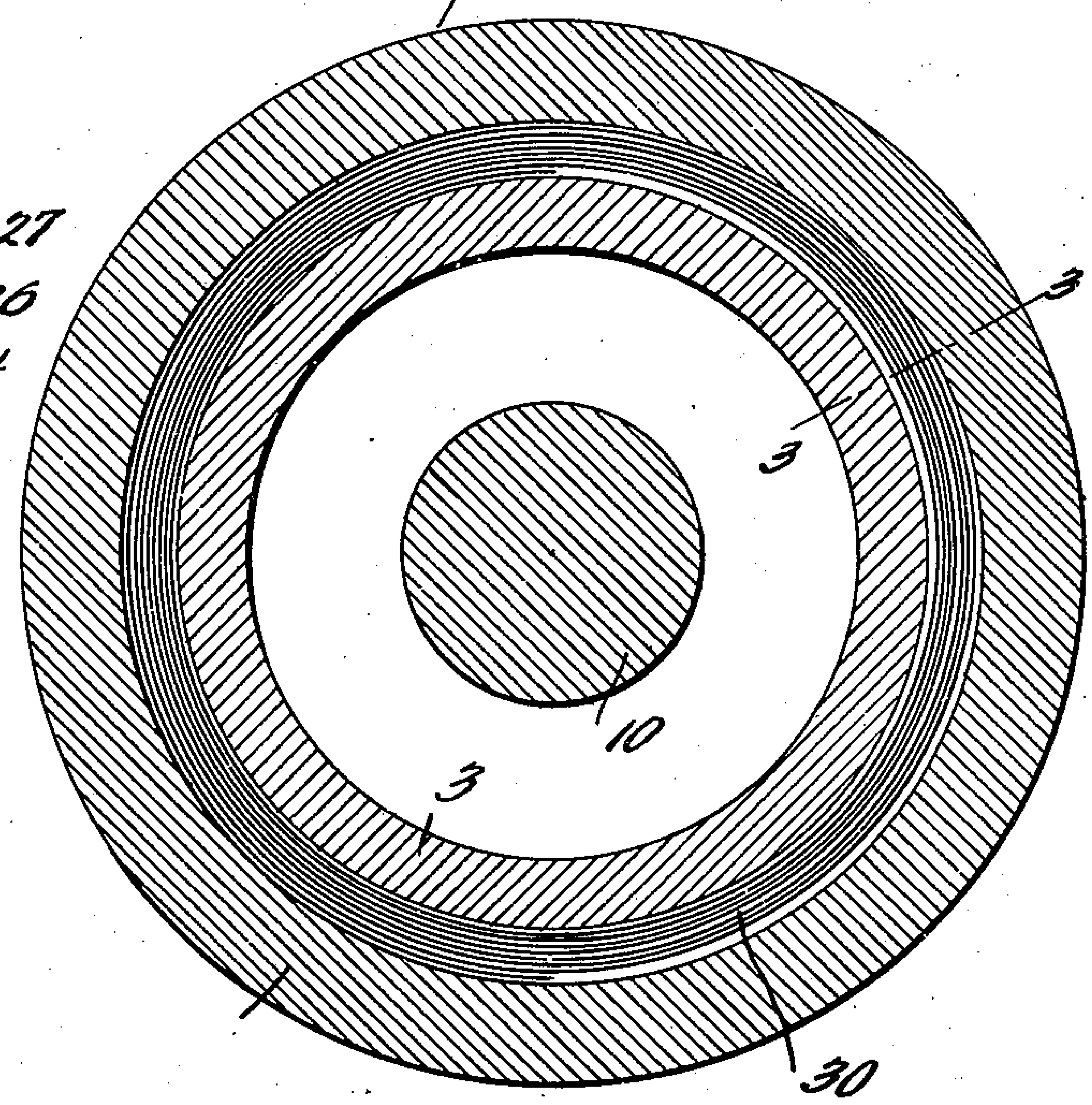
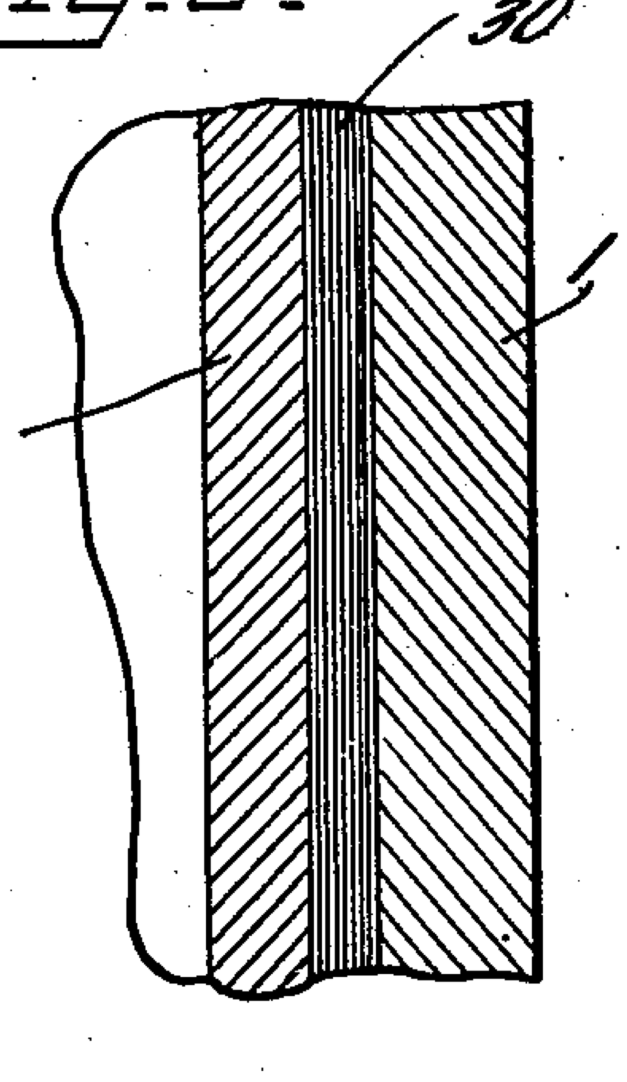


