

Feb. 3, 1959

J. R. COX ET AL

2,872,199

ADJUSTABLY TENSIONED PUSHER

Filed Sept. 10, 1957

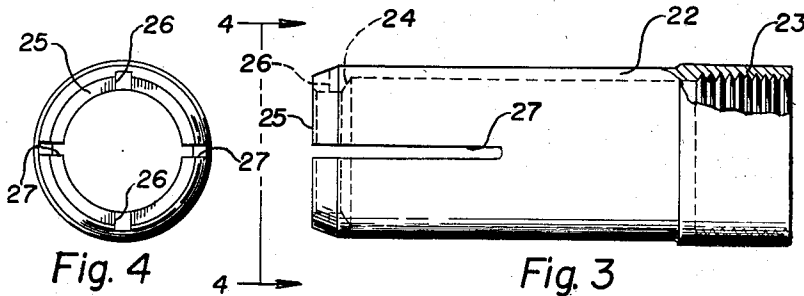
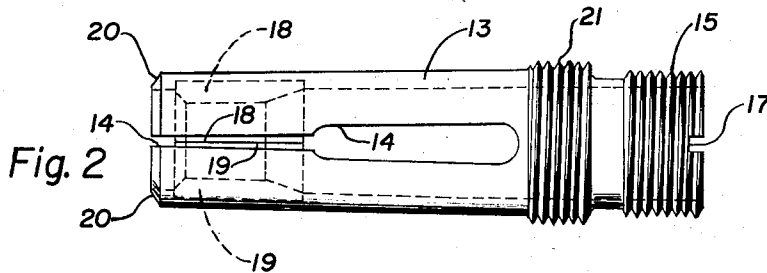
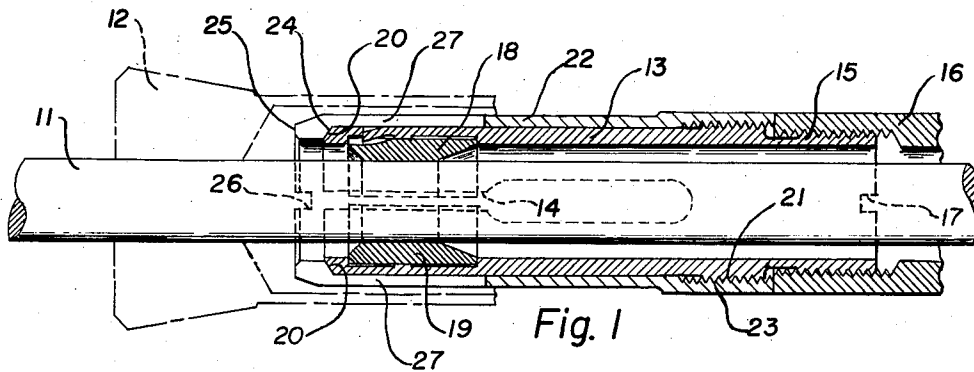


Fig. 4

Fig. 3

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## ADJUSTABLY TENSIONED PUSHER

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Application September 10, 1957, Serial No. 683,065

8 Claims. (Cl. 279—47)

Our invention relates to pushers or feeders for advancing stock in a machine tool, such as an automatic screw machine.

An object of our invention is to provide an improved pusher device having novel means for adjusting the grip of the pusher upon the stock being advanced.

Another object is the provision of novel means for varying the grip of the pads of a pusher to meet operating requirements.

Another object is a novel provision for obtaining the amount of grip of a pusher upon stock being advanced by the pusher to a fine degree not otherwise obtainable.

Another object is the provision for obtaining in a novel and highly useful manner the precise amount of tension upon stock by a pusher advancing the stock.

Another object is the provision for obtaining desired results by a new and useful construction.

Other objects and a fuller understanding of our invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a longitudinal sectional view of a form of our device showing the device gripping a piece of round stock;

Figure 2 is a side elevational view of the internal tubular member of our device;

Figure 3 is a side elevational view of the external tubular member or shell of our device removed from the internal tubular member; and

Figure 4 is an endwise view looking in the direction of the arrows 4—4 of Figure 3.

