March 20, 1951 R. KURZWEIL ET AL 2,545,852

HYDRAULICALLY OPERATED TAILSTOCK

Filed July 10, 1948 3 Sheets-Sheet 1

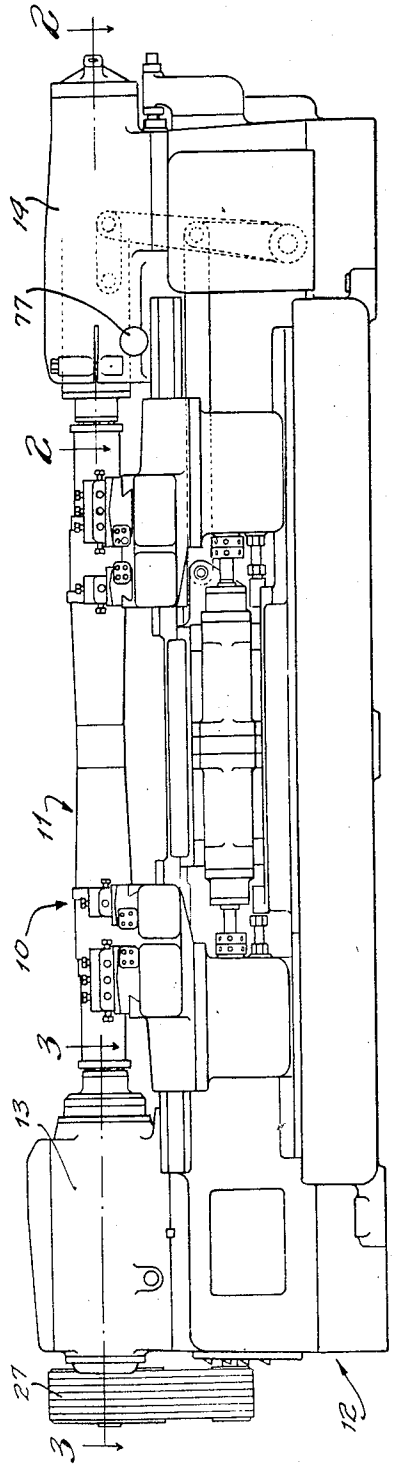


Fig. 1

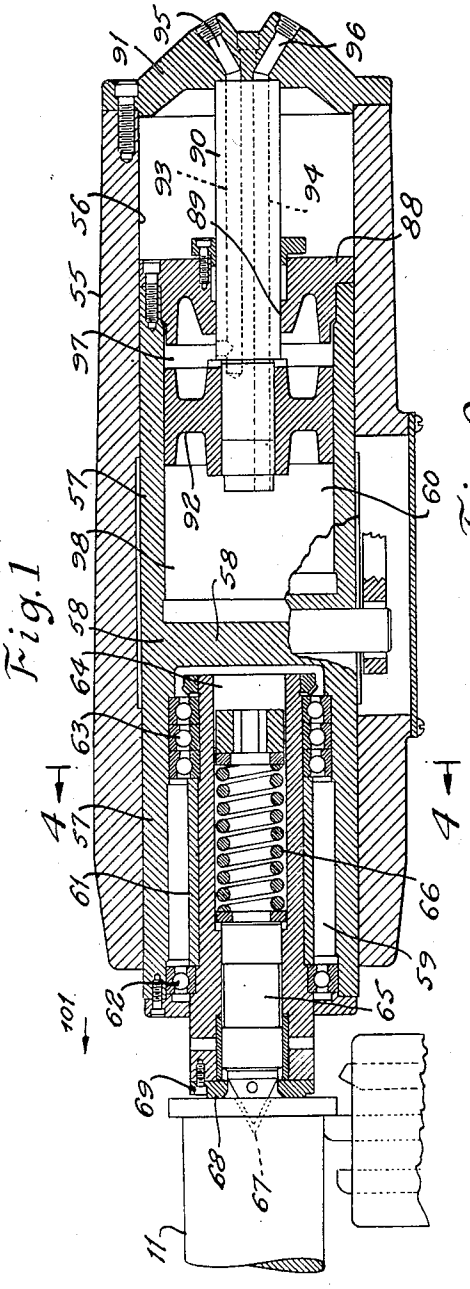


Fig. 2

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HYDRAULICALLY OPERATED TAILSTOCK

