H. L. BROWN.

SPINDLE.

APPLICATION FILED DEC. 24, 1909.

987,546.

Patented Mar. 21, 1911.

Fig. 1

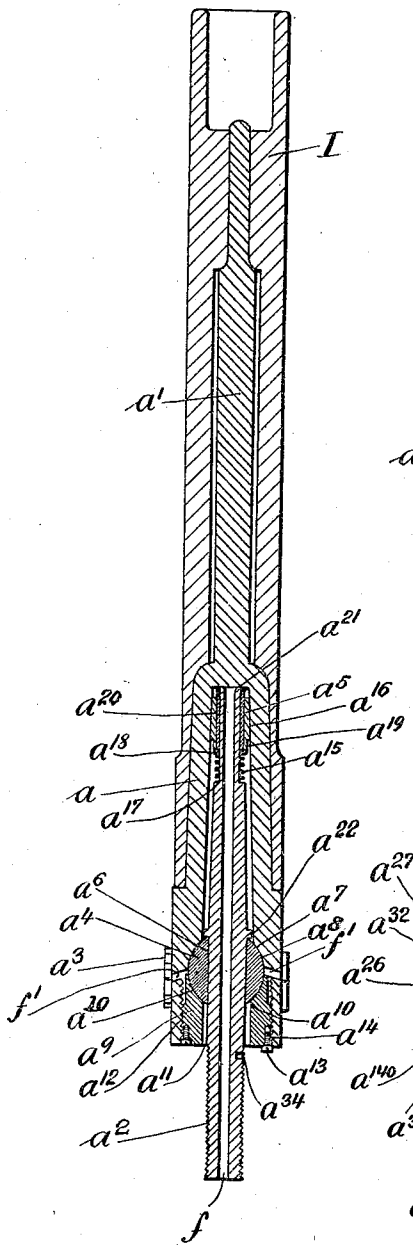


Fig. 4

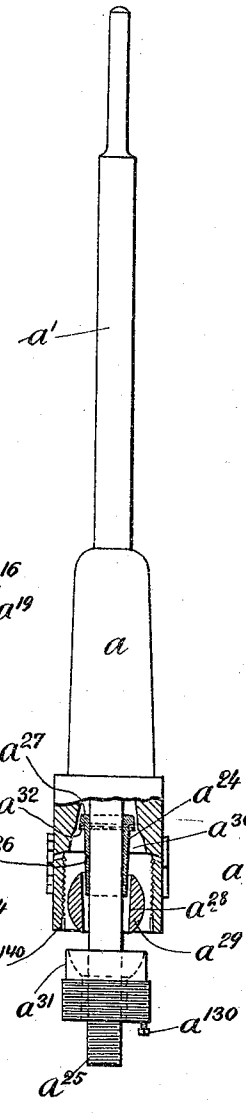


Fig. 3

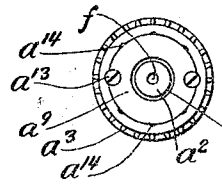
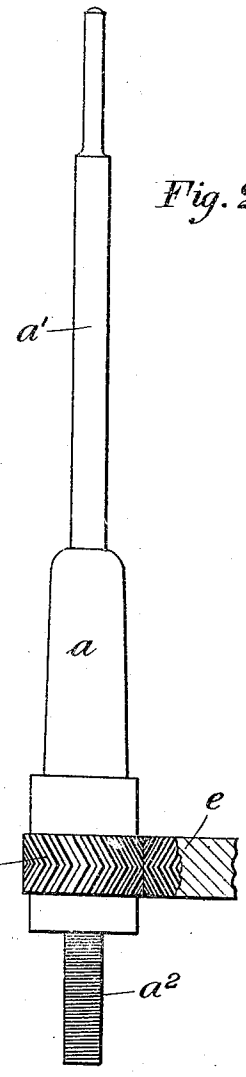


Fig. 2



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UNITED STATES PATENT OFFICE.

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SPINDLE.

987,546. Specification of Letters Patent. Patented Mar. 21, 1911.

Original application filed June 3, 1908, Serial No. 436,472. Divided and this application filed December 24, 1909. Serial No. 534,804.

To all whom it may concern:

Be it known that I, HENRY L. BROWN, of Paterson, New Jersey, have invented certain Improvements in Spindles, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings designating like parts.