FIG. 3.



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SPINDLE UNIT

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5 Claims. (Cl. 308—152)

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My invention relates to new and useful improvements in spindle units and has for an object to provide a unit wherein the spindle and the bobbin, either full or empty, can find a new center of rotation, since the entire spindle inner shell can adjust itself in the spindle base to accommodate any out-of-center condition.

Another object of the invention is to provide a unit that can also shift to accommodate any out-of-balance of the bobbin or yarn, partly due to the compressibility of a "neoprene" or polychloroprene washer that is mounted slightly above the roller bearing, also mounted near the neck of the spindle.

Still another object of the invention is to provide a spindle in which there is a wrapping of a steel or brass sheet to form a vibration dampening means between the outer casing and the inner shell of the spindle unit.

Still another object of the invention is to provide a dampening means wherein there is a wrapping of a steel or brass sheet formed with a plurality of coils, and wherein oil is to be absorbed into the steel sheet laminations in such a manner as to cause the coils to expand. Thus, if there are six or seven coils there will be five or six laminations which will be oil-coated; and, inasmuch as each wrapping or each turn of the laminated sheet is continuous, they will expand or contract to a certain degree, depending upon the thickness of the film of oil between each layer, which, of course, in turn depends on the viscosity of the oil.

Still another object of the invention is to provide a maximum dampening of the vibration by using a continuous roll of shim steel in place of separate bushings between the inner shell and the casing of the spindle unit bolster. The oil between the coils or laminations will cause the coil spring to expand and thus provide a constant pressure between the inner shell and the casing, and thus provide the desired dampening of any vibration of the spindle within the inner shell.

Still another object of the invention is to provide a spindle unit wherein the number of coils of the shim steel spring may be predetermined so that the vibration caused by the unbalanced package on the spindle blade can readily be absorbed by the numerous films of oil within the coils and their interposed films of oil.