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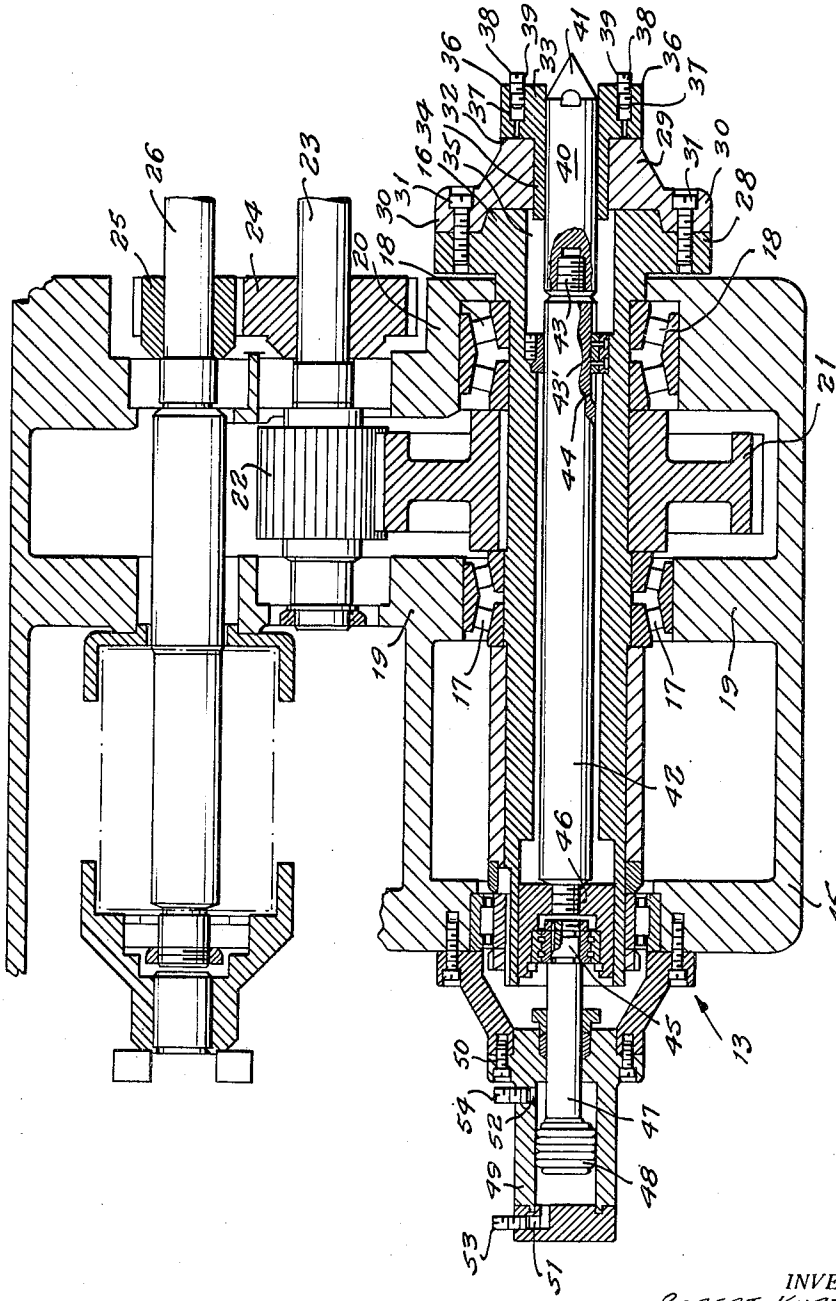


Fig. 3

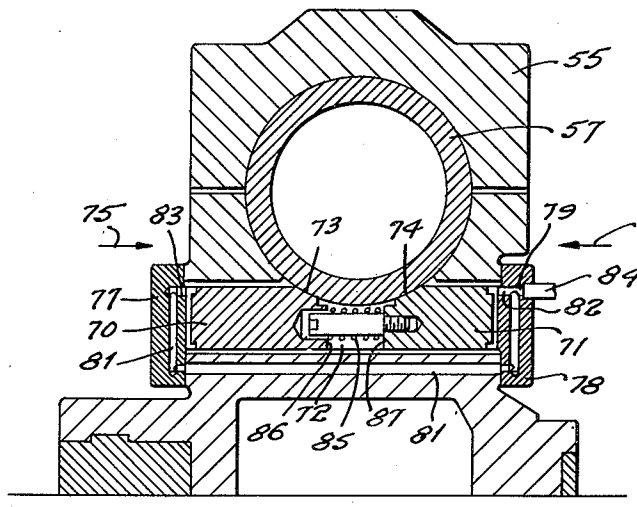
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HYDRAULICALLY OPERATED TAILSTOCK

