Sept. 8, 1953

H. M. OLSON

2,651,207

DRAWBAR ACTUATING POWER AMPLIFYING APPARATUS

Filed July 10, 1950

2 Sheets-Sheet 1

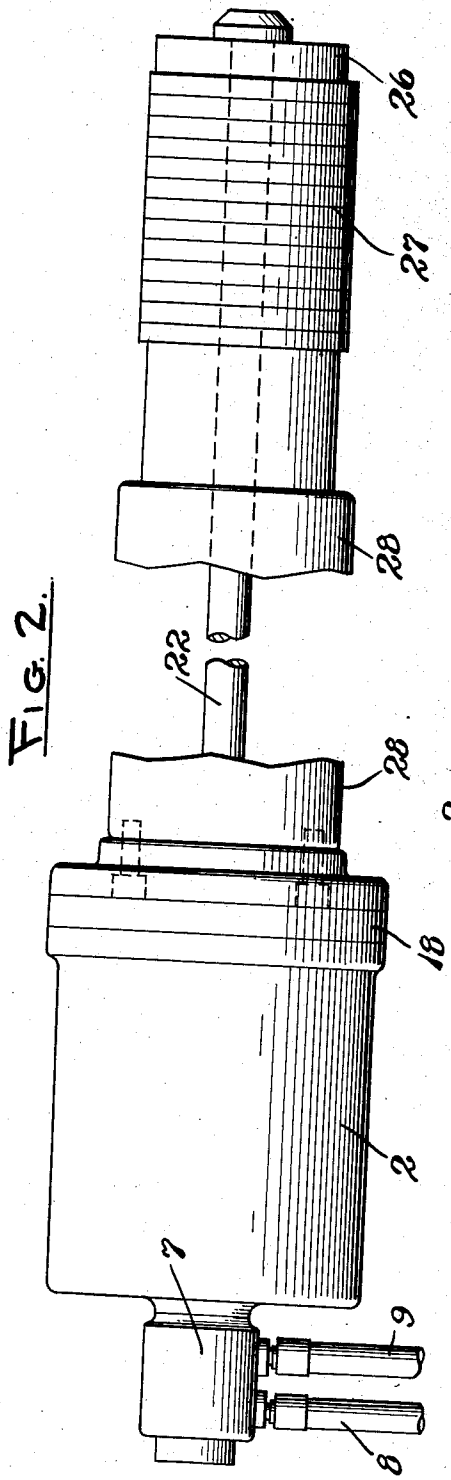

FIG. 2.

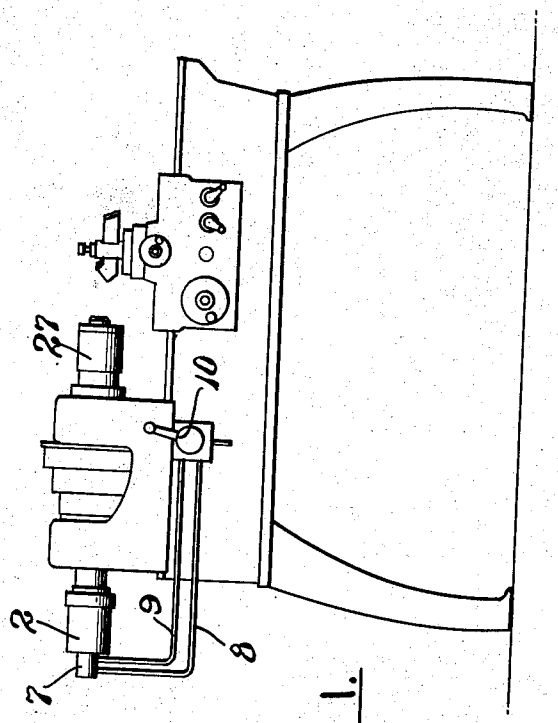

FIG. 1.