This invention relates to spindles, and is of special utility when embodied in apparatus for spinning or similar treatment of cotton, silk, wool, flax and other fibers, filaments or fibrous materials, although I contemplate the use of my improvements in any field for which they are adapted by their nature.

The primary object of my invention is to provide a spindle in which the quality of "flexibility," or capacity to yield somewhat from the normal, under the adventitious shocks and strains to which spindles are frequently subjected, is combined in an unusual degree with "stability," by which term I designate the equally desirable self-centering action of a properly constructed spindle, tending constantly to restore the axis of rotation to the normal.

My improvements are preferably embodied in a spindle-device of the type comprising a shell-member mounted to rotate upon a dead-spindle, and in accordance with an important feature of my invention, I prefer to provide a plurality of compound bearings between the shell and the portion of the dead-spindle extending within the socket of the shell, which is preferably made of considerable length, so that these bearings can be widely separated, to afford great stability to the spindle shell, while the dead-spindle may, and preferably does, comprise a fixed post transfixing the compound bearing-members, the latter preferably taking the form or sleeves rotatable freely on the post, while the shell rotates freely on, and with reference to, the sleeves, so that the latter have a free rotative movement relatively to both the shell and the post, and the friction is thereby distributed. The dead-spindle may be slightly resilient by nature, or may be tempered to increase its flexibility, so that it will permit the shell-spindle to yield slightly under the impact of an accidental blow or pull, but tending normally to restore the axis of rotation of the spindle to the normal. I prefer to provide a universal bearing between the shell and post at the region where the drive is applied to the shell, to facilitate this flexible movement of the post within the shell, while the shell continues to rotate on a true bearing, and for that reason I prefer to form the lower sleeve with a spherical periphery. As the rotating member of such a shell spindle usually exhibits a tendency to leave its post co-axially, at speeds of 3000 turns a minute or over, I prefer to provide in the mouth of the shell, adjacent to the sphere, a removable bearing bush of hardened metal, which may, and preferably does, form the main bearing surface, and for that reason I prefer to provide for its delicate and accurate adjustment, and for its ready replacement, this bushing being preferably of annular form, surrounding the post, and having an axial bore of sufficient diameter to permit the universal play above mentioned, and also to pass the oil. The upper sleeve I prefer to locate at or near the tip of the dead-spindle and I prefer to provide suitable means, such as a spring, coiled upon the post, to press this upper sleeve yieldingly into bearing engagement with the upper side walls of the shell socket, these bearing surfaces being preferably coned slightly to afford a seat which limits the co-axial movement of the sleeve. This spring serves to take up automatically any wear of either of the sleeve bearings and to maintain them both constantly in true bearing contact, but will give temporarily under undue pressure or shocks.

Another important object of my invention is to provide for flushing both the bearings constantly with a suitable fluid to cleanse them from the products of attrition, and to lubricate them, for which purpose I prefer to construct the post with an oil channel, which may take the form of a central bore having its discharge aperture above the tip bearing-sleeve, so that an abundant supply of oil can be introduced to the upper bearing, and pass thence to the spherical sleeve, the spring seated tip-sleeve yielding from time to time to facilitate a copious flow of lubricant through the upper bearing to the lower bearing.

In accordance with another important feature of my invention I provide for lubrication of the exterior drive gearing of

the spindle by forming one or more ports in the walls of the rotatable shell at or near the region of the driving gear, through which port the lubricant is drawn by centrifugal force and delivered into the gear teeth.

The subject matter of this application has been divided from my application, Serial No. 436,472, filed June 3, 1908.

The various features of my invention will be illustrated and described fully in the accompanying drawings and specification and pointed out in the claims.

In the drawings, Figure 1 is a vertical, sectional view of a spindle in the construction of which my improvements have been embodied. Fig. 2 shows in elevation the spindle of Fig. 1. Fig. 3 is a view in plan, looking from bottom to top, Fig. 1; and Fig. 4 is a view in elevation of a modified form of spindle, shown partly in section, with several of the members ready for assemblage.