Filed July 10, 1948 3 Sheets-Sheet 3

Fig. 4



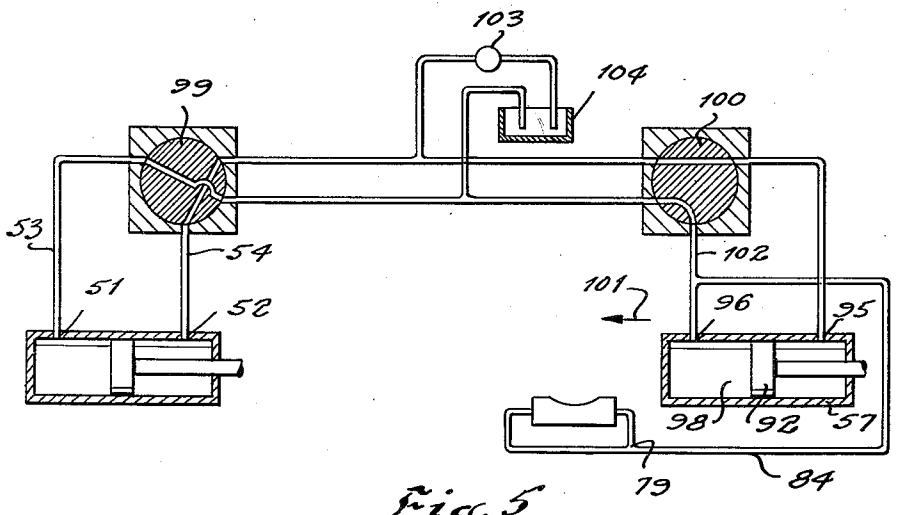


Fig. 5

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2,545,852

HYDRAULICALLY OPERATED TAILSTOCK

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Application July 10, 1948, Serial No. 38,088

10 Claims. (Cl. 82—31)

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The present invention relates to lathes and more particularly to lathe tailstocks.

It is an object of the present invention to provide a lathe tailstock with means adapted to slide the tailstock center and quill in axial direction.

It is another object of the present invention to provide in a tailstock means for sliding the tailstock center and quill towards the workpiece, and to hold it in operative position.

It is a further object of the present invention to provide hydraulic means for operating the center and quill sliding means and for actuating the blocking means holding these parts in operative position.

With the above objects in view, the present invention mainly consists of a lathe tailstock comprising in combination the following principle elements:

(*a*) A tailstock body;

(*b*) A quill arrangement mounted within said tailstock body rotatably and slidably in axial direction thereof;

(*c*) A tailstock center mounted within said quill arrangement slidably in axial direction of said tailstock body relative to said quill arrangement;

(*d*) Spring means permanently forcing said tailstock center outward into operative position adapted to engage one end of a work piece;

(*e*) Blocking means on said quill arrangement preventing sliding of said tailstock center in outward direction beyond said operative position;

(*f*) Gripping means on said quill arrangement for grippingly engaging said end of said work piece around said tailstock center;

(*g*) Hydraulic operating means for sliding said quill arrangement together with said tailstock center in axial direction of said tailstock body relative thereto;

(*h*) First actuating means for actuating said hydraulic operating means so that the same slides said quill arrangement in axial direction of said tailstock body towards said end of said work piece; and

(*i*) Second actuating means for actuating said hydraulic means so that the same slides said quill arrangement in axial direction of said tailstock body away from said end of said work piece.

In accordance with a preferred embodiment of the present invention the quill arrangement described above includes a cylindrical support mounted within the tailstock body, non-rotatably, but slidably in axial direction thereof, and a quill mounted within this cylindrical support at

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the front end thereof rotatably relative to this support, but non-slidably in axial direction thereof.