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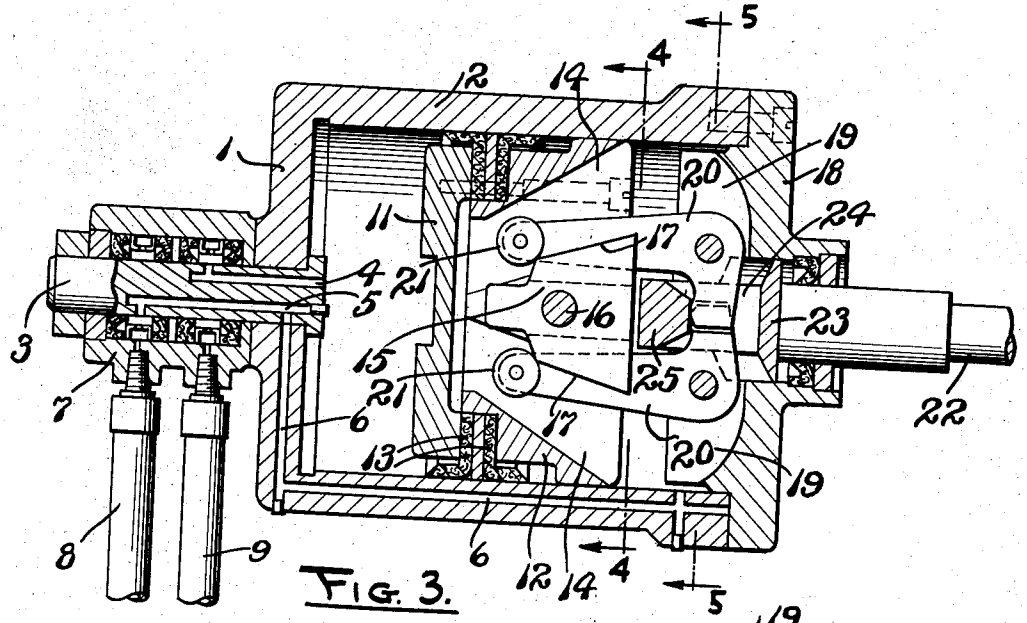


FIG. 3.

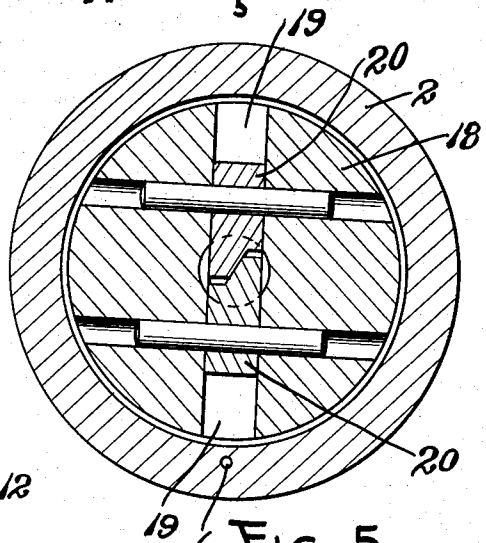
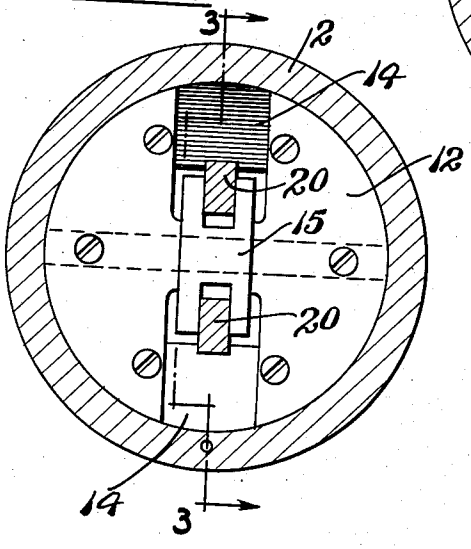


FIG. 5.

FIG. 4.



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Patented Sept. 8, 1953

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UNITED STATES PATENT OFFICE

2,651,207

DRAWBAR ACTUATING POWER AMPLIFYING APPARATUS

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3 Claims. (Cl. 74—110)

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The present invention relates to a power amplifying unit, including a cylinder, a piston therein movable by fluid pressure in opposite directions in the cylinder, and a draw bar operatively associated with the piston and extending through one end of the cylinder, between which draw bar and the piston a very simple, practical and novel means for multiplying the force of pull of the draw bar is accomplished, upon the principle of a wedge or inclined plane, which is also the principle of the screw, so that while the piston moves a distance in the cylinder, the draw bar moves a fractional part of such distance, with the result of greatly increasing the force which the draw bar applies to hold an article or series of articles clamped securely in position for machining.

My invention has been used, primarily, in the outside finishing of piston rings, but may also be used in many other machinings, such as cylinders, or the like, the work, namely, the piston rings or the cylinders, rotating at high speed, being clamped releasably in the use of my invention against slipping or other undesired movement, the clamping and release taking place substantially instantaneously. With my invention a perfect balance, free from vibration at all speeds, is obtained, the amount of consumption of compressed air or other fluid pressure is at a minimum, clamping and release is accomplished instantly, the structure is simple and relatively inexpensive to produce, backlash or lost motion is eliminated, the inertia factor is very low, and a clamping action is developed in which the power approaches that of a screw and a nut tightened by a wrench, which means of clamping articles, like piston rings, cylinders and the like which are to be outside turned, ground or otherwise finished, has previously been used in a large measure.

