Jan. 6, 1953 F. L. GREEN 2,624,102

FEED FINGER FOR AUTOMATIC SCREW MACHINES AND GRIPPING ELEMENT THEREFOR

Filed June 29, 1950 2 SHEETS—SHEET 1

Fig. 1

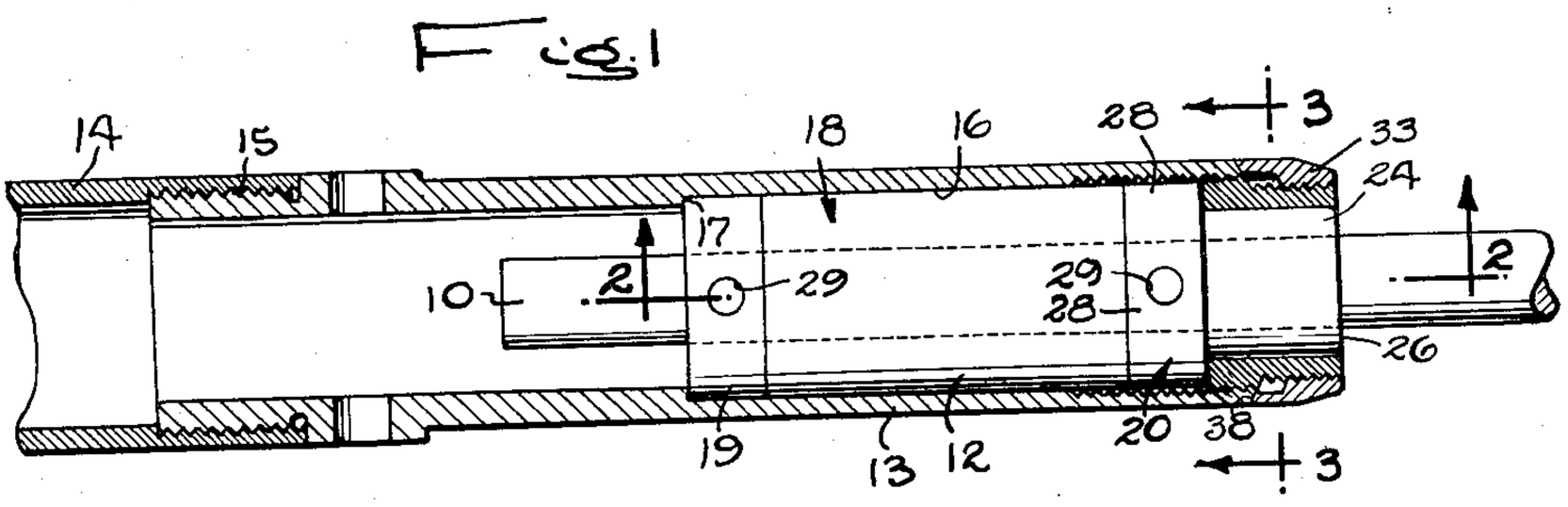


Fig. 2

