PATENT SPECIFICATION

365,088

Application Date: Oct. 10, 1930. No. 30,324/30.

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PROVISIONAL SPECIFICATION.

No. 30,324, A.D. 1930.

Improvements in and relating to Spindles for Milling, Drilling, Engraving and like Machines.

We, ROBERT ROBERTSON, a British Subject, and KAPELLA LIMITED, a British Company, both of 104, Stoughton Street, Leicester, do hereby declare the nature of this invention to be as follows:—

This invention relates to spindles for milling, drilling, engraving and like machines, and particularly to spindles of the kind having ball or roller bearings and adapted to withstand radial load and end-thrust mainly in one direction.

It is particularly applicable to the spindles used in engraving, milling, drilling and the like machines, in which a cutter or tool is carried by one end of the spindle outside the bearings thereof.

One form of spindle constructed according to the invention, and adapted to carry at one free end thereof a cutter subject to radial load and end-thrust in the direction of the spindle, may comprise:— a spindle mounted in a tubular quill, in two ball bearings, one at or near each end of the quill; means such as a pulley attached to the spindle for driving it; and means such as a taper hole in the free end of the spindle, by which a cutter may be attached thereto. The ball bearings must be of a kind adapted to carry simultaneously a radial load, and an axial thrust in one direction, and such that all shake in the bearing, whether from errors due to wear or errors or variations in construction, can be removed by relative axial movement of the inner and outer races.

The inner races of the bearings are formed in the spindle itself.

Of the outer races, one is fixed in the quill, and preferably the one nearest to the cutter. The other outer race is mounted in the quill for endwise adjustment, for the purpose of taking out both radial and longitudinal shake from the spindle bearings, and is urged longitudinally for this purpose by means of a spring. Preferably the bearing nearest to the cutter is arranged to support a longitudinal thrust in the direction from the cutter toward the said bearing, and the bearing at the other end, whose outer race is adjusably movable, is arranged to carry thrust load in the opposite direction, and accordingly it is convenient to use a helical compression spring housed within the quill and surrounding the spindle freely to maintain the endwise adjustment of the outer race. The spring abuts at one end against a fixed shoulder in the quill, and at the other end against the movable race. It will be seen that by putting the bearing with the movable race at the end of the quill remote from the cutter, we reduce to a minimum the risk that any force applied radially to the cutter in use shall affect the position of the adjustable race.

Dated the Eighth day of October, 1930.

ROBERT ROBERTSON,
KAPELLA LIMITED.

The Common Seal of Kapella Limited was hereunto affixed in the presence of:—

J. RONALD TAYLOR,
G. STAFFORD,
Directors.

G. STAFFORD,
Secretary.

PROVISIONAL SPECIFICATION.

No. 21,622, A.D. 1931.

Improvements in and relating to Spindles for Milling, Drilling, Engraving and like Machines.

We, ROBERT ROBERTSON, a British Subject, and KAPELLA LIMITED, a British Company, both of 104, Stoughton Street, Leicester, do hereby declare the nature

of this invention to be as follows:—

This invention is an improvement on that described in our earlier application for Letters Patent numbered 30,324 and dated October 10th, 1930.

This type of spindle may comprise a spindle mounted in a tubular quill in two ball bearings, one at or near each end of the quill: means such as a pulley attached to the spindle for driving it: means such as a taper hole on the free end of the spindle, by which a cutter may be attached thereto: the ball bearings being of a kind adapted to carry simultaneously a radial load and an axial thrust in one direction, and such that all shake in the bearings, whether from errors due to wear or errors or variation in construction, can be removed by relative axial movement of the inner and outer races: the inner races being formed in the spindle, one of the outer races (preferably the one nearest the cutter) being fixed in the quill, the other being free to slide longitudinally in this and thrust by means of a helical compression spring housed within the quill and surrounding the spindle freely, to maintain the endwise adjustment of the outer races.

According to the present invention, the operative surfaces of the outer races are of the form of internal cones with their larger ends facing outwards, and the inner races are formed integral with the spindle and of circular or curved cross section.