The hydraulic operating means mentioned above for sliding the cylindrical support, the quill and the tailstock center include preferably a cylindrical bore within the rear part of the cylindrical support extending in axial direction thereof; a stationary piston within said cylindrical bore; a stationary piston rod arranged behind said stationary piston secured at its front end to said stationary piston and at its rear end to said tailstock body extending in axial direction of said cylindrical support; hydraulic actuating means for sliding said cylindrical support together with said quill and said tailstock center in axial direction of said tailstock body relative thereto; and hydraulic conduits passing through said stationary piston rod and connecting said hydraulic actuating means with the two cylinder compartments formed by said stationary piston within said cylindrical bore in said cylindrical support.

Furthermore, also in accordance with the present invention locking means are provided for holding the cylindrical support in operative position; these locking means are operated by additional hydraulic means operatively connected with the hydraulic means for sliding the cylindrical support as explained above.

The novel features which we consider characteristic for the present invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a front elevational view of a lathe embodying the present invention;

Fig. 2 is a cross sectional view of the lathe tailstock forming part of the lathe shown in Fig. 1, taken on line 2—2 of Fig. 1;

Fig. 3 is a cross sectional view of the lathe headstock forming part of the lathe shown in Fig. 1, taken on line 3—3 of Fig. 1;

Fig. 4 is a cross section through the lathe tailstock shown in Fig. 2, taken on line 4—4 of Fig. 2; and

Fig. 5 is a schematic showing of the hydraulic means for operating the various parts of the headstock and the tailstock.

Referring now in detail to the drawings, 10 designates a lathe embodying the present inven-

tion. This lathe serves for turning a work piece, for instance a railroad axle or the like.

This lathe 10 is composed of a base 12, a headstock 13 and a tailstock 14.

The headstock 13 comprises, as clearly shown in Fig. 3, a headstock body 15 on which is mounted a hollow headstock spindle 16 supported by the roller bearing 17 and the front roller bearing 18. The roller bearing 17 is arranged in the rear wall 19 of the headstock body, whereas the roller bearing 18 is arranged in the front wall 20 thereof.

Fixed to the spindle 16 is a gear 21 meshing with the driving gear 22. This driving gear 22 is mounted on shaft 23. On this shaft 23, the gear 24 is mounted which engages gear 25 mounted on shaft 26. This shaft 26 is driven in any suitable manner, e. g. by means of a drive belt 27.

The spindle 16 is formed at its front end with an annular outwardly extending flange 28. In front of this annular flange 28, the nose 29 is arranged. This nose 29 is also provided with a flange 30 which is superimposed upon the front face of the annular flange 28 and secured to the same by means of screws 31. To the front face 32 of the nose 29, the annular ram ring 33 is secured by means of a plurality of screws not shown in the drawings.

This ram ring 33 is provided with a rearwardly projecting sleeve-shaped extension 34 reaching into the bore 35 of the tubular headstock spindle 16.

In the front face 36 of the ram ring 33 a plurality of holes 37 are provided. In each of these holes, a spur 38 is inserted: These spurs 38 are provided with gripping edges 39 and adapted to drivingly engage the work piece 11 when the same is in operative position.

In accordance with the present invention, a headstock center 40 is slidably supported by the sleeve-shaped extension 34 of the ram ring 33. This center 40 is provided at its front end in the usual manner with a conical piece 41 fitting into a corresponding centering hole on the work piece.

At its rear end, the center 40 is connected with the draw rod 42 by means of the screw 43. This draw rod is arranged slidably within the bore 35. Its turning within the tubular spindle 16, is however, prevented by means of key 43 secured to the inner surface of the tubular spindle 16 projecting into the bore 35 and the corresponding key way 44 provided in the draw rod 42, as clearly shown in Fig. 3.

The combined thrust bearing 45 is secured by means of screw 46 to the rear end of the draw rod 42. This thrust bearing 45 is connected also to the piston rod 47 of the hydraulic piston 48 arranged within the hydraulic cylinder 49; this hydraulic cylinder 49 is secured, as clearly shown, by means of screw 50 to the rear wall 19 of the headstock body 15.

The hydraulic cylinder 49 is furthermore connected by the ports 51 and 52 with the conduits 53 and 54, respectively. These conduits 51 and 52 connect the cylinder with hydraulic operating means for admitting hydraulic fluid into the cylinder 49; this hydraulic fluid moves the piston 48 within the cylinder 49, as will be described farther below in detail.