In the embodiment of my invention selected for illustration and description as a convenient form to enable ready and complete understanding of my improvements, the part designated by the reference character a is the shell of the spindle and constitutes the rotatable member in the instance illustrated, carrying a blade a_1 to receive a suitable bobbin or similar device, such as that illustrated at I in Fig. 1, the shell being mounted rotatively upon a supporting member a_2, which is situated axially within the socket or hollow interior bearing portion of the shell-spindle member. The shell has preferably an exterior pinion, gear or similar device a_3 of a character suitable to permit the spindle to be driven positively, for which purpose I have shown a gear e (partly broken away), and while I do not limit myself to any specific form of driving mechanism, I prefer to use gearing of the "herring bone" or analogous types for the spindle pinion and its actuating member, as such a form of gear will aid to serve that object of my invention which provides for means to counteract the tendency of shell spindles to leave their supports co-axially.

In accordance with an extremely important feature of my invention, I have provided, and illustrated at a_4, a universal bearing intermediate the shell a and its supporting member a_2, preferably at the driving region within the part of the socket surrounded by the gear a_3 so that during rotation of the shell a on its main bearing a_4 it may assume different axial positions varying in angular relation to the normal, moving about the universal bearing to find and maintain a true axis of rotative equilibrium, and I thus provide the yielding support or flexible quality recognized in modern spindle construction as an element of prime importance in the ability of a spindle to avoid deleterious vibrations, a factor especially important at high speeds. To promote stability of the spindle in its self-centered position, I prefer to locate the drive bearing a_4 at a region of low flexibility of the supporting member a_2, near the threaded attaching end, and I prefer to provide also a secondary or auxiliary bearing member a_5 at a region of greater flexibility, so that if the spindle blade a_1 be struck a sharp blow, as happens not infrequently, the tip of the supporting member a_2 is free to yield, while its threaded lower end, being held fast in a suitable base (not shown) holds the universal bearing member a_4 firmly, and the shell a may "nod" or "duck" with the tip of the member a_2 under the impact of the blow, moving around the universal bearing without straining or parting the bearing surfaces, and after the force of the blow has been spent, can again straighten up under the action of the member a_2. The shell and its blade may then, and preferably will, be of relatively rigid construction, forming an integral metal member, symmetrical, and as true as it is possible to make it mechanically, while the supporting post a_2 will also preferably be made of metal, its lesser diameter ordinarily serving to endow it with sufficient ability to give or yield slightly near its tip without any special preliminary treatment to impart resiliency, although where found desirable, tempering, or other suitable treatment to induce flexibility of the requisite degree, is to be considered within the scope of my invention.

It should be noted that the bearing parts of both bearings are in perfect contact at all times, and that I obviate the use of adventitious means to promote flexibility, such as felted or fibrous packings, which must be renewed from time to time, and the novel principle of construction above recited I conceive to be of general utility in its application to spindles and accordingly I claim it hereinafter generically.

When embodied in a spindle device wherein the rotating member takes the form of a shell, as illustrated herein, the bearing part a_4 which affords the capability of slight universal play may, and preferably will, comprise a separately formed sphere or member of generally spherical shape, provided with an axial bore a_6 to pass the supporting post and furnish a snug bearing fit thereon, the area of the cylindrical bearing surface constituted by this bore preferably being approximately equal to the area of the exterior spherical bearing surfaces a_8 and a_{10}, so that the bearing surfaces will together furnish a compound bearing, the member a_4 will be free to rotate between the post and shell, and the friction will be distributed.