This combination of surfaces provides a stable two-point contact for the balls, the angle of each conical surface determines the angle of the thrust across the balls, and, in spite of variations of workmanship, ensures the predetermined ratio between the longitudinal and radial load capacity. The invention facilitates interchangeable manufacture and ensures in the bearing true rolling contact and consequent long life.

Dated the Twenty-eighth day of July, 1931.

ROBERT ROBERTSON,
KAPELLA LIMITED.

The Common Seal of Kapella Limited was hereunto affixed in the presence of:—

WM. TAYLOR,
WM. S. HOBSON,
Directors.
G. STAFFORD,
Secretary.

COMPLETE SPECIFICATION.

Improvements in and relating to Spindles for Milling, Drilling, Engraving and like Machines.

We, ROBERT ROBERTSON, a British Subject, and KAPELLA LIMITED, a British Company, both of 104, Stoughton Street, Leicester, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to spindles and spindle mountings for milling, drilling, engraving and like machines, of the kind having ball bearings, adapted to withstand radial load and end-thrust, and in which the inner races of the said bearings are formed integral with the spindle, the outer race of one bearing being fixed in the mounting, the outer race of a second bearing being free to slide longitudinally in the mounting and adapted to be thrust endwise by a spring so that all shake in the bearings is taken up. The invention has for its object to provide an improved form of construction for such spindle and bearings and is particularly applicable to high speed spindles on which a cutter or tool is mounted at one end of the spindle outside the bearings thereof.

The present invention will be understood by reference to the accompanying drawing which shows a spindle and mounting, with means for driving the spindle, said means and the mounting being shown in section, and the spindle in part section.

The spindle A is housed in a tubular quill B, from the lower end of which it projects, the projecting end C having fixed on its exterior a pulley D with a groove E, whereby it is adapted to be driven by means of a band. The pulley protects that end of the quill from entrance of dust.

The projecting end C of the spindle has concentrically within it a taper hole F adapted for the attachment and centering of cutters or the like tools with taper shanks.

The spindle A has formed in its outer surface two concentric grooves G and H, of part circular cross section, which form the inner races of the ball bearings.

The outer races I and J of these bearings are separate and are fitted concentrically within the bore of the quill B,

the bearing I being securely held in said quill by means of the threaded clamp ring K. The race J is adapted to slide endwise and is urged upwards, as shown in the drawing, by means of the helical compression spring L, housed within the quill and around the spindle A, and abutting against the lower end of the race J and against a shoulder M in the quill. The inner operative surfaces I_1, J_1, of the outer races are formed as conical surfaces, and not curved in axial section.

Balls, which are plainly shown in the drawing as at N, lie between the inner race G and the surface J_1, of the outer race J, and balls such as N_1 lie between the inner race H and the surface I_1 of the outer race I.

A cap O, screwed into the upper end of the quill B, closes it and excludes dirt. The clamp ring K serves as an additional retainer for the balls N_1.

In assembling the spindle and bearings described, we prefer to put into the quill B the spring L, and the two outer races I and J. We then insert the spindle A, without the pulley D, and the balls N between the race surfaces G and J_1. Then by pressure upon the upper end of the spindle A, we force this downward, compressing the spring L, until we are able to place the balls N_1 between the race surfaces H and I_1, whereupon we release the pressure, screw in the clamp ring K, attach the pulley D, and the cap O, thus completing the assembly.

The object of forming the operative surfaces of one of each pair of races as conical surfaces and the operative surfaces of the other races with part circular cross section is that we thereby ensure a two point rolling contact, and, in spite of inevitable variations of diameter in these elements, a pre-determined ratio between the radial and the longitudinal load-carrying capacity of the bearings: and we find this arrangement to work well.

We prefer to arrange that the larger ends of the cones of the two outer races face outwards from one another, and to fix that outer race which is nearest to the tool, because any longitudinal thrust on the spindle (as, for example, in drilling) generally tends to put the rotating member in compression and this force is best borne by the first bearing: but we do not confine ourselves to this arrangement.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A spindle and spindle mounting of the kind referred to, in which the inner races integral with the spindle are of curved cross section and the outer races are of conical form.