In Figure 1, we show our device in assembled condition gripping a piece of cylindrical stock 11 which extends along the axis of our device. Our pusher device may be used for advancing the stock 11 in increments to a collet 12 shown in broken lines. Upon each reciprocal movement of our pusher device, the stock 11 is moving into the collet 12 while it is in an open or relaxed position and after the collet 12 seizes or grips the stock, then the pusher device slides back along the stock 11 to a withdrawn position where it again grips the stock ready for an advancing movement. Because the pusher must alternately hold the stock 11 firmly enough to advance it, and then be able to slide along the stock to a withdrawn position when the stock is held by the collet, the pusher device should have a fine degree of tension in order to obtain just the precise amount of required grip on the stock. This grip must be such as to firmly hold and push the stock when necessary and also be able to slide along the stock in the rearward movement of the pusher when the stock is firmly held by the collet. Our invention provides means for obtaining this fine degree of tension and the required amount of grip on the stock.

Our device incorporates in general two tubular members mounted concentric to each other and having a common axis along which the stock is disposed. The inner tubular member 13, preferably made of suitable heat-

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treated steel, is split to have forwardly extending fingers. In the form of the invention illustrated, there are two opposed slots 14 which separate two opposed fingers which extend forwardly from a rear annular portion. The fingers of the inner member 13 are heat-treated so as to be resilient and at the same time have the required degree of strength.

Adjacent the forward end of the inner member 13 and facing the bore thereof are a pair of arcuate pads 18 and 19 disposed to engage and grip the stock 11 extending through the pusher device. The resilient fingers of the inner member 13 are biased toward each other sufficiently to urge the pads 18 and 19 toward each other when there is no stock between the pads so that the pads 18 and 19 are held in the position shown in Figure 2. However, this bias is readily overcome so that the fingers may be spread apart and the pads 18 and 19 separated by the insertion of the stock 11 into the pusher, such as shown in Figure 1. It is to be noted that in Figure 1 the fingers and the pads 18 and 19 are spread farther apart than in Figure 2 by reason of the presence of the stock 11 between the pads 18 and 19. However, this inwardly directed bias of the fingers of the member 13 alone, as in Figure 2, is obtained only by the setting and heat-treating of the fingers. As is known, such a bias is not exact and it is difficult to predeterminedly fix and maintain the exact degree required to obtain the precise amount of grip on the stock during operation of the pusher device. Therefore, in our improved device there is only sufficient inward bias on the fingers to hold the pads in the position shown in Figure 2, but we do not depend upon this bias set in the fingers during manufacture of the inner member 13 for obtaining the required degree of grip upon the stock 11.

At the rearwardmost end of the inner member 13, there is a threaded portion 15 which is threadably engaged to a support 16. This support 16 carries the pusher device and reciprocates it along its axis during the operation of the pusher device. A transverse notch 17 is provided in the rearward annular wall of the inner member 13, this notch 17 being provided for accommodating a cross-piece when it is desired to turn the inner member 13. In short, the notch 17 provides a surface for wrenching of the inner member 13.

The forward end of the inner member 13 has a chamfered surface 20 extending therearound. This chamfered surface 20 provides a camming surface in the operation of our device. The angular disposition of this surface 20 is at an angle to the axis of the device of more than 45 degrees and preferably is at an angle in the range of 60 degrees to the axis of the device. Stated otherwise, the angle of the surface 20 is less than 45 degrees to a transverse plane normal to the axis of the device and most preferably is in the range of about 30 degrees to such a transverse plane. This camming surface is annular in form as it extends around the forward wall of the tubular member 13, being interrupted by the opposite slots 14.

There is a second threaded portion 21 disposed on the rear annular portion of the inner member 13. This threaded portion 21 has a somewhat larger diameter than the threaded portion 14 and is positioned in advance of the threaded portion 15. The threading of the threaded portion 21 is similar to the threading of the threaded portion 15. For example, in the illustration shown, the threaded portion 15 has a left-hand thread and the threaded portion 21 has a left-hand thread.

Our device includes a second tubular member or shell 22 which is concentrically mounted around the inner member 13. The outer tubular member 22 has a rearward threaded end portion 23 which is adapted to threadably engage the threaded portion 21 of the inner member

13. As shown in Figure 1, the interengagement of the threaded portions 21 and 23 of the respective tubular members secures the outer tubular member 22 to the inner tubular member 13.

