Dec. 1, 1931. A. DRUMMOND 1,834,831

TAILSTOCK FOR LATHES AND LIKE MACHINERY

Filed June 17, 1929 2 Sheets-Sheet 1

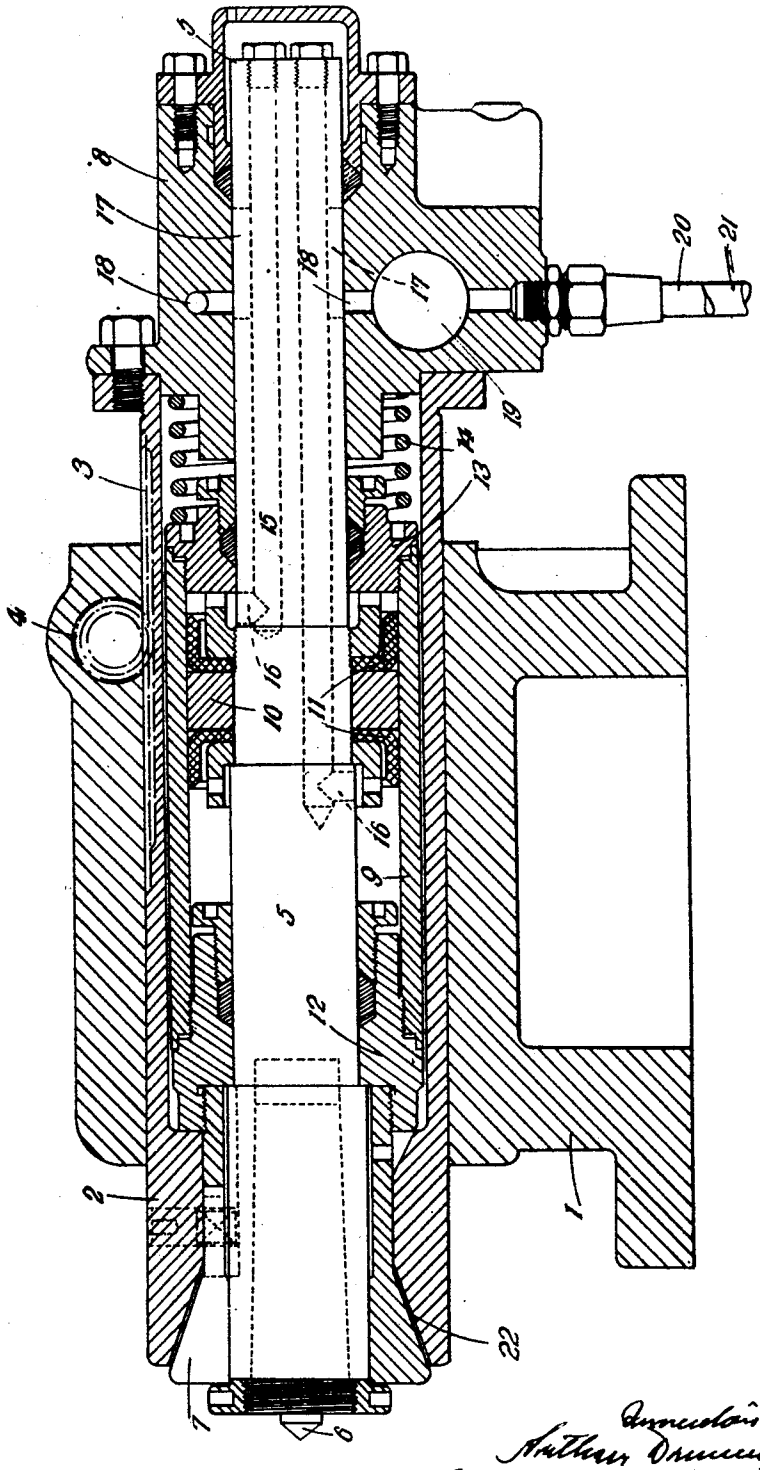

Fig. 1.

Inventor
Arthur Drummond
By Cushman, Darby & Cushman
Atty

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Fig. 2.