The tailstock 14 mounted on the base 10 includes a tailstock body 55 provided with a cylindrical bore 56. Within this cylindrical bore 56 the tubular cylinder 57 is slidably arranged. This tubular cylinder 57 is subdivided by the partition wall 58 into a front compartment 59 and a rear compartment 60.

Within the front compartment 59 of cylinder 57 the quill 61 is freely rotatably supported by means of the roller bearings 62 and 63. This quill is non-slidable relative to the cylinder 57 but can be moved together with the same in axial direction of the tailstock body 55. The quill 61 is provided with the cylindrical bore 64; in this bore, the tailstock center 65 is arranged. This center 65 is permanently forced by spring 66 towards the work piece 11 so as to engage the center hole 67 provided in the same. On the front face of quill 61, the gripping projections 68 are provided. These gripping projections 68 are secured to the quill by means of screws 69.

In order to prevent sliding of the tubular cylinder 57 supporting the quill 61 in rearward direction while in operative position, i. e. while supporting the work piece, a lock of the type shown in Fig. 4 is provided. This lock consists of two cylindrical locking members 70 and 71 arranged in a cylindrical bore 72 within the tailstock body 55. These cylindrical locking members 70 and 71 are provided with locking faces 73 and 74, respectively. These locking faces 73 and 74 are arranged so as to firmly engage the outer surface of the tubular cylinder 57 when the cylindrical locking members 70 and 71 are moved in direction of arrows 75 and 76, respectively. In this engaging position of the cylindrical members, movement of the tubular cylinder 57 and quill 61 in axial direction is completely blocked.

In order to enable sliding of the two cylindrical locking members 70 and 71 in direction of arrows 75 and 76, respectively, the cylindrical bore 72 is closed at its ends by closure plates 77 and 78, and hydraulic conduits 79, 80 and 81 leading to the ports 82 and 83, respectively, are provided for admission of hydraulic pressure fluid. Such pressure fluid is introduced through the inlet conduit 84 and operates the lock as will be described farther below in detail.

It should be noted that the spring 85 arranged between the inner faces 86 and 87 of the cylindrical locking members 70 and 71, respectively, permanently forces these cylindrical locking members 70 and 71 apart from each other against direction of arrows 75 and 76.

The rear compartment 60 of cylinder 57 is closed at its end by the cap 88. This cap 88 is provided with a bore 89 through which the stationary piston rod 90 passes. This stationary piston rod 90 is secured at its rear end to the rear wall 91 of the tailstock body 55 and carries at its front end a stationary piston 92. Within this piston rod 90, the two conduits 93 and 94 are arranged; they connect the ports 95 and 96 with the space 97 behind the stationary piston 92 and the space 98 in front of the piston 92, respectively.

During chucking and removal of the work piece from the lathe, the above described arrangement operates as follows:

During chucking, the work piece, e. g. railroad axle 11, is lifted by separate lifting means, not shown in the drawings, between the headstock 13 and the tailstock 14 with its centering holes properly aligned between the head stock center 41 and the tailstock center 65.

When the work piece 11 is in this position, pressure fluid is admited by the four-way distributing valve 99 through the port 51 into the hydraulic cylinder 49 on the headstock 13, forcing the piston 48 together with the draw rod 42 and center 41 towards the work piece. This will

result in engagement of the headstock center 41 and the corresponding center hole of the work piece 11, and center 41 will slide the work piece—while supported by the above mentioned lifting means—towards the tailstock 14 into contact with the tailstock center 65 and the griping projections 68 of the retracted quill 61.

At this moment, pressure fluid is admitted by means of the distributing valve 100 and port 96 into the conduit 94 and through the same into the space 98 in front of the stationary piston 92, forcing the freely slidable cylinder 57 together with the quill 61 and the spring pressed center 65 in direction of arrow 101. During the movement, the spring presed center 65 will engage the corresponding center hole 67 of the work piece, properly centering the same, and the gripping projections 68 will force the work piece against action of the hydraulic means provided in the headstock 13 in direction of arrow 101 towards the headstock.

We wish to note that this action is possible not due to a difference in line pressure within the various hydraulic conduits but due to the difference in the pressure faces of the pistons 92 and 48. Due to the fact that the pressure face of piston 92 is substantially larger than the pressure face of piston 48, the actual total pressure exerted by quill 61 will be substantially larger than the pressure exerted by center 41, and, therefore, it will be possible for quill 61 to move the work piece against action of piston 48 in direction of arrow 101. This movement will continue until the work piece engages the gripping edges 39 of the spurs 38, firmly pressed against the same.