An understanding of the invention may be had from the following description, taken in connection with the accompanying drawings, in which

Fig. 1 illustrates a turning lathe having my invention applied thereto.

Fig. 2 is a fragmentary enlarged elevation illustrative of the clamping mechanism, fluid operated and in which the clamping power is multiplied, showing a series of piston rings clamped in position to be machine finished at their outer curved surfaces.

Fig. 3 is a longitudinal vertical section through the apparatus embodying my invention, substantially on the plane of line 3—3 of Fig. 4, and

Figs. 4 and 5 are transverse vertical sections, substantially on the planes of lines 4—4 and 5—5 respectively of Fig. 3, looking in the direction indicated.

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Like reference characters refer to like parts in the different figures of the drawings.

In the structure illustrated (Fig. 3), a cylinder has an end 1 integral with walls 2 extending therefrom. Through the end 1 of the cylinder a rod 3, having an enlarged head within the cylinder extends. The rod has two longitudinal passages, 4 and 5 less in length than the length of the rod at its other end leads to the outside of rod 3. The passage 5 has an end leading to the cylinder, such end being closed or plugged, is longer than the passage 4, and likewise leads to the outside of rod 3, so that the two openings at the outer side of the rod 3 are spaced from each other. A passage 6 through the end 1 of a cylinder and a side 2 thereof leads to the open end of the cylinder and has a branch leading into the cylinder near such open end, it being understood that a piston structure is located between the fluid pressure inlet of air through the passage 4 into one end of the cylinder, and the inlet at the passage 6 into the other end of the cylinder.

A housing 7 is located around the rod 3 and has compressed air or other fluid pressure conduits 8 and 9 connected thereto, suitable packing and rings being disposed within the housing to provide grooves around the rod 3 so that air can be entered selectively into either end of the cylinder. Such conduits 8 and 9 lead to a control valve 10 (Fig. 1), conveniently located for the lathe operator to reverse the flow of compressed air, and thus reverse the direction of movement of the piston, hereafter described, within the cylinder.

A piston is mounted within the cylinder having a part 11 of generally circular form, between which and a heavier part 12, cup levers 13, reversed with respect to each other, are clamped, screws being used to fasten the parts together. Toward the open end of the cylinder, the member 12 is slotted diametrically as at 14. Centrally of the piston part 12 and between the opposite inclined sides of the slots 14 a member 15 is located, being mounted for rocking movement on a heavy pin 16 extending through it and through the piston part 12. The member 15 has opposed sides 17 which diverge from each other toward the open end of the cylinder and, as shown, are shorter than the length of the member 15 with somewhat abrupt shoulders at the inner ends of said sides.

The open end of the cylinder is closed by a heavy closure head 18, fastened by cap screws, which has a part projecting into the cylinder in which opposed slots 19 are cut across a diameter of the head. A bell crank lever 20 is pivotally

mounted at each of the slots 19. One arm of the bell crank lever extends into each of the slots 14 and opposed slots in wedge member 15 and at its free end is provided with a pair of rollers 21. Such rollers may ride upon the inclined sides or edges 17 of the wedging member 15. The other arms of the bell crank lever extend toward each other and slightly overlap substantially at the center of the cylinder (Fig. 5).

A draw bar 22 passes through the head 18 and at its inner end is formed with a yoke, having an outer head 23, spaced apart sides 24 and an inner cross head 25 against the outer side of which the ends of last mentioned arms of the bell crank levers bear.

It is apparent that when compressed air or other equivalent fluid pressure flows through the conduit 8 and passages 5 and 6 the piston will be moved to the left (Fig. 3). The rollers 21 will ride upon the diverging sides or edges of the wedging member 15, swinging the horizontal and longer arms of the bell crank levers 20 away from each other, and moving the short arms against the head 25 so as to move the draw bar 22 lengthwise to the left. On reverse flow of the pressure fluid through the conduit 9, and thence through the passage 4, the piston will be moved in the opposite direction and the cross head 25 will be pressed against by the outer end of the wedging member 15 to positively move the draw bar 22 longitudinally in the opposite direction.

The power amplifying cylinder apparatus may be used as an accessory to a turning lathe, as shown in Fig. 1, being mounted at the outer end of the head stock spindle with the draw bar passing through such spindle, which will be hollow, and have an axial opening therethrough for such passage. At the outer end of the draw bar, which will have a head at such end, a collar 26 is used to press against the outermost of a plurality or series of piston rings 27 and clamp them against the hollow spindle 28 upon the longitudinal movement of the draw bar 22 to the left.

