

May 15, 1934.

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1,958,705

APPARATUS FOR THIN WALL BROACHING

Filed March 15, 1930

2 Sheets-Sheet 1

Fig. 3.

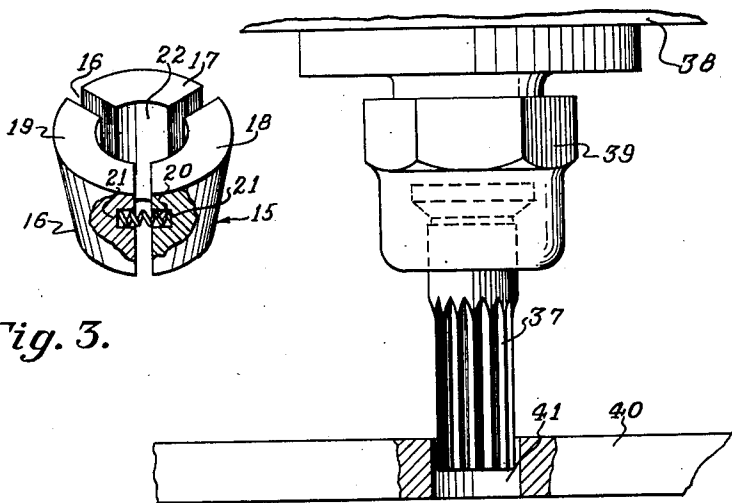


Fig. 1.

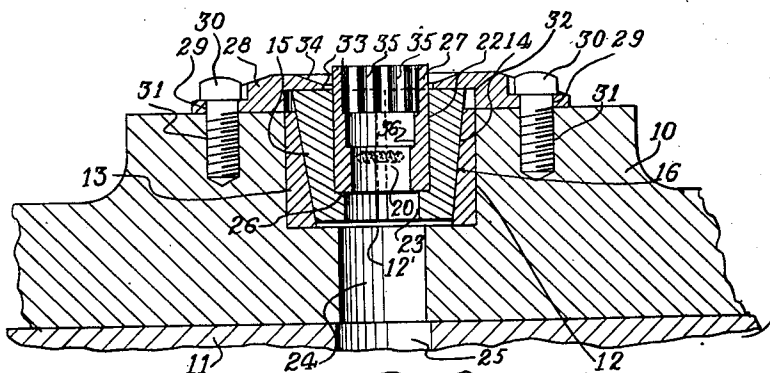


Fig. 4.

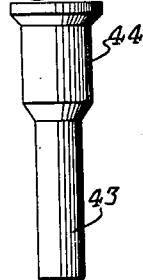
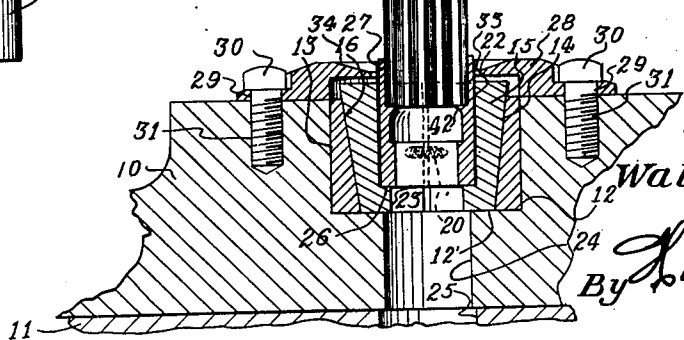


Fig. 2.



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2 Sheets-Sheet 2

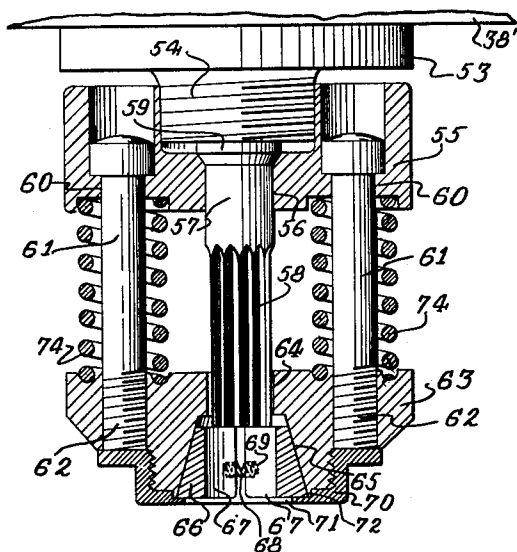


Fig. 5.