Adjacent the forward end of the outer member or shell 22 and extending therearound is an inner shoulder 24. This shoulder 24 is directed toward the rear of the outer member 22 and is in alignment with the camming surface 20 of the inner tubular member 12. Preferably, the angular disposition of the shoulder 24 relative to the axis of the device is such as to complement the angular disposition of the camming surface 20, as for example, shown in Figure 1. The forward end 25 of the outer member 22 has transverse notches 26 formed therein, the notches 26 being adapted to accommodate a cross-piece for the wrenching or turning of the outer member 22.

Formed in the wall of the outer tubular member 22 and extending from the forward end 25 thereof are two slots 27. These slots 27 are on opposite sides of the member 22 and through the cylindrical wall thereof. As seen in the drawing, the slots 27 extend rearwardly from the forward end 25 a substantial distance rearwardly of the inner shoulder 24 adjacent the forward end of the member 22. The slots 27 as illustrated in the drawing extend to a point rearwardly of the location of the pads 18 and 19. Other numbers of slots 27 may be incorporated in the member 22 but preferably one or two slots 27 are utilized.

This outer tubular member 22, is made of suitable steel and is heat-treated so that the tubular member 22 at the forward end thereof, and particularly the portion radially inward from the slots 27, is resiliently distortable. In effect, the heat-treated steel of the member 22 provides that the portions of the member 22 at the forward end and on opposite sides of the slots 27 are resilient fingers. The resiliency of the forward end of the member 22 is such that it is biased to the unrestrained position shown in Figure 3. Upon the forward end of the member 22 being forcibly spread apart to widen the slots 27, then the resiliency of the member 22 is such as to provide a radially inwardly directed force toward the axis of the member 22. The force of this resilient bias is dependent upon the degree to which the forward end of the member 22 is forcibly spaced apart to spread the slots 27. As seen in Figure 4, the forward end of the member 22 is in substantially two semi-cylindrical portions. The resiliency of these portions is such that they resiliently resist expansion to a larger diameter and thus resiliently tend to contract upon being forcibly spread apart. This resilient force is radial in direction and also somewhat circumferential as the arcuate parts upon being distorted and spread apart attempt to assume the arcuate unrestrained form shown in Figures 3 and 4.

Upon the mounting of the outer tubular member 22 to the inner tubular member 13 so as to be concentrically disposed in the relationship shown in Figure 1, the shoulder 24 is in longitudinal alignment with the camming surface 20. By forcibly turning the outer tubular member 22 relative to the inner tubular member 13, such as by using cross-pieces in the respective notches 17 and 26, the threaded interengagement of the threaded portions 21 and 23 of the respective members may be varied. By forcibly turning the tubular members relative to each other so as to move the threaded portion 23 rearwardly, that is, toward the rearward end of the tubular member 13, a longitudinal tension is applied to the outer tubular member 22 by reason of the abutment of the shoulder 24 on the camming surface 20. The resiliency of the forward slotted portion of the tubular member 22 is such as to yield to this longitudinal movement and to resiliently spread apart the forward arcuate portions of the member 22. The reaction of these resilient forward portions is such as to also press radially inward upon the resilient fingers of the inner member 13. This reaction of the forward resilient portion of the member 22

is in proportion to the longitudinal tension or stress provided by the interengagement of the threaded portions 21 and 23, that is, by the pressure of the shoulder 24 upon the camming surface 20. In this manner, a resilient force is applied externally of the fingers of the inner tubular member urging them inwardly against a piece of stock, such as the stock 11. This external resilient action provided by the outer member 22 is adjustably determined by adjusting the threaded interengagement of the threaded portions 21 and 23. A fine degree of tension on the stock 11 by the pads 18 and 19 may thus be obtained, this tension being yieldable and at the same time being adjustably determinable. It is to be noted that there is in addition to the resiliency of the fingers of the inner member, the variable and adjustably determinable tension applied to those fingers by the outer member 22. As is apparent, radial inward pressure on the camming surface 20 by the shoulder 24 by reason of the resilient urging of the forward end of the member 22 is such as to resiliently urge the fingers of the inner member 13 radially inward.