The distance that the draw bar is moved longitudinally is short. Initially upon the rollers 22 passing over the shoulders at the inner ends of the inclined sides 17 of the wedging member 15, there will be a greater rapidity of movement of the draw bar than after the rollers reach such inclined sides 17. This causes the collar 26 to quickly come against the outermost piston ring 27 and, thereafter, the movement will be slower until collar 26 can be moved no farther but will be subjected to static fluid pressure between the head 18 and the piston. Under such conditions the piston rings 27 are held securely clamped until a reversal of the flow of the pressure fluid, by operation of the manually controlled valve 10, takes place.

While the invention has been shown as used in conjunction with clamping a plurality of pistogether during outside machining operation ton rings to maintain them securely clamped thereon, it is apparent that many other articles such as cylinders or forms of cylindrical outline may be clamped for machining in the same manner.

With the present invention the bell crank levers are synchronized in their movements, the wedging member 15 having a rocking mounting upon the pin 16, so that the wedging member is floatingly mounted and automatically conforms to the rollers on the bell crank levers to operate them simultaneously and in equal amounts. The power is applied evenly to each fulcrum of the

bell crank levers and insures against any tendency of the piston to cant or tilt in the cylinder. It is of course apparent that the inclined surfaces of the wedge member 15 may be varied to increase or decrease the power mutliplication and, as shown, the shoulders provided by cutting away the inner end corners of the wedging member at opposite sides provides for a more rapid movement of the bell crank levers at the beginning of a clamping stroke.

The structure described is one which may take the place of a direct acting piston and cylinder clamping means, with a very great reduction in the size of the cylinder and its weight. The clamping force which may be applied with a cylinder approximately four inches in diameter will equal that of a direct acting piston cylinder apparatus of three to four times such diameter. The inertia of the moving parts is small so that rapid starting and stopping is attained with instant clamping and instant release. The structure embodying the invention is simple, practical, very sturdy and dependable. The cylinder rotates with the lathe spindle while the air supplying housing 7 is stationary. Vibration at all speeds is substantially non-existent. The consumption of compressed air is reduced to a minimum.

The invention is defined in the appended claims and is to be considered comprehensive of all forms of structure coming within their scope.

I claim:

1. Apparatus comprising, a fixed support, a draw bar slidably passing through the support, a yoke connected to the draw bar at an end thereof, a second support, means for mounting the second support for movements in opposite directions toward and away from the yoke, a wedging member having oppositely inclined sides diverging from each other toward the fixed support, said yoke being positioned between the wedging member and said fixed support, bell crank levers pivotally mounted on the fixed support at opposite inclined sides of the wedging member, engaging each at one end with the adjacent inclined side of said wedging member, and having arms at their opposite ends extending toward each other, said yoke having a head transverse to the length of the draw bar with which said arms engage, and means for mounting said wedging member on the movable second support for rocking movement about an axis perpendicular to the longitudinal axis of the draw bar.

2. Apparatus comprising, a fixed support, a draw bar slidably passing through the support, a yoke connected to the draw bar at an end thereof, a second support, means for mounting the second support for movements in opposite directions toward and away from the yoke, a wedging member having oppositely inclined sides diverging from each other toward the fixed support, said yoke being positioned between the wedging member and the fixed support, bell crank levers pivotally mounted on the fixed support at opposite inclined sides of the wedging member, a roller on each of said bell crank levers, at the ends of one of the arms thereof engaging the wedging member, said wedging member at the end thereof toward which its inclined sides converge having recesses at opposite sides, said rollers being received in said recess when in conjunction therewith, the other arms of said bell crank levers extending toward each other, said yoke having a head transverse to the draw bar with which said last mentioned arms engage, and means for mounting said wedg-

ing member on the movable second support for rocking movement about an axis perpendicular to the longitudinal axis of the draw bar.

3. Apparatus comprising, a fixed support, a draw bar slidably passing through an end of the fixed support, a yoke connected to the draw bar adjacent said end of the fixed support comprising, spaced sides extending away from the draw bar and a transverse cross head connecting the sides, with an opening between the cross head and the adjacent end of the draw bar, a second support movably mounted on the fixed support for movement toward and away from said end of the fixed support in a direction parallel to the length of the draw bar, two bell crank levers pivotally mounted on the fixed support at opposite sides of and spaced from the longitudinal axis of the draw bar, each having one arm extending into the yoke opening and engaging said cross head and each having a second arm generally parallel to the length of the draw bar, a wedging member mounted on and carried by the movable second support having opposed inclined sides diverging toward said end of the fixed support, said wedging member at inclined opposite sides thereof having slots in which said second mentioned arms of the bell crank levers are received, and a roller on the free end of each of the generally horizontal arms of said bell crank levers for bearing against adjacent inclined sides of the wedging members.

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