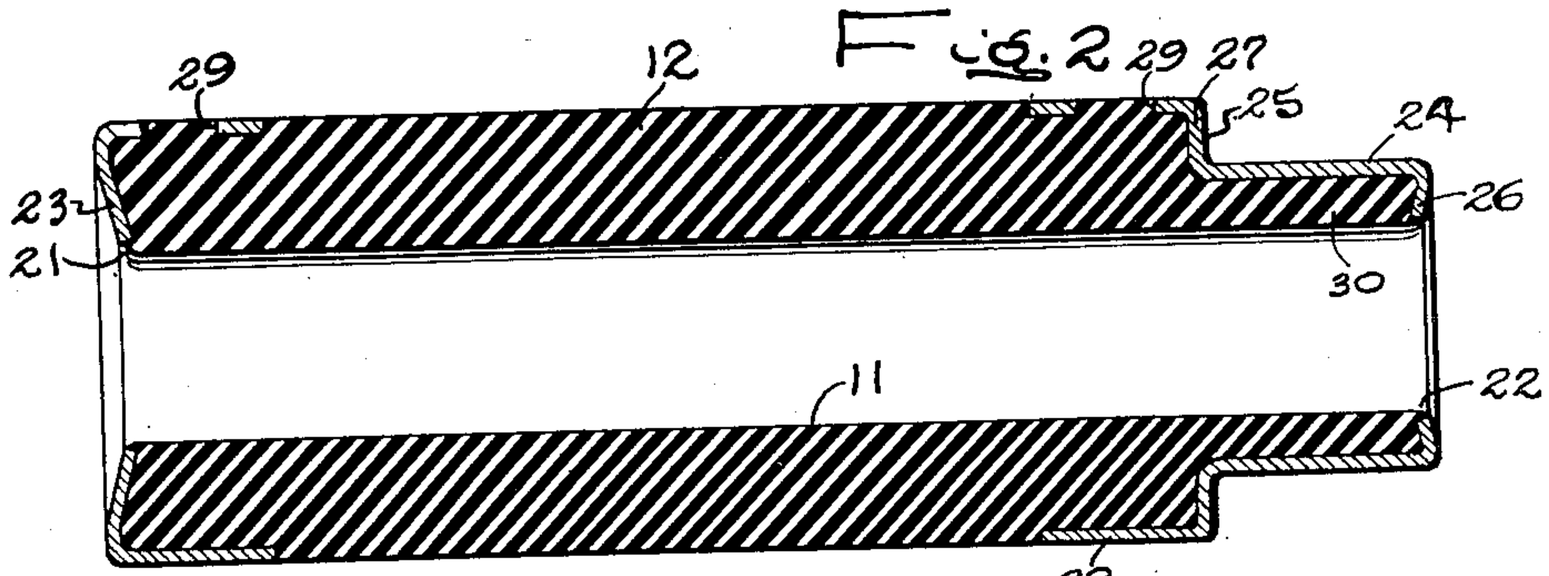


Fig. 3

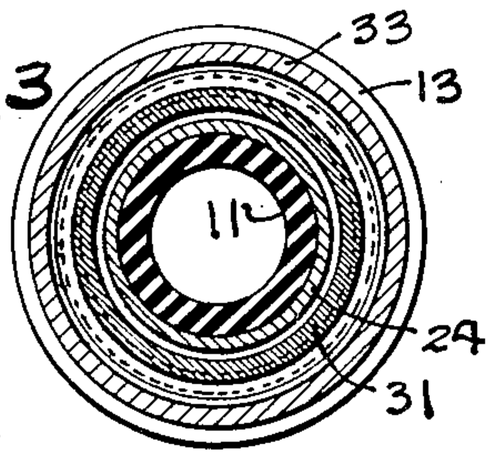
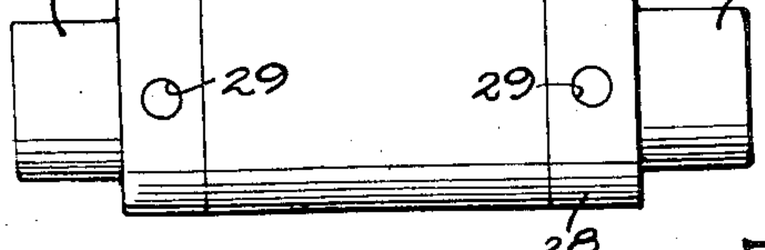


Fig. 4

Fig. 5



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Jan. 6, 1953 F. L. GREEN 2,624,102