A fine degree of adjustment of the grip on the stock 11 may be obtained by turning the members 13 and 22 relative to each other so as to vary the described threaded engagement of the complementary threaded portions 21 and 23. A relatively small amount of turning of the outer member 22 relative to the inner member 13 will provide a change to the desired required degree in the inwardly directed force of the pads 18 and 19 against the stock 11. The tension of the shoulder 24 against the camming surface 20 is maintained substantially constant and yet is resiliently yieldable by reason of the resiliency of the forward slotted portion of the outer member 22. The resiliency of the heat-treated steel of the members 13 and 22 is such that when they are disassembled or when there is no pressure of the shoulder 24 on the camming surface 20, the members 13 and 22 are in the relaxed position shown in Figures 2 and 3. The resilient fingers of the inner member 13 tend to be spread apart by a piece of stock 11 inserted through the member 13. Also the resilient slotted forward end of the member 22 tends to be spread apart by resilient distortion upon the forcing of the shoulder 24 and camming surface 20 against each other by providing the desired amount of longitudinal tension. This provides the desired amount of radially inwardly directed resilient force by the distorted forward end of the member 22.

After adjusting the position of the outer member 22 relative to the inner member 13 as described, the assembly of members 13 and 22 is turned relative to support 16 to the point where the rear end of the outer member 22 abuts the forward end of the support 16. Thus, the support 16 by its jamming action frictionally resists further turning of the outer member 22 relative to the inner member 13.

The present disclosure includes that contained in the appended claims, as well as that of the foregoing description.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. A pusher for advancing stock extending axially of the pusher comprising in combination, a feed member having a bore adapted to accommodate stock therein, said feed member having a rearward portion and forwardly extending fingers resiliently movable at the forward end of the feed member toward the axis of the feed member, said fingers carrying pad portions adapted to engage stock in said bore, said feed member at the

forward end thereof being chamfered to provide a camming surface therearound disposed at an included angle of more than 45 degrees to the axis of the feed member, and a shell member concentrically mounted around said feed member, said shell member having an internal shoulder adjacent the forward end thereof interengaging the said camming surface of said feed member, said shell member and said feed member at an axial distance rearwardly from said interengaged camming surface and shoulder having complementary threaded portions threadably interlocked, said shell member being longitudinally slotted from the forward end thereof an axial distance substantially greater than the axial distance of said shoulder from said forward end of the shell member, the shell member being resiliently distortable adjacent said forward end to provide a resilient contractable and expandable forward end portion adapted to exert a resiliently maintained radially directed inward force on said camming surface upon the forward end portion being flexed radially outward by longitudinally directed pressure of the said internal shoulder against the said camming surface, the adjustment of the threaded interlocking of said threaded portions relative to said internal shoulder and camming surface providing a determinable resiliently maintained longitudinally directed pressure of the internal shoulder against said camming surface, the radially directed inward force of said resilient forward end portion resiliently urging said fingers radially inward toward said stock in accordance with the degree of said pressure.

2. A pusher for advancing stock extending axially of the pusher comprising in combination, concentrically disposed members, the inner of said members having resilient fingers at its forward end adapted to exert radially inwardly directed force for gripping said stock in accordance with said inward force, the outer of said members also having resilient fingers at its forward end and adapted to exert radially inwardly directed force upon the said inner member, said fingers of said outer member being resiliently expandable and resiliently contractable to exert a radially inwardly directed force upon being expanded, said inner and outer members adjacent their forward ends having interengaged camming surfaces adapted to exert opposed radially directed forces on the resilient fingers of the inner and outer members, respectively, upon longitudinal movement of the camming surface of one of said members toward the camming surface of the other of said members, said members at an axial distance rearwardly of said camming surfaces being threadably interconnected by complementary threads concentric with the common axis of said member, adjustment of the threaded interconnection of said members to vary the spacing of the threaded interconnection along the inner member relative to the camming surface of the inner member varying the said opposed radially directed forces on the resilient fingers of the inner and outer members exerted by the interengaged camming surfaces, the resilient fingers of the outer member exerting a resiliently maintained radially inward force on the resilient fingers of the inner member in accordance with the magnitude of said opposed forces.

3. In a pusher for advancing stock along the axis of the stock comprising the combination of resilient finger means for gripping said stock, camming means for moving said finger means radially inward for gripping said stock in accordance with the force imparted by the camming means on said finger means, resilient compression means disposed radially outward of and embracing said finger means at the forward end of the pusher for exerting resiliently maintained force on said camming means in a direction radially inward of said finger means to move said finger means radially inward, and longitudinal tension means interconnecting said resilient compression means and said finger means for moving said resilient compression means relative to said camming means to

adjust the degree of force of said resilient compression means, said longitudinal tension means including adjustable means for adjustably determining the tension of said longitudinal tension means.