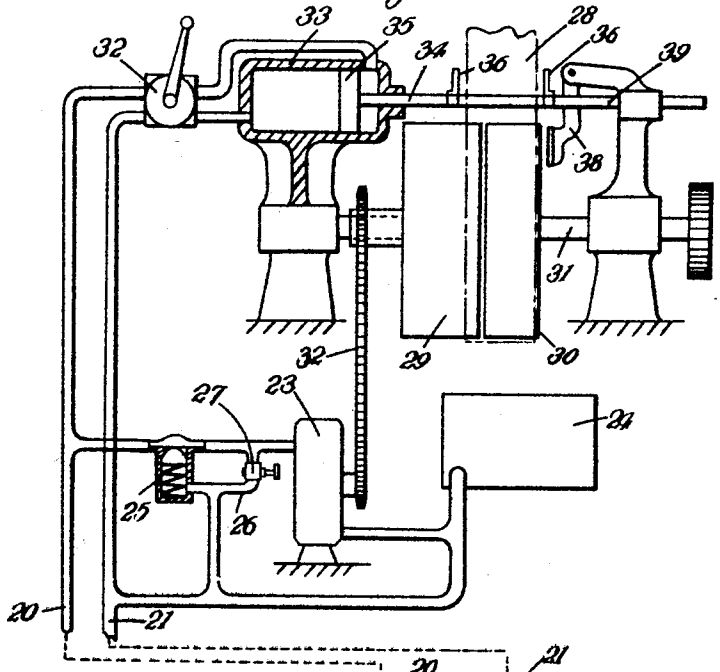
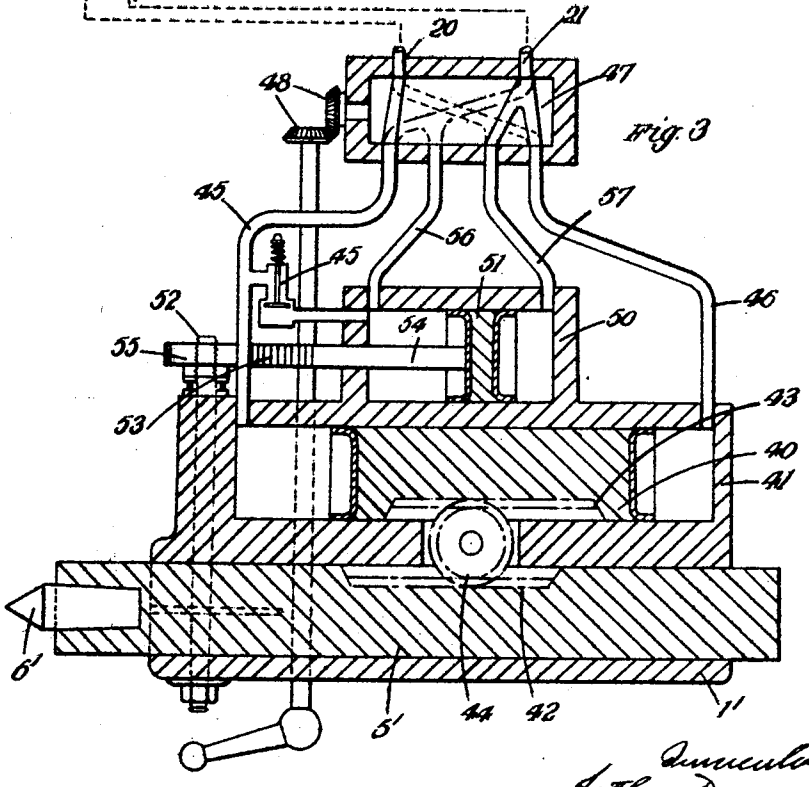


Fig. 3



Inventor
Arthur Drummond
By Cushman Darby & Cushman
Attys

Patented Dec. 1, 1931 1,834,831

UNITED STATES PATENT OFFICE

ARTHUR DRUMMOND, OF GUILDFORD, ENGLAND

TAILSTOCK FOR LATHES AND LIKE MACHINERY

Application filed June 17, 1929, Serial No. 371,663, and in Great Britain August 14, 1928.