FEED FINGER FOR AUTOMATIC SCREW MACHINES AND GRIPPING ELEMENT THEREFOR

Filed June 29, 1950 2 SHEETS—SHEET 2

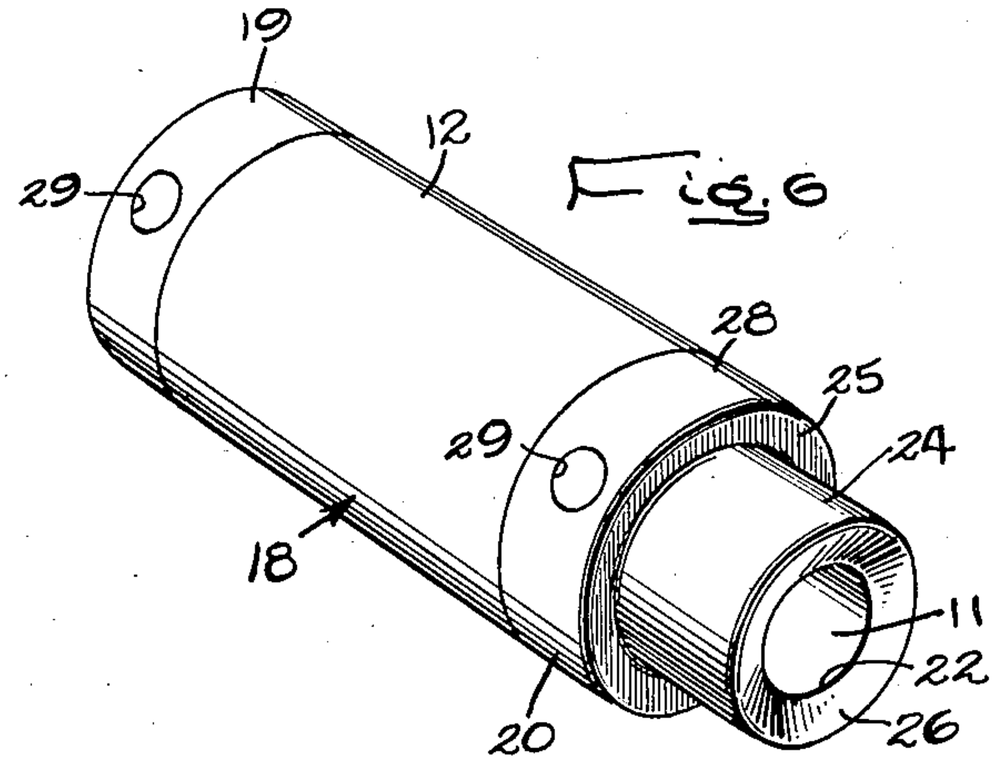

Fig. 6

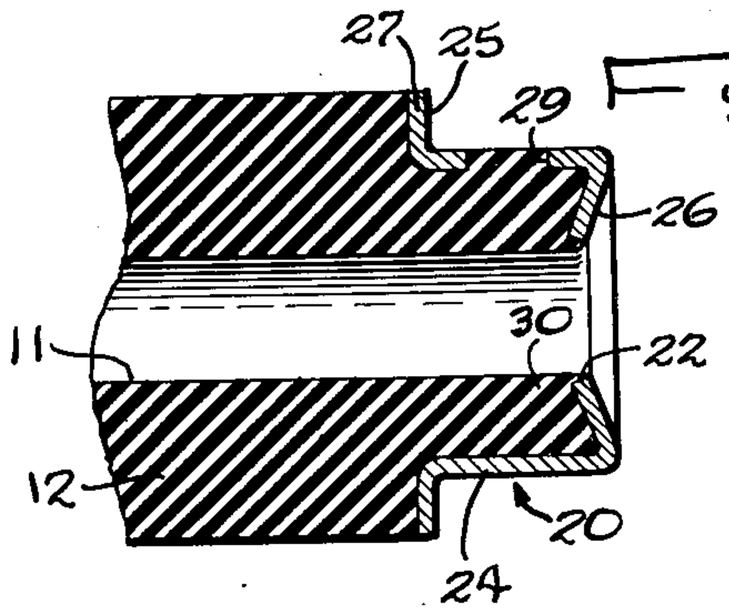

Fig. 7

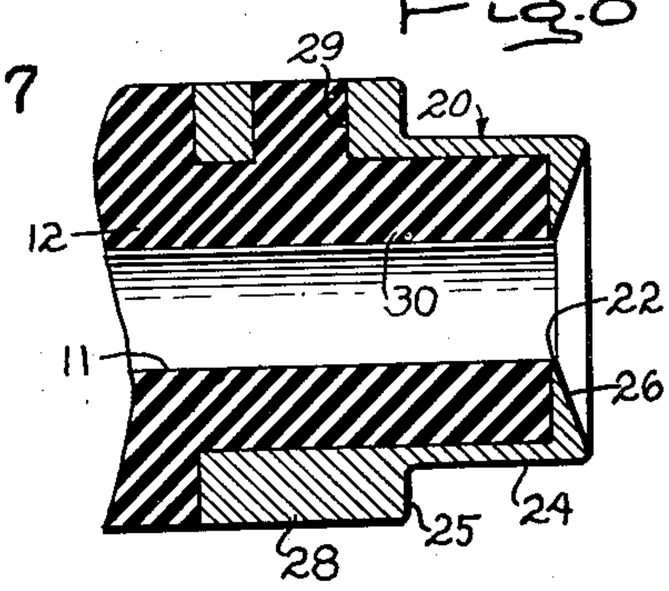

Fig. 8

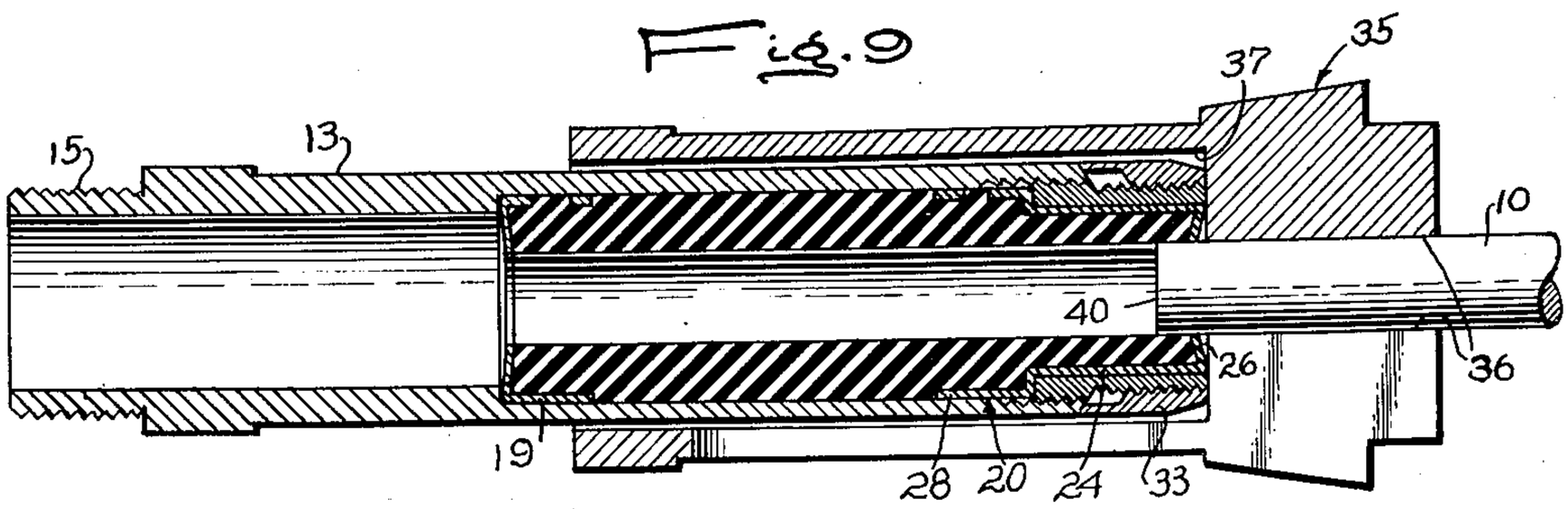

Fig. 9

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FEED FINGER FOR AUTOMATIC SCREW MACHINES AND GRIPPING ELEMENT THEREFOR

Frank L. Green, Rockton, Ill.

Application June 29, 1950, Serial No. 171,061

8 Claims. (Cl. 29—62)

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This invention relates to a so-called feed finger mountable on the reciprocable feed head of an automatic screw machine and operable to grip a work bar to advance the same step by step, the gripping pressure applied to the bar being derived by axial compression of a body of yieldable material within the finger.

One object is to provide a feed finger in which the means for adjusting the gripping pressure on the work bar is located at the forward or outboard end of the feed finger so as to permit the gripping pressure to be adjusted without removing the finger from its mounting in the screw machine.

A more detailed object is to provide a feed finger of the above character in which the gripping pressure is adjusted by a plug threading into the forward end of the finger and locked in adjusted position by a nut constructed and arranged in a novel manner and also accessible from the forward end of the feed finger.

Another object is to provide a gripping element of novel construction which enables a maximum amount of the stock bar to be used in a screw machine.

A further object is to provide a gripping element axially compressible to vary the work-gripping pressure and having a shoulder spaced from the end of the element to receive the adjusting force.

The invention also resides in the novel construction of the gripping element which enables the work bar to be gripped outwardly beyond the shoulder to which the axial pressure is applied.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figure 1 is a longitudinal sectional view of a feed finger embodying the novel features of the present invention, the finger being carried in a screw machine mounting.

Fig. 2 is a longitudinal section taken along the line 2—2 of Fig. 1 of one form of the work gripping element.

Fig. 3 is a section taken along the line 3—3 of Fig. 1.

Fig. 4 is a fragmentary exploded view of the head end of the feed finger.

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Fig. 5 is an elevational view of another form of the gripping element.