The bearing surface upon the rotating

member of the spindle may be of any form suitable to coöperate with the bearing surface with which it is to engage, and as one convenient form of surface to engage the spherical surface a_7, I have illustrated at a_8 a concave annular shoulder which in the instance illustrated is formed integral with the material of the spindle shell and faces the open mouth of the shell, while to coöperate with the lower spherical surface of the member a_4 I prefer to provide a bearing member a_9 of annular form and having a concave bearing surface a_{10}, facing oppositely to the surface a_8, the two surfaces embracing the sphere between them, and affording the maximum distribution of friction. The member a_9 will preferably be made removable and arranged to be secured in adjusted position, serving as means to retain the shell upon its support, a function of great importance at high speeds, inasmuch as heretofore it has been found impossible to operate shell spindles at a speed of three thousand turns to a minute and over, owing to the co-axial aberration of the shell. This retaining bearing bush will preferably have its axial bore a_{11} slightly larger in diameter than the portion of the supporting post passing therethrough, in order to clear the post during nutative displacement of the shell from parallelism with the main axis of the post, and also to afford ample exit of the fluid lubricant with such detritus as may result from the attrition of the bearings, or otherwise find its way into the circulating lubricant, this continuous self-cleaning action of the spindle constituting one of the most important and novel features of my invention, as will be understood more fully upon reference to the more detailed explanation of the oiling system set forth elsewhere herein. Viewing the member a_9 in another aspect, it may be regarded as the main wearing part of the device, in view of the above recited tendency of shell spindles to rise on their supports at the high speeds common in spinning cotton, silk and other fibers, and I prefer to harden the material of the member to withstand this wear, and to provide for its ready replacement when worn; its occasional adjustment with accuracy and nicety; and its positive fixation in adjusted position; these requirements being subserved by a threaded connection of relatively fine pitch as at a_{12} between the periphery of the bush and the throat of the shell, and by screws a_{13} tapped into the base of the bush and so positioned that their heads may enter recesses a_{14} (see Fig. 3) arranged at such intervals as may be found desirable around the mouth of the shell, the distance between recesses representing a predetermined co-axial displacement of the bush along the post, corresponding to the degree of wear which may necessitate readjustment, according to experience. As a corollary of the establishment of this bush a_9 as the main bearing part, I may, and prefer to, arrange the auxiliary bearing a_5 in such a manner as to coördinate its operation and adjustment with that of the bushing a_9, and for this purpose I have shown means a_{15} to maintain the auxiliary bushing bearing member a_5 automatically in snug engagement with its coöperating bearing a_{16} within the shell member a, and to serve at the same time as means to exert a co-axial draft upon the shell tending to maintain the bush-bearing surface a_{10} in normal operative engagement with the mouthward surface of the bearing part a_4. Any suitable means a_{15} may be provided to maintain the parts in this relation, and as one convenient form of such means I have shown a coil spring surrounding the post a_2 which may be reduced somewhat in diameter to seat the spring, one end of the spring bearing against the shoulder a_{17} while its other end exerts a constant thrust against a loose washer a_{18} below the anterior portion of the auxiliary bushing a_5. The shell-bearing surface a_{16} will preferably be slightly coned, to correspond with which the exterior of the bushing a_5 may be similarly coned, and as it is desirable to secure at this bearing the advantageous distribution of friction afforded by compounding, the free rotation of the bushing a_5 may be facilitated by equalizing the area of its outer and inner surfaces, and for this purpose an extension a_{19} is shown which causes the inner bearing surface to present by its additional length, an area equal to the greater outside diameter of the member a_5.

I prefer to provide for a hardened and easily renewable bearing surface upon the tip of the post a_2 to engage with the inner surface of the bushing a_5, and this may take any suitable form, as for example the metal sleeve a_{20} shown in Fig. 1, to retain which in place the post may be swaged outward slightly as indicated at a_{21}.

At a_{22} in Fig. 1 I have shown an integral shoulder which may be provided to limit the upward shift of the bearing part a_4 under the action of the spring a_{15} and to resist the co-axial aberrancy of the shell at high speeds. In the modification illustrated in Fig. 4, a similar stop is provided in the form of a sleeve a_{24} which may be secured upon the supporting post a_{25} in suitable fashion, as by shrinking, for example, and has preferably a coned surface a_{26} and stop shoulder a_{27}, the sleeve being hardened preferably and serving as a bearing for the similarly coned surface a_{28} of the sphere a_{29}, which in other respects is preferably similar to the sphere a_4 shown in Fig. 1 and coöperates in like fashion with the shell bearing portion a_{30} and the bearing bush a_{31}, these parts

being shown as slightly separated, ready for assemblage. The bush a_{31} may be secured in adjusted position by a screw a_{130}, similar to the screws a_{13} already described, and shown in Figs. 1 and 3. One or more washers a_{32} may be provided as shown in Fig. 4, adjacent the shoulder a_{27}, to limit the upward shift of the sphere a_{29}, and as the coned axial bore of the latter wears larger, the sphere may be reseated after removal of one or more of the washers a_{32}.

The support post a_2 of my improved spindle, may have a threaded shank, as illustrated in Fig. 1, and may be mounted on any suitable "rail", by which term I designate broadly the portion of a spinning frame or other apparatus utilized as the main support for that part of each spindle which carries the rotating or spinning member thereof, without limitation to any technical use of the term "rail".