Still another object of the invention is to provide a dampening means consisting of a plurality of coils that extend substantially throughout the length of the entire spindle bolster; and

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to further provide the base in which the spindle is mounted to bear against a steel spring which in turn contacts with a curved steel plate that can swing on an arcuate bottom of the casing, so that any tendency caused by the unbalance of the load to throw the lower part of the spindle out of center will cause this plate to slide up on the radius to increase spring pressure, and returning the spindle to its normal center of rotation.

Still another object of the invention is, first, to provide a unit wherein substantially the entire length of the inner shell of the spindle unit is surrounded by numerous coils of shim steel between which coils will be a film of oil; second, to further place the spindle under transverse compression; and, third, provide a frictional means at the base of the unit to thus add a frictional dampening means to the coils and oil dampening means.

With these and other objects in view, the invention consists in certain new and novel arrangements and combination of parts as will be hereafter more fully described and pointed out in the claims.

Referring now to the drawings, showing a preferred embodiment,

Fig. 1 is a vertical, sectional view of the assembled spindle unit,

Fig. 2 is an enlarged, sectional view taken on line 2—2 of Fig. 1 to show the plurality of convolutions of the dampening spring, and

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2.

Referring now more particularly to the several views, and, for the moment to Fig. 1, there is shown the assembled unit, which consists of the outer cylindrical cast iron casing 1, and it is to be noticed that the inner bottom surface 2 is concave, the purpose of which will be set out as the specification proceeds.

Mounted within this outer casing 1 with sufficient clearance for a spring to be hereinafter mentioned is what I term the shell 3, the internal diameter of which is slightly enlarged at its neck as at 4 so that the roller bearing 5 may be mounted therein. The extreme upper end of the shell 3 is bent or crimped downwardly and inwardly as at 6 to permanently secure this roller bearing 5 within the shell 3. In a similar manner the lower end of the shell 3 has its internal diameter slightly enlarged at 7 so that the lower frictional bearing 8 may also be mounted in the shell 3. Likewise, the extreme lower end of the shell as at 9 is crimped inwardly to thus secure this bearing 8 rigidly within the shell 3.

Thus, it will be seen there is a roller bearing 5 mounted at the top of the shell and a frictional bearing 8 mounted at the lower end of the shell 3, in which bearings 5 and 8 will be mounted the spindle 10. The frictional bearing 8 is preferably made of bronze and is provided with a central aperture 11, and, of course, provided with a tapered seat 12 in which will fit the tapered bearing point 13 of the spindle 10. In this lower bearing 8 there will be noticed the vertical oil passageway 14 which is connected by the transverse oil passageway 15 so that oil may always be present on the bearing seat 12.

Still referring to the bearing 8, it is also grooved as at 16 to receive the lower ends 9 of the shell 3; and is also slightly reduced as at 17 so that the coil spring 18 may seat about the reduced portion, while the lower end of the spring will rest on the plate 19, which is reduced as at 20, and rides on the arcuate surface 2 of the aforementioned outer casing 1.

This plate 19 is also rounded or dome-shaped on its bottom as at 21 to correspond with the curvature 2 at the bottom of the casing 1.

Mounted at the upper end of the inner casing or shell 3 and bearing against the crimped upper edge thereof 6 is the metal collar 23 with its lower flange 24; and mounted about this collar 23 and resting on the flange 24 is the "neoprene" washer 25 over which fits the metal disc 26, the disc also, of course, being mounted over the collar 23.

To hold this "neoprene" washer 25 in place and tightly against the upper end 6 of the shell 3 is a split ring 27 which fits in the appropriate groove 28 formed in the inner surface of the outer casing 1, as may be clearly seen.

Thus the spring 18 compressed against the bronze bearing 8 will hold the inner shell 3 tightly against the "neoprene" washer 25.

