

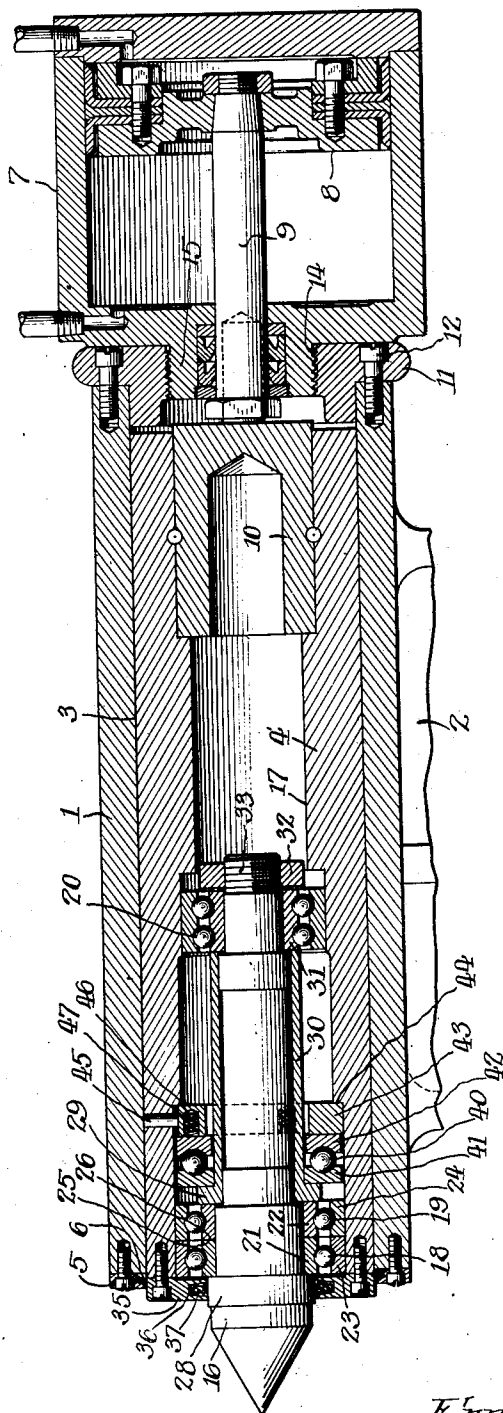
Sept. 1, 1931.

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1,821,331

TAILSTOCK

Filed March 19, 1928



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UNITED STATES PATENT OFFICE

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TAILSTOCK

Application filed March 19, 1928. Serial No. 262,672.

The invention relates generally to lathes and more specifically to a novel tailstock therefor.

The primary object of the present invention is to provide a tailstock for lathes which will meet the demands of the present day production methods of turning metal articles.

In order to cut down the production time for such work it is the practice to employ high rates of cutter feed and relatively heavy cuts, which conditions have heretofore resulted in the production of a high percentage of defective work. The large radial thrust of the cutter has a tendency to move the work radially relatively to the tailstock center which results in an eccentricity of the work if there is any play whatsoever between the work piece and center. In order to overcome this source of defective work, it is necessary to apply sufficient end thrust to the tailstock center to overcome the tendency of the work to run out under the impulse of the radial thrust.

Such an application of force axially of the tailstock however, has been found to result in a difficulty which is even more serious than the one which it is intended to overcome, namely, excessive wear upon the bearings which support the tailstock center. The wearing of these bearings results in a wobbling of the center and therefore the production of inaccurate work.

A more specific object of the invention is to provide a tailstock of new and improved construction which will prevent radial and end play of the center and make possible the high speed production of accurately turned work.

Another object is to provide a novel mounting for a tailstock center embodying anti-friction bearings arranged so as to avoid excessive wear of the bearings due to thrust loads.

Other objects and advantages will become apparent from the following description and from the drawing, in which the figure shows a fragmental longitudinal central sectional view of a tailstock embodying the preferred form of the invention.

While the invention is herein shown em-

bodied in a lathe tailstock construction having actuating means of the fluid-pressure operated type, it is to be understood that it is not intended to limit the invention to tailstocks embodying this particular type of actuating means, it being contemplated that the invention might be equally as well embodied in tailstocks having the common screw-thread type of manual operating means. The scope of the invention will be pointed out in the appended claims.