This invention relates to tailstocks for lathes and like machinery such as grinders and milling machines (hereinafter referred to as lathes) and operating means therefor and is particularly applicable for use with metal working lathes adapted for mass production. In the ordinary form of lathe the time spent in setting up or removing the work in and from the lathe usually constitutes a small proportion of the time taken in the actual cutting operation which may occupy some hours. If, however, the lathe is adapted for mass production wherein, for example, the time taken in executing a similar cutting operation occupies some minutes only, the time taken up in setting and removing the work such as manipulating the hand wheel of the tailstock and the locking screw thereof assumes an important factor, and the present invention has for its chief object to reduce such time taken in effecting such necessary but non-productive operations.

According to the invention, in place of or in addition to manual operating mechanism of the barrel of the tailstock, hydraulic operating means therefor are provided whereby, by the manual operation of, for example, a control cock or cocks, the said barrel is moved under fluid pressure towards or away from the work and as soon as the centre of the barrel and the work are in pressing contact the said barrel is locked against further longitudinal movement in either direction by additional hydraulically controlled means. When the work has been completed further manipulation of the said control cock or cocks may be adapted to cause the barrel to be first unlocked and then retracted from the work thereby permitting the latter to be removed from the lathe. The pressure of the working fluid such as oil in order to effect such movements of the barrel is preferably produced by a pump, carried by the lathe, which may be constantly driven by the main drive of the lathe so that the tailstock can be operated when the lathe is at rest. According to one arrangement wherein the power is transmitted to the lathe by a belt that, in known manner, is adapted to be moved laterally of the rims of fast and loose pulleys mounted about a common axis, the belt or a portion thereof is maintained in constant engagement with the rim of the loose pulley irrespective of its position relatively to the fast pulley and the said loose pulley is adapted constantly to drive the pump of the hydraulic system. The building-up of the excessive pressure in the pipe lines for the working fluid is prevented by providing a relief valve which is arranged to permit the return of the working fluid to the sump when the pressure attains a predetermined value and in order to prevent a chattering or "water hammering" of the relief valve when it is caused to operate and which results in an intermittent or jerky movement of the part being moved as well as the liability of damage being caused to the lathe or to the system generally owing to the excessive and extensive vibrations so set up, a permanent "leak" or passageways may be provided between the suction and pressure sides of the pump so that at all times a portion of the working fluid is able to flow in a constant direction. The "leak" may be in the form of a by-pass around the relief valve and is preferably provided with a cock or tap for controlling the amount of fluid flowing through it.

In order that the said invention may be clearly understood and readily carried into effect the same will now be described more fully with reference to the accompanying drawings illustrating preferred embodiments of the invention, and in which:—

Figure 1 is a sectional elevation of one form of tailstock the main body of which is adapted to be fixed relatively to the lathe or other bed.

Figure 2 shows diagrammatically part of hydraulic operating means employed for effecting all the necessary movements of the tailstock, and,

Figure 3 is a diagrammatic sectional view of a further construction of tailstock.

Referring to Figure 1, 1 is the tailstock adapted to be fixed to the bed of a lathe and 2 a hollow cylindrical member positioned within the tailstock and capable of being adjusted longitudinally of the latter by means of a rack 3 and a pinion 4 which can be

manually actuated and the member locked in any desired position by a suitable clamping device (not shown). 5 is the barrel of the tailstock carrying a centre 6 and positioned concentrically within the member 2 by means of a clutch or clamping device 7, situated at the front end of the barrel, that is to say at the end thereof adjacent the work in the lathe, and by a bearing member 8 secured to the rear end of the member 2.