During this period, the pressure of the pressure fluid admitted through the common conduit 102 to the port 96 for moving cylinder 57 through the conduit 79 to the port 82 of the locking mechanism shown in Fig. 4 will be insufficient to operate the locking mechanism, i. e. to slide the locking cylinders 70 and 71 against action of spring 85. However, the moment the cylinder 57 reaches its forward position and is in standstill, the pressure in conduit 102 will greatly increase so as to overcome the pressure of spring 85 and to move the locking members 73 and 74 into engagment with cylinder 57, firmly locking the same in its forward operative position.

The line pressure is maintained during turning operation.

When, after turning, it is desired to move the work piece, the following procedure is followed:

While the pressure is maintained in conduit 53, the valve 100 is turned so as to connect the conduit 102 with an outlet conduit leading to tank 104 and to simultaneously connect port 95 with a pressure conduit including the pump 103. Thereby hydraulic pressure fluid is forced into the space 97 behind the stationary piston 92, moving the cylinder 57 together with quill 61 and center 65 against direction of arrow 101. During this movement, disengagement of the tailstock center 65 from the work piece 11 is prevented by the fact that the work piece will be forced by the headstock center 41—which is under pressure of the piston 46—to follow the tailstock center 65 in its movement against direction of arrow 101 away from the spurs 38 of the headstock, safely disengaging the same from the work piece.

When the cylinder 57 reaches its utmost retracted position, valve 99 is automatically operated e. g. by a pre-set electric switch which actuates a solenoid shifting valve 99, so as to connect the conduit 52 with a pressure line, thereby retracting the headstock center 41 and moving it out of engagement with the corresponding center hole of the work piece, thus safely depositing this work piece on the lifting means moved in the meantime under the work piece.

The subject matter of the present application is partly disclosed in the U. S. patent application Serial No. 31,273, filed by Robert Kurzweil on June 5, 1948, for a Hydraulically Operated Headstock Center.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of metal working machines differing from the types described above.

While we have illustrated and described the invention as embodied in lathes for turning heavy work pieces, we do not intend to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of this invention.

Without further analysis, the foregoing will so fully reveal the gist of our invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention, and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What we claim as new and desire to secure by Letters Patent is:

1. In a lathe tailstock equipped with a tailstock body, a quill arangement mounted within said tailstock body rotatably and slidably in axial direction thereof, a tailstock center mounted within said quill arrangement slidably in axial direction of said tailstock body relative to said quill arrangement, resilient means permanently forcing said tailstock center outward into operative position adapted to engage one end of a work piece, and gripping means on said quill arrangement for grippingly engaging said end of said work piece around said tailstock center, the combination of first hydraulic operating means for sliding said quill arrangement together with said tailstock center and said gripping means forward into operative position in which said tailstock center and said gripping means engage said end of said work piece and backward into inoperative position with said tailstock center and said gripping means not engaging said end of said work piece; locking means for holding said quill arrangement in operative position; second hydraulic operating means for moving said locking means into operative locking position; and combined hydraulic actuating means for first actuating said first hydraulic operating means and then automatically actuating said second hydraulic operating means and thereby moving said locking means into operative locking position after said first hydraulic operating means have slid said quill arrangement together with said tailstock center and said gripping means forward into operative position.

2. In a lathe tailstock equipped with a tailstock body, a quill arrangement mounted within said tailstock body rotatably and slidably in axial direction thereof, a tailstock center mounted within said quill arrangement slidably in axial direction of said tailstock body relative to said quill arrangement, resilient means permanently forcing said tailstock center outward into opera-

tive position adapted to engage one end of a work piece, and gripping means on said quill arrangement for grippingly engaging said end of said work piece around said tailstock center, in combination, first hydraulic operating means for sliding said quill arrangement together with said tailstock center and said gripping means forward into operative position in which said tailstock center and said gripping means engage said end of said work piece and backward into inoperative position with said tailstock center and said gripping means not engaging said end of said work piece; locking means for holding said quill arrangement in operative position; second hydraulic operating means for moving said locking means into operative locking position; and spring means for moving said locking means into inoperative non-locking position when said second hydraulic operating means are not holding said locking means in operative position.