The form of the invention chosen for purposes of disclosure is shown embodied in a lathe tailstock of the pressure-fluid operated type having a cylindrical body portion 1 cast integrally with a suitable supporting frame 2. The body 1 has an internal bore 3 adapted to receive a movable body or plunger 4 which is slidable in the bore longitudinally of the lathe.

The range of movement of the plunger 4 is such that the forward end (left end as shown herein) moves beyond the end of the surrounding cylindrical body 1 and when the movement of the plunger is reversed there is a tendency to carry particles of dust or metal between the contacting surfaces of the plunger and the bore 3. In order to prevent such entrance of dirt and to assist in the lubrication of these surfaces, a collar 5 having an internal groove 6 is secured to the end of the body 1 surrounding the plunger and suitable packing is positioned in the groove so as to contact the surface of the plunger.

Any preferred means may be provided for reciprocating the plunger 4. This means in the present instance is of the fluid-pressure operated type and comprises a double acting cylinder 7 mounted on the rear end of the body 1 and having a piston 8 therein connected by means of a rod 9 and bushing 10 to the rear end of the plunger 4. For the purpose of securing the cylinder 7 to the end of the body 1, an end wall 11 is secured to the body by means of headed screws 12 which extend through suitable apertures in the wall and engage the walls of the body. A centrally positioned threaded aperture 14 is formed in the end wall 11 to receive the threaded ex-

terior of a stuffing box 15 on the end of the cylinder 7 and thus firmly secure the cylinder to the end wall 11.

A tailstock center or spindle 16 is mounted in a central bore 17 which extends longitudinally of the plunger 4 so that the one end of the center projects forwardly from the plunger to engage a work piece when the plunger is moved forwardly by the piston 9. In order to avoid wearing of the center hole in the work piece, the center 16 is rotatably mounted in the plunger 4 so as to rotate with the work piece and is preferably mounted on ball bearings arranged so as to eliminate radial and end play of the center in the plunger and thereby prevent wobbling of the center 16.

For the purpose of taking the radial load impressed upon the center 16, two single row ball bearings 18, 19 are positioned adjacent the forward end of the center 16 and a double row ball bearing 20 is positioned at the rear end thereof. Since the two single row ball bearings 18, 19 are positioned so close to the work engaging portion of the spindle 16, it is essential that radial play in the bearings be practically eliminated. Factors which might cause wear on the bearings and thus cause such radial play must also be eliminated in order to insure satisfactory operation of the tailstock over a reasonably long period of time.

To this end the outer races 23 and 24 of the bearings 18, 19 are mounted within the bore 17 so as to permit slight axial movement thereof, thus to avoid axial or thrust load thereon. In order that the outer races 23, 24 may be so moved by the spindle without changing the direction of application of force to the balls 18, 19, the two single row bearings are arranged to cooperate with each other and act as a unit, all spring and play between the balls and races of these bearings being removed. This is accomplished preferably by grinding off the adjacent faces 25, 26 of the inner races 21, 22 so that when these races are clamped tightly together as herein-after described, the balls are normally subjected to a constant load slightly greater than the average working load on the balls. By assembling the bearings in this manner the radial play therein is eliminated and due to the initial pressure exerted on the parts of the bearing, any displacement which might otherwise be caused by compression of the parts is effectively avoided. Due to the angular direction of the forces applied to the balls, the necessary axial movement of the outer races is accomplished without changing the relative positions of the parts of either of the bearings 18 and 19. Thus one of the primary causes of wear is eliminated and the life of the bearing prolonged.

As illustrated herein, the inner races of bearings 18, 19 are positioned on the center

16 and are held in fixed longitudinal position adjacent each other by flanges 28 and 29 which abut the forward and rear sides respectively of the races. The flange 28 is preferably formed integrally with the center 16 by means of a shoulder thereon while the flange 29 is formed on the forward end of a sleeve 30 which surrounds the center between the forward bearings 18, 19 and the rear bearing 20. The rear end of the sleeve 30 abuts the forward edge of the inner race 31 of the rear bearing 20. A nut 32 engages the threaded end 33 of the center at the other side of the rear bearing and is arranged to clamp the assembled races 21, 22 of the front bearings, the spacing sleeve 30 and the race 31 of the rear bearing together on the spindle. This places the desired load upon the front bearings 18, 19 and properly positions the assembled parts.