The hydraulic operating means whereby the barrel 5 can be moved relatively to the member 2 includes a cylinder 9 positioned about the barrel 5 and capable of axial movement within the member 2 and a double-acting piston 10 secured in a medial position to the barrel 5 and provided with cup washers 11 of leather or other suitable material in contact with the inner cylindrical surface of the cylinder 9. The cylinder 9 is provided with stuffing boxes 12 and 13 at its front and rear ends respectively the stuffing box 12 being in screwed engagement with the clutch or clamping device 7. A coil spring 14 is positioned between the inner face of the bearing member 8 and the stuffing box 13 so that the cylinder 9, together with the clutch or clamping device 7, is constantly urged in a direction towards the work. The barrel 5 is formed with two longitudinal passages 15 which communicate by means of transverse passages 16, with both sides of the piston 10 and, by means of slots 17 formed in the rear end of the barrel 5, with further passages 18 formed in the bearing member 8 and communicated with a multi-way or reversing cock 19 carried by the said bearing member 8. The cock 19 is in communication with a fluid pressure supply pipe 20 and a release or exhaust pipe 21 so that either end of the cylinder 9 can be subjected to the fluid pressure or can be connected directly to the release or exhaust pipe 21. The piston 10 may thus be forced towards either end of the cylinder 9 by actuation of the reversing cock 19 whereby the barrel 5 is moved towards or away from the work in the lathe.

The clutch or clamping device 7 consists of a split cone member or collet which engages with an appropriately tapered or coned surface 22 formed at the inner end of the cylindrical member 2 so that when the collet engages such tapered surface it is pressed inwardly to engage with and lock the barrel 5. Such movement of the collet is effected in the following manner:—When the end of the cylinder 9, remote from the work, is placed in communication with the fluid pressure supply, the piston 10 and the barrel 5 are forced forward until the centre 6 of the latter is in pressing contact with the work. As further forward movement of the barrel 5 is prevented, the fluid pressure causes a rearward movement of the cylinder 9 against the resilient pressure of the coil spring 14 thereby causing a retraction of the collet and its movement into locking contact with the barrel 5 so that further longitudinal movement of the latter in either direction is prevented. By actuation of the reversing cock 19 the fluid, under pressure can be admitted to the other side of the piston 10 whereupon the pressure of the spring 14 causes the forward longitudinal movement of the cylinder 9 with the consequent displacement of the collet 7 relatively to the surface 22 of the barrel 5 whereupon the piston 10 together with the barrel is moved away from the work thereby releasing the centre 6 from contact with the latter.

In Figure 2, 23 is the pump, for example a rotary gear pump, which supplies the fluid under pressure from the sump or reservoir 24 to the main pressure pipe 20 of the hydraulic operating means. The building-up of excessive pressure in the system is prevented by providing a relief valve 25 which is arranged to permit the return of the working fluid to the sump 24 when the pressure attains some predetermined value and in order to prevent the chattering or "water hammering" of the valve 24 when it is operated, as aforesaid, a "leak" is provided across the valve 25 in the form of a bye-pass 26 having a cock 27 for varying the amount of working fluid flowing through it so that at all times a portion of the working fluid is able to flow in a constant direction. The transmission of power to the lathe and to the pump from a prime mover (not shown) is effected by means of a belt 28 which can be laterally moved relatively to the rims of fast and loose pulleys 29 and 30 respectively mounted about a shaft 31 which constitutes the main drive shaft of the lathe itself. The width of the rim of the loose pulley 29 is substantially that of the belt 28 and is greater than the width of the rim of the fast pulley 30 so that irrespective of the position of the belt relatively to the fast pulley, the belt always overlaps and effects a constant rotation of the loose pulley which is adapted to drive the pump 23 by means of a chain 32 and sprocket wheels on the shaft of the pump 23 and on the boss of the loose pulley 29 or by any other suitable power transmission arrangement. A cylinder 33 in communication with the pipes 20, 21 is mounted adjacent the pulleys 29 and 30 and the rod 34 on a double-acting piston 35 within the cylinder 33 carrying arms 36 which are adapted when the rod 34 is moved, to displace the belt 28 laterally of the rims of the pulleys. By means of a reversing cock 37 the fluid pressure can be applied to either end of the cylinder 33 thereby causing its piston to move towards one of its extreme positions resulting in the belt being moved wholly over the loose pulley 29 or over the fast pulley 30 and an adjacent portion of the loose pulley. A braking device for the fast pulley is pro-

vided in the form of a pivoted lever 38 which is normally out of contact with the fast pulley and which is adapted, when the belt is moved wholly over the loose pulley, to be engaged by a pin or projection 39 on the rod 34 which presses the pivoted lever 38 positively against a part of the fast pulley.