Fig. 6 is a perspective view of the gripping element shown in Fig. 2.

Figs. 7 and 8 are fragmentary longitudinal sectional views showing other modifications of the gripping element.

Fig. 9 is a fragmentary longitudinal sectional view showing the feed finger in relation to the collet of an automatic screw machine.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment. It is to be understood, however, that I do not intend to limit the invention by such disclosure, but aim to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

The invention is embodied for purposes of illustration in a feed finger of the type in which a work bar 10 is gripped by the internal surface 11 of a tubular sleeve 12 of yieldable material such as oil resistant rubber, the sleeve being disposed within a shell 13 mountable on the reciprocable feed tube or head 14 of an automatic screw machine. The shell 13 comprises a steel tube formed at one end with an external screw thread 15 adapted to mate with the threaded bore in the screw machine head 14 from which the feed finger projects in the direction of the step-by-step advance of the work bar 10 toward the collet (not shown).

The shell has a generally cylindrical internal surface 16 terminating at one end in a shoulder 17 which constitutes an abutment for one end of the work-gripping element 18. The latter comprises the yieldable sleeve 12 and metallic end caps 19 and 20 therefor in the form of cups having bottom holes 21 and 22 substantially equal in size and cross-sectional shape to the bore 11 in the sleeve 12. The sleeve bore is somewhat larger than the work bar 10 with which the gripping element is to be used, so that by compressing the tube axially while radially confined by the shell 13, the internal tube surface will be contracted radially to grip the work bar with a force proportional to the degree of such compression and distributed substantially uniformly over the tube surface 11.

While both of the end caps may be of the same construction as shown in Fig. 5, one cap, 19 in this instance, may be made of simplified construction comprising a cylindrical collar having an inturned flange 23 defining the hole 21 and abutting against one end of the rubber tube 12. Preferably, the flange 23 is coned to form an inwardly tapering end surface by which guiding of a new work bar 10 through the gripping element is facilitated.

In accordance with the present invention, at least one of the end caps, in this instance the cap 20, is formed with a tubular or outer end portion 24 of a diameter somewhat smaller than the sleeve 12 and terminating in a rigid substantially right angular shoulder 25 spaced from the outer end of the cap 20 which end is formed by an inturned flange 26, preferably coned inwardly and defining the hole 22. As shown, the shoulder 25 is of a width about half the radial thickness of the sleeve 12 and is preferably formed by an outturned flange 27 integral with the tubular portion 24. This flange forms a rigid abutment for the outer portion of the rubber sleeve 12 while the inner portion of the rubber sleeve abuts against the flange 26, as a result of which the sleeve 12 will be compressed axially throughout its length in response to a force exerted on the shoulder 25 in a direction to contract the element axially.

The flange 27 may terminate at the outer surface of the rubber sleeve 12 as shown in Fig. 7, or, if desired, a cylindrical extension 28 (Figs. 1, 2, and 6) integral with the flange 27 and flush with the outer sleeve surface may be extended a short distance along the sleeve. The caps 19 and 20, which are preferably made of relatively thin metal of uniform thickness, may be bonded to the rubber of the sleeve during molding of the latter, or may be locked thereto mechanically by providing holes 29 either in the tubular portion 24 (Fig. 7) or in the extension 28 (Figs. 1, 2, and 6). While the caps may be punched from sheet metal, they may also be turned from solid stock, in which case the rubber sleeve portion 30 of reduced diameter would extend the full length of the cap 20 as shown in Fig. 8 and its extension 28 instead of only to the shoulder 25 as in the forms shown in Figs. 2 and 7.

Preferably, the sleeve 12 is made of oil resistant or synthetic rubber or material having equivalent yielding properties, and is molded in one integral piece into the caps 19 and 20 to form a unitary assembly (Fig. 6) of uniform internal size and cross section throughout its length, the sleeve 12 having a cylindrical external surface flush with the outer surfaces of the caps, which outer surfaces are only slightly smaller than the internal surface 16 of the shell 13. Thus, the radial space between the internal or gripping surface 11 and the outer cap surfaces is filled solidly with the yieldable material. This body acts as a fluid, and, when confined radially by the shell 13, responds to endwise compression to vary the radially directed pressure by which the internal rubber surface 11 grips the work bar 10. In this instance, the gripping surface is smooth and continuous, but it may, if desired, be made of any preferred contour or be defined by harder metal parts set into the rubber whose primary function is that of providing a fluid-like medium for converting the axially applied compressive force to a radially directed gripping pressure.