In order to exclude dust or other foreign matter which might be injurious to the bearings contained within the plunger 4, a protective collar 35 is attached to the forward end of the plunger and surrounding the flange 28 on the center. This collar is preferably provided with an internal groove 36 in which suitable packing 37 may be positioned.

For the purpose of taking the thrust load impressed upon the spindle 16, a ball bearing 40 is provided. This bearing comprises two similar races 41 and 42 herein illustrated as surrounding the sleeve 30 rearwardly of the flange 29. The forward race 41 abuts the flange 29 and may be fixed upon the sleeve 30 by a light press fit. Both of the races are arranged for a slight clearance between their outer edges and the walls of the bore, and the rear race 42 has a small clearance between its inner edge and the outer surface of the sleeve 30. The rear race 42 is arranged to abut a thrust washer 43 which is positioned against a shoulder 44 formed within the bore of the plunger. This washer is preferably arranged so as to have a substantial clearance between its outer edge and the wall of the bore and between its inner edge and the sleeve and float therebetween and is fixed against rotation relatively to the plunger by a pin 45 secured to the race and radially slidable in the wall of the plunger. Thus the rear race may float between the plunger and sleeve and the bearing is arranged so as to avoid taking any radial load which might tend to wear the bearing.

In order to prevent axial separation of the two races 41 and 42 which would allow the balls 40 to drop out of their proper positions, means is provided to press the races toward each other. In the present instance this means comprises a plurality of expansive coil springs 46 positioned in axially extending bores 47 formed at spaced intervals about the thrust washer 44. The springs 46 are arranged

to abut the rear side of the race 42. Thus in case there should be any slight end play of the center when removed from the work, the springs retain the thrust bearing parts in their proper operating relation.

From the foregoing it will be apparent that the invention provides a tailstock which will support a rotating work piece so as to produce accurately turned work. The novel arrangement of radial bearings prevents radial play of the center and this in conjunction with the effective mounting for the thrust bearing avoids excessive wear and makes it possible to chuck the work with great axial force.

It will also be apparent that the parts may be readily assembled and are conveniently removable for inspection and replacement. By removing the protective collar 35 and the pin 45, the center and all the parts within the plunger may be withdrawn axially.

I claim as my invention:

1. A lathe tailstock comprising, in combination, a supporting frame having a bore, a plunger reciprocably mounted therein, means for reciprocating said plunger, a center in the forward end of said plunger, and bearing means for rotatably supporting said center comprising a ball bearing having an inner race mounted near the rear end of said center and having an outer race arranged for sliding movement on said plunger, a pair of single row ball bearings mounted adjacent each other on said center near its forward end, means to clamp the two inner races thereof together axially so as to place the balls in said bearings under a constant pressure tending to maintain said outer races abutting each other, an antifriction thrust bearing comprising a forward race fixed on said center, a rear race loosely surrounding said center and balls interposed between said races, a thrust washer mounted in said plunger and adapted to abut said rear race, and resilient means interposed between said washer and said rear race tending to urge said rear race towards said forward race so as to prevent displacement of said balls.

2. A lathe tailstock comprising, in combination, a supporting frame having a bore, a plunger reciprocably mounted therein, means for reciprocating said plunger, a centering spindle in the forward end of said plunger, and bearing means for rotatably supporting said spindle comprising a ball bearing mounted on the spindle near the rear end thereof and arranged for axial floating movement relatively to said plunger, a pair of single row ball bearings mounted adjacent each other near the forward end of the spindle and having outer races arranged for axial sliding movement on said plunger, means for clamping the inner races of said bearings together axially so as to place the balls in said bearings under constant pressure, and a ball

thrust bearing arranged to float radially relatively to said plunger.

3. A lathe tailstock comprising, in combination, a body, a plunger mounted for longitudinal sliding movement relatively to said body, said plunger having a longitudinal bore formed therein, a spindle rotatably mounted in said bore and having a shoulder near its forward end, a ball bearing positioned on said spindle having an inner race rearwardly of and abutting said shoulder, a sleeve surrounding said spindle and abutting the rear side of said inner race, a second ball bearing on the rear end of said spindle having an inner race abutting the end of said sleeve, and a nut threaded on the rear end of said spindle and abutting the rear end of said inner race whereby said front and rear bearings may be clamped in position.