In Figure 3, which illustrates a further construction of tailstock, the centre 6^1 of the barrel 5^1 is moved towards or away from the work by means of a double-acting piston 40 working within a hydraulic cylinder 41 and connected with the said barrel by rack teeth 42, 43 formed in the barrel and piston respectively and engaging a common pinion wheel 44. Both ends of the cylinder 41 are connected by means of pipe lines 45, 48 to the fluid pressure pipe 20 and the exhaust or release pipe 21 through the intermediary of a reversing cock or valve 47 which can be actuated by rotation of the bevel gears 48 by a lever 49. It will be appreciated therefore that, dependent upon which end of the cylinder 41 is subjected to the fluid pressure, the barrel 5^1 can be moved either towards or away from the work by manipulation of the lever 49.

If, for example, the barrel 5^1 is moved towards the work, the centre 6^1 thereof is forced against the work at a pressure dependent upon the pressure of the fluid and the diameter of the piston 40. At this stage, fluid pressure is built up momentarily in the pipe line 45 which effects the opening of a spring loaded valve 45^1 which admits the fluid into an additional cylinder 50 similarly provided with a double-acting piston 51, and the latter is thus moved towards one of its extreme positions and causes a lock or clamping screw 52 to be operated by means of a rack 53 which is formed in or carried by the rod 54 of the piston 51 and which engages a pinion 55 associated with the clamping screw; such operation effecting the locking of the barrel 5^1 in its engaging position with the work. Both ends of the cylinder 50 communicate with the reversing cock 47 by pipes 56, 57 so that, when it is desired to disengage the centre 6^1 from the work, the cock is manually operated causing the pressure end of the cylinder 50 to communicate with the exhaust or release pipe 21 and the other end thereof to communicate with the fluid pressure pipe 20 by the particular formation of passageways in the cock 47, shown in dotted and dot and dash lines. The piston 51 is thereby moved in the reverse direction causing, in a manner as aforesaid, the locking screw 52 to be again operated to release the barrel for movement by the reverse motion of the piston 40 in the cylinder 41 consequent upon the reversal of the connections of the pipes 45, 46 with the pressure in exhaust pipes 20, 21.

The cylinders 41 and 50 and their component parts may be conveniently housed within the hollow casting of the tailstock itself and it is preferred to place the actuating handles of the various reversing cocks in such positions that any one of them can be readily actuated by, for example, the arm or elbow of the operator so that both hands of the latter are free to effect the setting up or removal of the work, or if desired any one or more of the said actuating handles may be extended downwardly or one or more of the said cocks may be so positioned that actuation thereof can be effected by the foot of the operator. The hydraulic power produced by the pump 23 may be in excess of that required to actuate the tailstock and to control the rotation of the main driving shaft 31 and such excess power may be utilized in any desired manner, such as for example, in effecting the movements of the cutting tools of the lathe.

What I claim and desire to secure by Letters Patent of the United States is:—

1. Mechanism for operating a tailstock for lathes and other machine tools comprising a barrel in said tailstock, manually controlled hydraulically operated means for moving said barrel towards or away from the work in the machine tool, additional hydraulically operated locking means for preventing further longitudinal movement of the barrel in either direction when the said barrel is in pressing contact with the work, a sump containing working fluid, a pump for supplying the working fluid under pressure from the sump to the said hydraulically operated means, a power drive for said machine tool and means associated with the said power drive for constantly driving the said pump.

2. Mechanism for operating a tailstock for lathes and other machine tools comprising a barrel in said tailstock, manually controlled hydraulically operated means for moving said barrel towards or away from the work in the machine tool, additional hydraulically operated locking means for preventing further longitudinal movement of the barrel in either direction when the said barrel is in pressing contact with the work, a sump containing working fluid, a pump for supplying the working fluid under pressure from the sump to the said hydraulically operated means, a counter-shaft, a fast pulley secured to said counter-shaft, a loose pulley mounted on the shaft adjacent the fast pulley, a power transmission belt constantly in engagement with the said loose pulley and means associated with the said loose pulley for driving the pump.