As far as the specification has proceeded, it will be seen that there is the inner casing or shell 3 in which in turn there is a roller bearing 5 at its top and a frictional bearing 8 at its bottom and a coil spring 18 forcing the inner shell 3 up against the fixed "neoprene" washer 25.

At the top of the outer casing 1 is the whorl 29 through which the spindle blade 10′ passes.

Now, referring to one of the principal features of the invention, it will be noticed that between the inner shell 3 and the inner surface of the outer casing 1 I provide a wrapping of a steel or brass sheet 30. This spring should be approximately .002″ ($^{2}/_{1000}$ of an inch) thick and I have found that approximately seven and a half turns or coils of the spring will give the desired results, if the distance between the inner and outer shell is at least one-thirty-second of an inch ($^{1}/_{32}$″) or larger, which will vary according to the amount of dampening required.

The coils will separate at least .001″ ($^{1}/_{1000}$ of an inch) so that seven and a half coils will give approximately .007½″ ($^{7.5}/_{1000}$ of an inch) movements in either direction, or an overall possibility of .015″ ($^{15}/_{1000}$ of an inch) between the inner shell 3 and the inner surface of the outer casing 1. The distance, however, between the inner shell 3 and the inner surface of the outer casing 1 is approximately $\frac{1}{32}$″.

It will be understood that the space between the coils will be filled with oil, and where a continual roll of shim steel is used in place of separate bushings, pressure can be exerted by expansion of the oil film between the sheets. Of course, the amount of pressure exerted can be controlled by the number of wrappings within the fixed space.

In this type of spindle unit the diameter of each wrapping or coil can expand when the oil is placed inside of the spindle casing and cause each wrapping to expand to a point where the entire unit will be held under oil pressure, thus getting a considerable vibration-dampening possibility, which is not possible in the fixed diameter type of bushings where the oil film could not expand beyond particular limits imposed by a fixed sleeve.

It will be understood also too many wrappings of the steel sheet 30 might cause too much pressure and might even tend to increase vibration, but with the correct amount of coils or wrappings this is controlled, so that the vibration caused by the unbalanced package on a spindle blade could readily be absorbed by the plurality of oil films between the wrappings.

I consider the arrangement shown superior to a fixed diameter sleeve, as there will be less movement or looseness in my type than in one with the fixed diameter.

Again, by providing a coil 30, as shown, the lower part of the spindle blade 10 can adjust itself to a new position and move temporarily further out of line than the upper part, since these coils or sleeves can expand, say, more on the lower side of the spindle at the bottom and to a lesser amount on the opposite side of the spindle at the top. In other words, the present arrangement is a full floating spindle, yet, due to the internal pressure created by the expanding film of oil, it will be held more restrained in the spindle base.

It will also be noticed that this wrapping of shim steel or brass 30 extends the entire length of the inner shell 3, which tends to provide for a more even and smooth-running spindle.

It will be understood that the unit is assemled in the dry state, that is, without oil; but after oil is placed in the assembly for lubricating purposes, it will be absorbed between the steel sheet laminations in such a manner as to cause them to expand laterally. The expansion of this coil 30 would vary according to the viscosity of the oil; but in any case there will be a film of oil between adjacent wrappings or turns of the laminated spring 30 which, being continuous, will expand or contract depending upon the quantity of oil between each layer, which in turn depends upon the viscosity of the oil.

Furthermore, the plate 19 in the bottom of the casing 1, which, it will be remembered, is held under spring pressure, will exert more pressure on the spring in any other than a central position.

Therefore, any tendency caused by the unbalance of the load to throw the lower part of the spindle blade 10 off-center will cause this plate 19 to ride up on the radius, resulting in increased spring-pressure, and returning the spindle to its normal center of rotation.

In other words, if the spindle and its load were in perfect balance, this plate 19 under spring pressure would find its seat at the lowest point of the radius, thus exerting the least spring-pressure, under conditions of perfect balance.

On the other hand, for the spindle to move out of center will increase the spring-pressure, which in turn will provide additional dampening means.