The force for compressing the gripping element axially is derived by the action of a hollow

screw plug 31 threaded into the forward or free end of the shell 13 and having a central hole somewhat larger than the smaller portion 24 of the cap 20. In the final assembly, this cap end is usually spaced inwardly from the outer plug end which has cross slots 32 formed therein to receive a cylindrical wrench or a crossbar by which the plug may be turned into the shell and thus advanced into abutment with the shoulder 25 on the gripping element 16. Further advance of the plug compresses the rubber axially, resulting in gripping of the work surface with a force proportional to the degree of axial compression of the rubber.

This gripping force is distributed substantially uniformly throughout the full length of the rubber surface 11 including the part thereof outwardly beyond the shoulder 25 and within the reduced diameter 24 of the cap 20. This is for the reason that part of the compressive force exerted on the shoulder 25 is transmitted through the rigid cap 20 and applied to the end of the tubular portion 30. Thus, I have taken advantage of the flowability of the yieldable material to maintain such uniform pressure in spite of the fact that the shoulder 25 engaged by the screw is spaced inwardly from the end 26 of the gripping element. As a result and for the reasons mentioned later, the finger will feed a greater length of the work bar 10 in an automatic screw machine, the increase in length being equal to the spacing of the shoulder 25 from the forward end of the gripping element.

To lock the plug 31 securely in its adjusted position, the invention contemplates the use of a nut 33 coacting with the end of the shell 13 to increase the frictional engagement between the threaded parts of the shell and plug without at the same time increasing the overall external diameter of the finger. The nut comprises a ring equipped with means such as flat surfaces 34 to engage a tool such as a wrench by which the nut may be tightened. A minimum diameter of the nut is made possible in the present instance by reducing the diameter of the outer projecting end of the plug 31 and turning the nut onto an external thread 35 on this reduced portion.

In the present instance, the locking action of the nut is produced by contracting the forward end of the shell 13 around the plug 31. For this purpose, the shell is split as indicated at 36 at annularly spaced points and thus rendered somewhat flexible. The extreme end of the shell is tapered as indicated at 37, and this conical surface mates with and fits into an internal surface 38 on the inner end of the nut. As the nut is advanced along the thread 35 into engagement with the conical surfaces 37 between the splits 36, the latter surfaces are cammed inwardly into gripping engagement with the plug thread, thereby holding the plug frictionally against loosening.

Location of the plug and the friction lock therefor at the forward end of the shell facilitates adjustment of the gripping pressure on the work bar without removal of the feed finger from the screw machine. To effect such adjustment, the nut 33 is first backed off by means of a wrench applied to the flats 34 after which the plug 31 may be turned by a suitable wrench fitted into the slots 32 in the exposed end of the plug.

The wastage of material as the work bar becomes used up in a screw machine is reduced to a minimum by virtue of the shouldered construction of the gripping element whose smaller

end may be extended outwardly through the compression adjusting mechanism above described and to or even beyond the end of the feed finger shell (see Figs. 1 and 9). This end of the finger, during the stacking motion is projected in a recess **37** in the screw machine collet **35** whose jaws **36** are collapsed to grip and hold the work after its farthest advance in which, as shown in Fig. 9, the end flange **26** of the gripping element is disposed very close to the rear end of the collet jaws **36**. As a result, the rubber surface continues to grip the work and feed it forwardly until substantially the full length of the bar has been fed into the collet jaws and the end **40** of the work bar has reached the flange **26**. Very little of the work bar at its trailing end is wasted, and, as compared to prior feed finger constructions, a substantial saving is thus effected which is especially important in the case of expensive materials.

This application is a continuation-in-part of my prior application Serial No. 768,964, filed August 16, 1947, and now abandoned.

I claim as my invention:

1. A feed finger comprising a tubular shell threaded at one end for mounting in an automatic screw machine, a shoulder within said shell facing toward the second end of the shell, the latter shell end being threaded internally, a hollow plug threaded into said second shell end and providing a second shoulder within the shell facing toward said shoulder, an elongated tube of resiliently yieldable material disposed within said shell in abutment with said shoulders and compressible axially by adjustment of said plug to reduce the internal diameter of the tube, said tube having an outer end portion of reduced diameter projecting outwardly through the internally threaded end portion of the shell, and a cup of smaller diameter than the interior of said plug fitting over the exterior of said reduced end portion and having an inturned flange abutting against the outer end of the reduced portion to prevent the axial flow of said material as an incident to compression of the larger diameter portion of the tube between said shoulders.