3. Mechanism for operating a tailstock for lathes and other machine tools comprising a barrel in said tailstock, manually controlled hydraulically operated means for moving said barrel towards or away from the work in the machine tool, additional hydraulically operated locking means for preventing fur-

ther longitudinally movement of the barrel in either direction when the said barrel is in pressing contact with the work, a sump containing the working fluid, a pump for supplying the working fluid under pressure from the sump to the said hydraulically operated means, a counter-shaft, a fast pulley secured to said counter-shaft, a loose pulley mounted on the counter-shaft adjacent the fast pulley, a power transmission belt constantly in engagement with the said loose pulley, a hydraulically operated device for moving the belt laterally across the rims of the fast and loose pulleys, and means for driving the pump associated with the said loose pulley.

4. Mechanism for operating a tailstock for lathes and other machine tools comprising a barrel in said tailstock, manually controlled hydraulically operated means for moving said barrel towards or away from the work in the machine tool, additional hydraulically operated locking means for preventing further longitudinal movement of the barrel in either direction when the said barrel is in pressing contact with the work, a sump containing working fluid, a pump for supplying the working fluid under pressure from the sump to the said hydraulically operated means, a relief valve to return the working fluid from the pump to the said sump, a counter-shaft, a fast pulley secured to said counter-shaft, a loose pulley mounted on the counter-shaft adjacent the fast pulley, a power transmission belt constantly in engagement with the said loose pulley, a hydraulically operated device for moving the belt laterally across the rims of the fast and loose pulleys, and means associated with the said loose pulley for driving the pump.

5. Mechanism for operating a tailstock for lathes and other machine tools comprising a barrel in said tailstock, manually controlled hydraulically operated means for moving said barrel towards or away from the work in the machine tool, additional hydraulically operated locking means for preventing further longitudinal movement of the barrel in either direction when the said barrel is in pressing contact with the work, a sump containing working fluid, a pump for supplying the working fluid under pressure from the sump to the said hydraulically operated means, a relief valve to return the working fluid from the pump to the said sump, a by-pass positioned between the suction and pressure sides of the pump, a counter-shaft, a fast pulley secured to said counter-shaft, a loose pulley mounted on the counter-shaft adjacent the fast pulley, a power transmission belt constantly in engagement with the said loose pulley, a hydraulically operated device for moving the belt laterally across the rims of the fast and loose pulleys, and means for driving the pump associated with the said loose pulley.

6. Mechanism for operating a tailstock for lathes and other machine tools comprising a barrel in said tailstock, manually controlled hydraulically operated means for moving said barrel towards or away from the work in the machine tool, additional hydraulically operated locking means for preventing further longitudinal movement of the barrel in either direction when the said barrel is in pressing contact with the work, a sump containing working fluid, a pump for supplying the working fluid under pressure from the sump to the said hydraulically operated means, a relief valve to return the working fluid from the pump to the said sump, a by-pass positioned between the suction and pressure sides of the pump and means for controlling the amount of working fluid passing through said by-pass, a power drive for said machine tool and means associated with said power drive for constantly driving the said pump.

7. A tailstock for lathes and other machine tools comprising a member longitudinally adjustable within said tailstock, a clamping device positioned at the front end of said member, a bearing element secured to the rear end of said member, a barrel slidably mounted in said clamping device and said bearing element, a cylinder positioned about said barrel and secured to said clamping device, a piston carried by said barrel and positioned within the cylinder, a spring inserted between the rear end of the cylinder and the said bearing element and manually controlled means for admitting fluid under pressure to either end of the cylinder.

8. A tailstock for lathes and other machine tools comprising a member longitudinally adjustable within said tailstock, a part-conical surface formed at the front end of the adjustable member, a collet adapted to engage said surface and positioned at the front end of said member, a bearing element secured to the rear end of said member, a barrel slidably mounted in said collet and said bearing element, a cylinder positioned about said barrel and secured to said collet, a piston carried by said barrel and positioned within the cylinder, a spring inserted between the rear end of the cylinder and the said bearing element and manually controlled means for admitting fluid under pressure to either end of the cylinder.