To attain the best results at high speeds, and indeed at any speed, means should be provided for the regular, and preferably continuous, circulation of lubricant over the bearing surfaces between a spindle and its support and driving gears, and for that purpose any suitable device may be adopted, in accordance with my invention. The preferred system of oiling which I have devised, and illustrated herein, permits circulation of oil, or other suitable lubricant, through channels f in the respective spindle posts, to the auxiliary bearings a_5, thence down between the shell and post to the drive bearing a_4 and from there partly through ports or vents f_1 in the shell-part a_3 to drench or lubricate the gear a_3, preferably, and partly through the bush bore a_{11}.

Having illustrated and described my invention thus fully, and suitable means for carrying the same into effect, it will be understood that I do not limit myself to the specific materials, construction or uses shown and described, nor in general otherwise than as set forth in the claims read in connection with this specification.

What I claim and desire to secure by Letters Patent is:—

1. A spindle of the class described; comprising a rotatable shell member presenting an interior bearing toward its mouth, a removable bearing member arranged to enter said mouth, and means to secure said removable member in adjusted position; said removable member presenting a bearing surface opposite to said interior bearing surface to embrace a shell-supporting bearing member therebetween, said shell and removable member having respectively axial bores of sufficient size to permit a limited universal movement of said shell about said supporting member; substantially as described.

2. A spindle of the class described; comprising a shell member presenting an interior bearing toward its mouth, a removable bearing member arranged to enter said mouth, and a screw in the base of one of said members to enter one of a plurality of recesses in said other member to secure said removable member in adjusted position.

3. A spindle of the class described comprising a shell member presenting an interior bearing toward its mouth; a removable bearing member arranged to enter said mouth; a freely rotatable annular bearing member embraced between said interior bearing and removable member; and means to secure said removable member in adjusted position, said removable member presenting a bearing surface opposite to said interior bearing surface.

4. A shell spindle of the class described; its support; and a plurality of compound bearings intermediate said spindle and support; one of said bearings being a universal bearing; substantially as described.

5. A shell-spindle of the class described; a supporting post therefor; and a spherical bearing member intermediate said post and shell, said spherical member being transfixed by said post and rotatable independently of both post and shell; substantially as described.

6. A support for shell spindles of the class described; comprising a post having a coned bearing surface and a shoulder, and provided with a plurality of removable washers; and a spherical bearing member having a coned central bearing bore to fit on said post cone, up against one of said washers; substantially as described.

7. A spindle device of the class described; comprising a supporting post provided with a medial, spherical universal bearing and having near one end a rotatable bushing and a spring to press the same normally toward the end of said post; a spindle-shell mounted to rotate about said post and having similarly faced bearing surfaces to engage rotatively with said bushing and spherical members respectively; a removable member to engage the side of said spherical member opposite said shell bearing; and means to secure said removable member to said shell, embracing said spherical member, and holding said spring under compression; substantially in the manner and for the purpose set forth.

8. A spindle of the class described; comprising a rotatable shell having a plurality of similarly faced bearing surfaces separated by a substantial distance; a supporting post to enter said shell and having a plurality of bearing surfaces to engage said shell bearings, one of said post bearings being mounted yieldingly; and means to exert a constant pressure on said shell tending normally to move said shell co-axially along

said support and force said bearing members respectively into engagement.

9. A spindle of the class described, having an exterior gear surrounding said spindle and rotatable thereupon, and a port in the walls of said gear to convey lubricant to the teeth of said gear from the interior of said spindle; substantially as described.

10. A rotating member for a spindle of the class described, having a peripheral or exteriorly arranged driven portion to be engaged with driving means; and means to permit flow of lubricant from the interior of said rotating member through the walls of said driven portion to the region of driving engagement; substantially as described.

11. A shell-spindle; and a supporting post having an upper bushing bearing and a universal, spherical bearing for said shell, both within the latter, said post having a conduit to convey lubricant in copious quantities to the interior of said shell at a region above said bushing, and means to seat said bushing yieldingly to permit the passage of said lubricant freely to flush and to lubricate said spherical bearing; substantially as described.

Signed at New York in the county and State of New York, this 16th day of December, 1909.

HENRY L. BROWN.

Witnesses:
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