3. In a lathe tailstock equipped with a tailstock body, a quill arrangement mounted within said tailstock body rotatably and slidably in axial direction thereof, a tailstock center mounted within said quill arrangement slidably in axial direction of said tailstock body relative to said quill arrangement, resilient means permanently forcing said tailstock center outward into operative position adapted to engage one end of a work piece, and gripping means on said quill arrangement for grippingly engaging said end of said work piece around said tailstock center, in combination first hydraulic operating means for sliding said quill arrangement together with said tailstock center and said gripping means forward into operative position in which said tailstock center and said gripping means engage said end of said work piece and backward into inoperative position with said tailstock center and said gripping means not engaging said end of said work piece; locking means for holding said quill arrangement in operative position; second hydraulic operating means for moving said locking means into operative locking position; spring means for moving said locking means into inoperative non-locking position when said second hydraulic operating means are not holding said locking means in operative position; and combined hydraulic actuating means for first actuating said first hydraulic operating means and then automatically actuating said second hydraulic operating means and thereby moving said locking means into operative locking position after said first hydraulic operating means have slid said quill arrangement together with said tailstock center and said gripping means forward into operative position.

4. In a lathe tailstock equipped with a tailstock body, a cylindrical support mounted within said tailstock body non-rotatably but slidably in axial direction thereof, a quill mounted within said cylindrical support at the front end thereof rotatably relative to said cylindrical support, but non-slidably in axial direction thereof, a tailstock center mounted within said quill slidably in axial direction thereof, resilient means permanently forcing said tailstock center outward into operative position adapted to engage one end of a work piece, and gripping means on the front end of said quill for grippingly engaging said end of said work piece around said tailstock center when said cylindrical support is moved within said tailstock body forward into operative position, in combination, a cylindrical bore within the rear part of said cylindrical support extending in axial direction thereof; a stationary piston within said cylindrical bore forming within the same a forward and a rearward cylinder compartment; a cover secured to the rear face of said cylindrical support closing said cylindrical bore within the same; an aperture within said cover; a stationary piston rod passing through said aperture and secured at its front end to said stationary piston and at its rear end to said tailstock body extending in axial direction of said cylindrical support; a first hydraulic conduit passing through said stationary piston rod and leading into said forward compartment within said bore; a second hydraulic conduit passing through said stationary piston rod and leading into said rearward compartment within said cylindrical bore; combined valve means connected to said hydraulic conduits so as to be adapted to connect each of the same either with a source of pressure fluid or an exhaust conduit for said fluid; locking means for holding said cylindrical support in operative position; hydraulic operating means for moving said locking means into operative locking position and holding said locking means in such operative position; and a third hydraulic conduit connecting said first hydraulic conduit with said hydraulic operating means and serving for moving said locking means.

5. In a lathe tailstock equipped with a tailstock body; a cylindrical support mounted within said tailstock body non-rotatably but slidably in axial direction thereof, a quill mounted within said cylindrical support at the front end thereof rotatably relative to said cylindrical support, but non-slidably in axial direction thereof, a tailstock center mounted within said quill slidably in axial direction thereof, resilient means permanently forcing said tailstock center outward into operative position adapted to engage one end of a work piece, and gripping means on the front end of said quill for grippingly engaging said end of said work piece around said tailstock center when said cylindrical support is moved within said tailstock body forward into operative position, in combination, a cylindrical bore within the rear part of said cylindrical support extending in axial direction thereof; a stationary piston within said cylindrical bore forming within the same a forward and a rearward cylinder compartment; a cover secured to the rear face of said cylindrical support closing said cylindrical bore within the same; an aperture within said cover; a stationary piston rod passing through said aperture and secured at its front end to said stationary piston and at its rear end to said tailstock body extending in axial direction of said cylindrical support; a first hydraulic conduit passing through said stationary piston rod and leading into said forward compartment within said bore; a second hydraulic conduit passing through said stationary piston rod and leading into said rearward compartment within said cylindrical bore; combined valve means connected to said hydraulic conduits so as to be adapted to connect each of the same either with a source of pressure fluid or an exhaust conduit for said fluid; locking means for holding said cylindrical support in operative position; hydraulic operating means for moving said locking means into operative locking position and holding said locking means in such operative position; a third hydraulic conduit connecting said first hydraulic conduit with said hydraulic operating means and

serving for moving said locking means; and spring means for moving said locking means into inoperative non-locking position when said hydraulic operating means are not operated by pressure fluid admitted through said third fluid conduit and are therefore, not moving said locking means into operative position and holding it in such position.