2. A gripping element for a feed finger comprising an elongated tube of resiliently yieldable material of generally cylindrical external contour throughout the major portion of its length and of reduced diameter and cylindrical external contour over the remaining minor portion of its length whereby to provide an axially facing shoulder at the junction of the larger and reduced end portions of the tube, a rigid ring on the outer end of the larger portion of the tube forming an abutment for applying an endwise compressive force to the tube, a rigid cylindrical cup of an external diameter smaller than said larger tube portion surrounding said reduced portion and confining the material thereof against outward flow, said cup having a flange at its outer end turned inwardly at the end of said tube and forming an abutment therefor preventing endwise flow of said material, and an external rigid flange on the inner end of said cup forming an abutment at the second end of the larger cylindrical portion of the tube.

3. A gripping element for a feed finger comprising an elongated tube of resiliently yieldable material of generally cylindrical external contour throughout the major portion of its length and of reduced diameter and cylindrical external contour over the remaining minor portion of its length whereby to provide an axially facing

shoulder at the junction of the larger and reduced end portions of the tube, and a rigid cylindrical cup of an external diameter smaller than said larger tube portion surrounding said reduced portion, and having a flange at its outer end turned inwardly at the end of said tube and forming an abutment therefor preventing endwise flow of the material.

4. A gripping element for a feed finger comprising an elongated tube of resiliently yieldable material, a minor portion of the tube length at one end thereof being of reduced external diameter whereby to provide an axially facing shoulder at the junction of the larger and reduced diameters, a rigid cup of an external diameter smaller than the larger tube portion surrounding said reduced portion and having a flange at its outer end turned inwardly at the end of said tube and forming an abutment therefor preventing endwise flow of the material, and an external flange on the inner end of said cup abutting against said shoulder.

5. A feed finger comprising a tubular shell contoured at one end for mounting in an automatic screw machine, an abutment within said shell adjacent said end and facing toward the second end of said shell, the latter shell end being threaded internally, a hollow plug threaded into said second shell end, a sleeve of yieldable material within said shell engaging said abutment at its inner end, the outer end portion of said sleeve being of reduced diameter and projecting axially at least partially through said plug, a rigid flange abutting against the outer end of said reduced portion, a shoulder surrounding said reduced end portion at the inner end thereof, and a member surrounding said reduced portion and rigidly connecting said flange and said shoulder.

6. A feed finger comprising a tubular shell contoured at one end for mounting in an automatic screw machine, an abutment within said shell adjacent said end and facing toward the second end of said shell, the latter shell end being threaded internally, a hollow plug threaded into said second shell end, a sleeve-like gripping element within said shell engaging said abutment at one end and having an end portion of reduced diameter at its other end terminating at a shoulder spaced from the latter end and engageable with said plug, said element having an internal surface contractible radially by axial compression of the element between said abutment and plug, and a member rigidly connecting the inner end of said plug and the outer end of said reduced portion for compressing such portion axially simultaneously with the compression of the remaining portion of the element between said plug and said abutment.

7. A feed finger comprising a tubular shell contoured at one end for mounting in an automatic screw machine, an abutment within said shell adjacent said end and facing toward the second end of said shell, the latter shell end being threaded internally, a sleeve-like gripping element of yieldable material within said shell engaging said abutment at one end and having a portion of reduced diameter at the other end projecting through said threaded shell end and terminating at an axially facing shoulder, a rigid member having outturned and inturned flanges respectively abutting against said shoulder and the outer end of said reduced portion, and a plug surrounding said reduced portion and

threaded into said shell into abutment with said outturned flange.

8. A feed finger comprising a tubular shell contoured at one end for mounting in an automatic screw machine, an abutment within said shell adjacent said end and facing toward the second end of said shell, the latter shell end being threaded internally, a sleeve of yieldable material disposed within said shell with one end engaging said abutment, the other end portion of said sleeve being of reduced diameter and terminating at a shoulder intermediate the ends of the sleeve, a plug surrounding said reduced portion and screwed into the threaded shell end,

and an inturned abutment rigid with said plug and engageable with the outer end of said reduced portion when the inner end of the plug is engaging said shoulder.

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