2. A spindle and mounting as claimed in Claim 1, in which the larger ends of the cones of the two outer races are set facing outwards from one another.

3. A spindle and mounting as claimed in Claim 1 or Claim 2, in which the means by which a tool may be attached to the spindle comprises a taper hole in said spindle.

4. A spindle as claimed in any of the preceding claims, in which one end only of the spindle projects from the housing, the other end being enclosed therein, and means are provided by which a tool may be attached to the spindle, and separate means by which it may be rotated, said means being both at the projecting end of the spindle.

5. A spindle of the kind referred to, designed and constructed substantially as described and illustrated.

Dated the Thirty-first day of July, 1931.

ROBERT ROBERTSON,
KAPELLA LIMITED.

The Common Seal of Kapella Limited was hereunto affixed in the presence of:—

WM. TAYLOR,
WM. S. HOBSON,
Directors.
G. STAFFORD,
Secretary.

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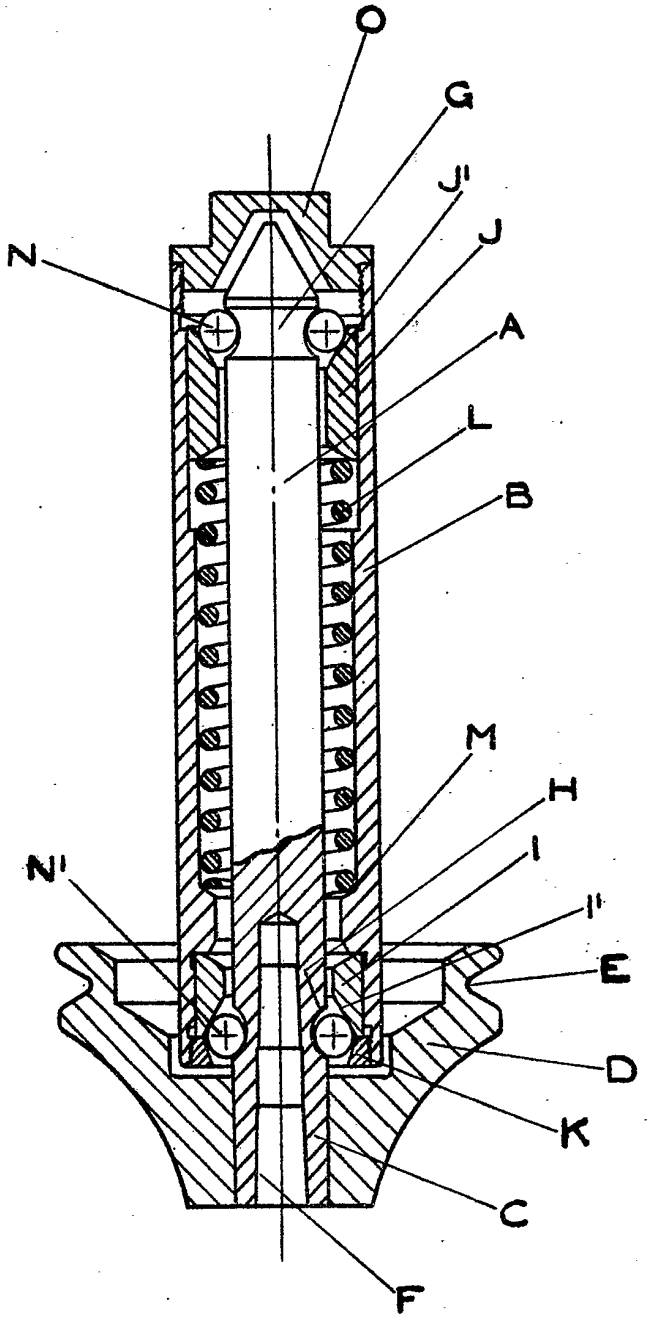

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