6. In a lathe tailstock in combination, a quill arrangement mounted within said tailstock slidably in axial direction; first hydraulic operating means for sliding said quill arrangement forward into operative position and backward into inoperative position; locking means for holding said quill arrangement in operative position; second hydraulic operating means for moving said locking means into operative locking position; and combined hydraulic actuating means for first actuating said first hydraulic operating means and thereby moving said locking means into operative locking position after said first hydraulic operating means have slid said quill arrangement forward into operative position.

7. In a lathe tailstock in combination, a quill arrangement mounted within said tailstock slidably in axial direction; first hydraulic operating means for sliding said quill arrangement forward into operative position and backward into inoperative position; locking means for holding said quill arrangement in operative position; second hydraulic operating means for moving said locking means into operative locking position; and spring means for moving said locking means into inoperative non-locking position when said second hydraulic operating means are not holding said locking means in operative position.

8. In a lathe tailstock in combination, a quill arrangement mounted within said tailstock slidably in axial direction; first hydraulic operating means for sliding said quill arrangement forward into operative position and backward into inoperative position; locking means for holding said quill arrangement in operative position; second hydraulic operating means for moving said locking means into operative locking position; spring means for moving said locking means into inoperative non-locking position when said second hydraulic operating means are not holding said locking means in operative position; and combined hydraulic actuating means for first actuating said first hydraulic operating means and then automatically actuating said second hydraulic operating means and thereby moving said locking means into operative locking position after said first hydraulic operating means have slid said quill arrangement into operative position.

9. In a lathe tailstock a tailstock body; a cylindrical support for a tailstock center mounted within said tailstock slidably in axial direction thereof; a cylindrical bore within the rear part of said cylindrical support extending in axial direction thereof; a stationary piston within said cylindrical bore forming within the same a forward and a rearward cylinder compartment; a cover secured to the rear face of said cylindrical support closing said cylindrical bore within the same; an aperture within said cover; a stationary piston rod passing through said aperture and secured at its front end to said stationary piston and at its rear end to said tailstock body extending in axial direction of said cylindrical support; a first hydraulic conduit passing through said stationary piston rod and leading into said forward compartment within said bore; a second hydraulic conduit passing through said stationary piston rod and leading into said rearward compartment within said cylindrical bore; combined valve means connected to said hydraulic conduits so as to be adapted to connect each of the same either with a source of pressure fluid or an exhaust conduit for said fluid; locking means for holding said cylindrical support in operative position; hydraulic operating means for moving said locking means into operative locking position and holding said locking means in such operative position; and a third hydraulic conduit connecting said first hydraulic conduit with said hydraulic operating means and serving for moving said locking means.

10. In a lathe tailstock a tailstock body; a cylindrical support for a tailstock center mounted within said tailstock slidably in axial direction thereof; a cylindrical bore within the rear part of said cylindrical support extending in axial direction thereof; a stationary piston within said cylindrical bore forming within the same a forward and a rearward cylinder compartment; a cover secured to the rear face of said cylindrical support closing said cylindrical bore within the same; an aperture within said cover; a stationary piston rod passing through said aperture and secured at its front end to said stationary piston and at its rear end to said tailstock body extending in axial direction of said cylindrical support; a first hydraulic conduit passing through said stationary piston rod and leading into said forward compartment within said bore; a second hydraulic conduit passing through said stationary piston rod and leading into said rearward compartment within said cylindrical bore; combined valve means connected to said hydraulic conduits so as to be adapted to connect each of the same either with a source of pressure fluid or an exhaust conduit for said fluid; locking means for holding said cylindrical support in operative position; hydraulic operating means for moving said locking means into operative locking position and holding said locking means in such operative position; a third hydraulic conduit connecting said first hydraulic conduit with said hydraulic operating means and serving for moving said locking means; and spring means for moving said locking means into inoperative non-locking position when said hydraulic operating means are not operated by pressure fluid admitted through said third fluid conduit and are therefore, not moving said locking means into operative position and holding it in such position.

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