4. In a pusher for advancing stock in increments along its axis, the combination of, stock-gripping means disposed about said axis and adapted to be moved radially inward toward said axis for gripping said stock, camming means engaging said stock-gripping means for moving said stock-gripping means radially inward, resilient compression means at the forward end of the pusher and disposed concentrically and radially outwardly of said stock-gripping means for radially pressing and resiliently urging said camming means radially inward, and adjustable tension means interconnecting said resilient compression means and said stock-gripping means for adjustably varying the pressure of the resilient compression means on said camming means.

5. In a pusher for advancing stock along its axis, the combination of a first tubular member adapted to accommodate stock therein along said axis, said first tubular member having resilient feed fingers formed at its forward end and having an annular portion adjacent its rearward end, said fingers being adapted to carry pads for gripping said stock, said pads gripping the stock with a force dependent upon the inward thrust of said fingers toward said axis, the forward end of said first tubular member being chamfered to provide an annular camming surface disposed at more than 45 degrees to said axis, and a second tubular member mounted concentrically around said first tubular member, said second tubular member having an internal annular shoulder adjacent its forward end and interengaging said camming surface of the first tubular member to cammingly force said feed fingers inwardly toward said axis upon the urging of said shoulder against said camming surface longitudinally of said first tubular member toward said rearward end, said second tubular member having a threaded end portion concentric with, and threadably engaged to, said annular portion of the first tubular member, the said second tubular member being slotted from its forward end to a location spaced substantially rearwardly of said annular shoulder and being resiliently distortable to permit resilient radial expansion of the second tubular member about said annular camming surface upon longitudinally directed pressure of the annular shoulder against said annular camming surface, said resilient expansion of the second tubular member exerting an opposing resilient radially inward force on said resilient feed fingers to inwardly thrust the feed fingers toward said axis, the longitudinally directed pressure of the annular shoulder against said annular camming surface being adjustable by varying the threaded engagement of the threaded end portion of the second tubular member along the annular portion of the first tubular member.

6. In a pusher for advancing stock therethrough along its axis, the combination of stock-gripping means movable toward said axis for gripping said stock, longitudinally movable means concentric with and carried by said stock-gripping means, camming means operatively connecting said stock-engaging means and said longitudinally movable means for moving said stock-engaging means toward said axis upon longitudinal movement in one direction of said movable means, and resilient means disposed at the forward end of the stock-gripping means and concentrically disposed about and engaging said camming means for resiliently contracting radially inward about said stock-gripping means to urge the same radially inward, the resilient bias of said resilient means being determinable by the force of the engagement of said resilient means and said camming means, said movable means being connected to said resilient means to vary the pressure of said engagement by longitudinal movement of the movable means relative to the stock-gripping means.

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7. In a pusher for advancing stock therethrough along its axis, the combination of stock-gripping means movable toward said axis for gripping said stock, longitudinally movable means concentric with and carried by said stock-gripping means, camming means operatively connecting said stock-engaging means and said longitudinally movable means for moving said stock-engaging means toward said axis upon longitudinal movement in one direction of said movable means, resilient means disposed at the forward end of the stock-gripping means and concentrically disposed about and engaging said camming means for resiliently contracting radially inward about said stock-gripping means to urge the same radially inward, the resilient bias of said resilient means being determinable by the force of the engagement of said resilient means and said camming means, said movable means being connected to said resilient means to vary the pressure of said engagement by longitudinal movement of the movable means relative to the stock-gripping means, and adjustable means for adjusting the movement of the movable means relative to said stock-gripping means to obtain the desired degree of force for the engagement of the resilient means and camming means.

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8. The combination of a hollow feed member having resilient fingers adapted to exert radial inward pressure toward stock within the feed member and a hollow actuating member carried by, and concentric with, the feed member, said members having opposed camming surfaces adapted to actuate the feed member to move said fingers radially inward upon longitudinal tension on said actuating member, said actuating member including a resiliently contractable member at the forward end thereof and biased to contract radially inward upon said feed member to press said camming surfaces together in a radial direction and having a resilient bias dependent upon the pressure exerted on said camming surfaces and an adjustable longitudinally movable member to move the resiliently contractable member in a longitudinal direction relative to the camming surfaces to adjust said resilient bias.

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