From the foregoing it will be seen that I have provided a spindle unit wherein the spindle is a full floating one. Included in the spindle unit are an upper and a lower bearing, which in turn are mounted in a shell, which shell fits within the outer casing, leaving an annular space between the shell and the said outer casing.

This space, however, as heretofore mentioned, is filled with a thin steel spring extending the entire length of the shell, and the laminations between the coils of the spring are also filled with oil to thus provide a dampening effect for any vibration caused by the spindle being out of center, due to the off-center displacement of the mass on the spindle blade.

Finally, it will be seen that besides the dampening effect provided by the oil filled laminations between the coils of the spring, I have provided a frictional arrangement at the bottom of the casing to assist in the dampening of the vibrations.

Thus, there is provided a full floating spindle that can shift laterally throughout its vertical axis rather than being pivoted at its upper portion. Also, the spindle is held under compression substantially transversely throughout its length.

Having thus described my invention, what I claim is new and desire to secure by Letters Patent is:

1. In a full floating spindle unit, an outer casing, an inner shell, bearings mounted at the upper and lower ends of said shell, a spindle mounted in said bearings, a resilient washer mounted in said outer casing against which the upper end of said shell bears, a spring at the lower end of said casing for holding the shell upwardly against said washer, a relatively thin sheet metal spring having a plurality of convolutions interposed between the shell and the said casing, the said spring extending throughout the entire length of said shell, and the space between the convolutions of the spring adapted to receive oil to provide a vibration dampening effect throughout the length of the shell and its spindle.

2. In a full floating spindle unit, an outer casing, an inner shell normally disposed concentrically within said casing, a roller bearing mounted at the upper end of said shell, a frictional bearing mounted at the lower end of said shell, a spindle mounted in said bearings, an elastic washer mounted in said outer casing against which the upper end of the shell bears, a spring in the lower end of the casing for holding the shell upwardly against said washer, a relatively thin sheet metal spring having a plurality of convolutions interposed between the shell and the said casing, the said spring extending substantially throughout the entire length of the said shell, and the space between the convolutions of the spring adapted to receive oil to provide a dampening effect throughout the length of the shell and its spindle.

3. In a full floating spindle unit, an outer casing, an inner shell, bearings mounted in said shell, a spindle mounted in said bearings, an

elastic washer mounted in said outer casing in contact with the upper end of the shell, the inner bottom of the outer casing being arcuate, an arcuate plate mounted in said bottom, a spring extending between the lower bearing of the shell and said plate, a relatively thin sheet metal spring having a plurality of convolutions interposed between the shell and the casing, the said spring extending substantially throughout the entire length of said shell, the space between the convolutions of the spring adapted to retain oil to provide a vibration dampening effect for the spindle, and the spring and the arcuate plate in the bottom of the casing adapted to assist in returning the spindle to its normal center of rotation from that assumed by the spindle due to an unbalanced load.

4. In a spindle unit, an outer casing, a full floating inner casing, a spindle rotatably mounted within the inner casing, a resilient washer in contact with the upper end of the inner casing, bearings in said inner casing, a spring-pressed frictional means bearing against the bottom of one of said bearings for holding the inner casing upwardly and to assist in retaining the spindle in its true central axial position, and sheet spring means also interposed between the inner shell and outer casing adapted to retain an oil film between the convolutions to thus provide a vibration dampening effect for the spindle due to any unbalanced load on the spindle.

5. In a spindle unit, an outer casing, a full floating inner casing, a spindle rotatably mounted within the inner casing, a resilient washer mounted in the outer casing and in contact with the upper end of the inner casing, an upper and lower bearing in said inner casing, the lower bearing provided with passageways to admit oil to the seat of said bearing, a spring-pressed frictional means bearing against the bottom of one of said bearings for holding the inner casing upwardly and to assist in retaining the spindle in its true central axial position, and sheet spring means also interposed between the inner shell and outer casing adapted to retain an oil film between the convolutions to thus provide a vibration dampening effect for the spindle due to any unbalanced load on the spindle.

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