4. In a lathe tailstock, the combination of a spindle having a shoulder near its forward end, a ball bearing on said spindle rearwardly of said shoulder and having an inner race abutting said shoulder, a sleeve surrounding said spindle and abutting the rear side of said inner race a second bearing on the rear end of said spindle having an inner race abutting the rear end of said sleeve, and a nut threaded on the rear end of said spindle engaging the inner race of said second bearing so as to be operable to clamp said front and rear bearings in position on said spindle.

5. A tailstock comprising in combination, a frame, a longitudinally slidable plunger mounted therein, a work center rotatably mounted in said plunger, radial bearings interposed between said center and said plunger so as to permit slight longitudinal movement of the center relative to the plunger, and a ball thrust bearing interposed between said center and said plunger, said bearing comprising a front race fixed on said center, an abutment on the plunger against which the rear race may bear when pressure is applied to the spindle to positively determine the axial position of the spindle, and resilient means pressing forwardly on said rear race to hold said bearing parts in assembled relation when the spindle is not in engagement with a work piece.

6. In a lathe tailstock, a body, a spindle rotatably mounted therein, bearing means for the forward end of said spindle comprising two single row ball bearings having inner races arranged so as to be separated in an axial direction when the outer races abut each other, and means associated with said spindle operable to clamp said inner races together axially so as to exert a normal working pressure on the balls of the bearing.

7. A tailstock comprising, in combination, a body, a plunger longitudinally slidable in said body, said plunger having a longitudinal bore formed therein, a spindle rotatably mounted in said bore and having a shoulder

- adjacent to its forward end, a first antifriction radial bearing having an outer race engaging said bore for floating movement longitudinally thereof and an inner race surrounding said spindle and abutting said shoulder, a sleeve surrounding said spindle and having one end abutting the rear side of said inner race, an antifriction thrust bearing having one race engaging said sleeve and another race operatively engaging a shoulder in said bore for floating movement radially of said bore, a second antifriction radial bearing having an outer race engaging said bore for floating movement longitudinally of the bore and an inner race surrounding the spindle and engaging the other end of said sleeve, and a nut threaded on the rear end of said spindle and engaging the inner race of said second radial bearing for clamping the inner races of said radial bearings in position on the spindle.
8. In a lathe tailstock, the combination with a body having a spindle rotatably mounted therein, of a ball thrust bearing having one race abutting a shoulder formed on said spindle, a radially floating mounting interposed between said body and the other race of said bearing, and means acting between said body and said other race arranged to take up axial play in said bearing.
9. A lathe tailstock comprising, in combination, a body, a centering spindle rotatably mounted therein, a radial bearing for the forward end of said spindle floating axially of said body, a thrust bearing for said spindle floating radially of said body, adjustable means for taking up radial play in said radial bearing, and means automatically operable to take up axial play in said thrust bearing.
10. A tailstock comprising, in combination, a body, a plunger mounted for longitudinal sliding movement relative to said body, said plunger having a longitudinal bore formed therein, a spindle rotatably mounted in said bore and having a shoulder near its forward end, a ball bearing for taking radial load positioned on said spindle and having an inner race rearwardly of and abutting said shoulder, a sleeve surrounding said spindle and abutting the rear side of said inner race, a ball thrust bearing carried by said sleeve, a second ball bearing for taking radial load positioned on the rear end of said spindle and having an inner race abutting the rear end of said sleeve, and a nut threaded on the rear end of said spindle and engaging said inner race whereby the three bearings may be clamped in position on the spindle.
11. A lathe tailstock comprising a body, a longitudinally adjustable plunger in said body, a spindle rotatably mounted in said plunger, bearing means for the forward end of said spindle comprising two bearings each having an inner and an outer race and a single row of antifriction members, the two outer races engaging each other and the inner races being spaced from each other longitudinally of said spindle, said members and said races being formed so that relative movement of said inner races axially of the spindle toward each other acts to take up radial play in said bearings, and means associated with said spindle operable to clamp said inner races together axially of the spindle to exert a normal working pressure on said antifriction members.
- In testimony whereof, I have hereunto affixed my signature.
- ERNEST J. SVENSON.