9. A tailstock for lathes and other machine tools comprising a member longitudinally adjustable within said tailstock, a clamping device positioned at the front end of said member, a bearing element secured to the rear end of said member, a barrel slidably mounted in said clamping device and said bearing element, a cylinder positioned about said barrel and secured to said clamping device, a piston carried by said barrel and positioned within the cylinder, a spring

inserted between the rear end of the cylinder and the said bearing element, a manually operated reversing cock, a fluid pressure pipe communicating with said cock, an exhaust pipe communicating with said cock and passageways communicating between said cock and both ends of the said cylinder, and manually controlled means for admitting fluid under pressure to either end of the cylinder.

10. A tailstock for lathes and other machine tools comprising a center holder, locking means for locking said centre holder against longitudinal movement, a cylinder the end walls of which are capable of longitudinal movement, in opposite directions and one of which walls is connected to said holder and the other to means for operating said locking means, yielding means tending to maintain said locking means inoperative, and means for supplying fluid under pressure to said cylinder between said end walls.

11. A tailstock for lathes and other machine tools comprising a centre holder, a cylinder having end walls, a piston located within said cylinder and connected to said holder, locking means for locking said holder against longitudinal movement connected to said cylinder and operable thereby, yielding means normally to maintain said cylinder from movement in the direction away from the work, and hand controlled means for supplying fluid pressure to said cylinder on either side of said piston.

12. A tailstock for lathes and other machine tools comprising a member longitudinally adjustable within said tailstock, a barrel, a centre carried by said barrel, means for positioning the barrel concentrically within said member consisting of a clamping device positioned at the front end of said member and a bearing element secured to the rear end of said member, manually controlled hydraulically operated means for moving said barrel towards or away from the work in the machine tool and additional hydraulically operated locking means for preventing further longitudinal movement of the barrel in either direction when the centre is in pressing contact with the work, the first mentioned hydraulically operated means including a cylinder positioned about the barrel and adapted to be moved within the adjustable member and a double acting piston secured to the barrel and positioned within the cylinder.

13. A tailstock for lathes and other machine tools comprising a centre holder, a movable member connected to said holder, locking means for locking said holder against longitudinal movement, a movable member connected to said locking means, a fluid pressure supply arranged for operating both said members, and means to prevent operation of the locking means until the first mentioned member has been moved by the fluid pressure to bring the centre into contact with the work whereafter the fluid pressure operates the second mentioned member to move said locking means into the locking position.

14. A tailstock for lathes and other machine tools comprising a centre holder, a cylinder, a piston in said cylinder and connected to said holder, locking means for locking said holder against longitudinal movement, a second cylinder, a piston in said second cylinder connected with said locking means, a fluid pressure supply conduit connected with both cylinders, and a pressure operated valve adapted to prevent entrance of fluid pressure to the second cylinder.

15. A tailstock for lathes and other machine tools comprising a centre holder, means to move said holder into contact with the work, means to lock the holder against longitudinal movement when the centre is in contact with the work, and hydraulically operating means which when put in operation act automatically first to unlock said means and then to move said holder away from the work.

16. A tailstock for lathes and other machine tools comprising a center holder, hydraulically operated means for moving said holder towards the work, locking means for locking said holder against longitudinal movement, a spring normally preventing operation of said locking means, and a hand controlled device for supplying fluid pressure to both said means.

17. A tailstock for lathes and other machine tools comprising a center holder, hydraulically operating means including a piston device for moving said holder towards the work, other hydraulicaly operated means including a second piston device for locking the holder against longitudinal movement, yielding means tending to prevent operation of the locking means, and a hand controlled valve for supplying fluid to both said piston devices.

18. A tailstock for lathes and other machine tools comprising a center holder, means to move the holder towards the work, a clamping device for preventing longitudinal movement of the holder, means to operate said device, a spring tending to prevent operation of the clamping device, a hydraulic arrangement for operating both said means including fluid pressure communication between said means, the arrangement being such that the fluid pressure operates between said means first in one direction to actuate the means for moving the holder into engagement with the work whereafter the pressure acts in the opposite direction to overcome the resistance of the spring and operate the locking means.

ARTHUR DRUMMOND.