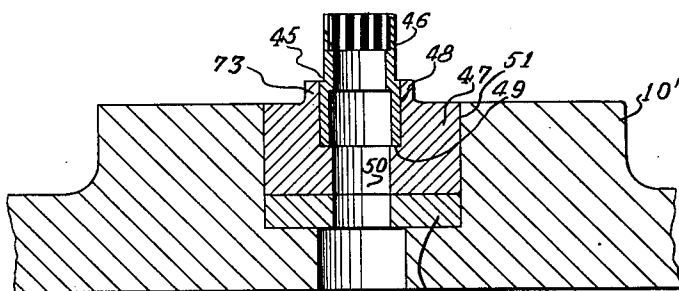


Fig. 7.

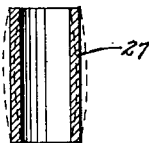


Fig. 8.

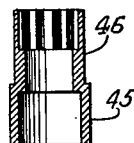
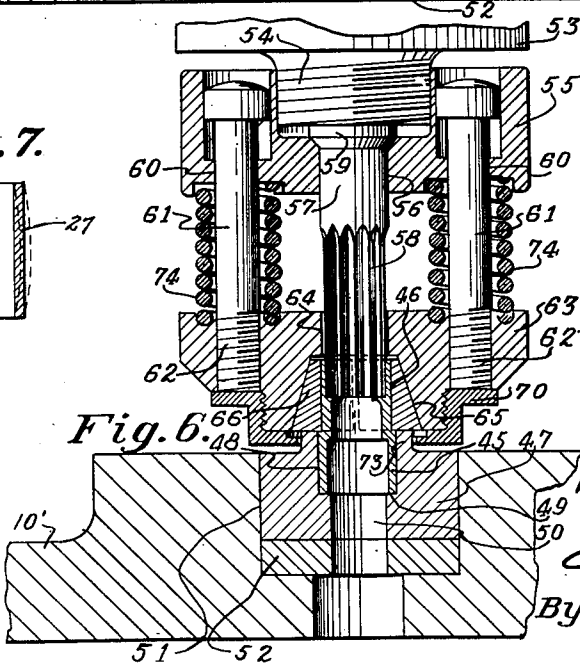


Fig. 6.

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1,958,705

APPARATUS FOR THIN WALL BROACHING

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Application March 15, 1930, Serial No. 436,150

3 Claims. (Cl. 90—33)

This invention relates to means for broaching or otherwise forming thin-walled devices such as wrench sockets, although it may be employed with equal advantage for other purposes.

It contemplates more especially the provision of means for reinforcing blanks or the walls thereof which are normally incapable of withstanding the stresses or temporary deformation incident to processing into suitable or desired devices.

Thin-walled devices such as wrench sockets are especially efficacious owing to their extreme accessibility to restricted locations for nut turning with minimum effort and maximum convenience. Heretofore it has been necessary to provide a wall body of sufficient thickness to withstand broaching or other cutting operations; therefore, the resulting blanks, devices or sockets are not sufficiently thinned within the nut turning requirements thereof to provide maximum accessibility.

One object of the present invention is to provide a novel method of broaching or otherwise forming blanks thinned to their physical requirements for nut turning.

Another object is the provision of novel means for enabling blanks to withstand the stresses incident to the conversion thereof into articles of commerce.

Still another object is to provide means for increasing the stressed resistance of blanks or materials during the broaching or other processing thereof to impart any desired formations thereto.

A further object is to provide means which will prevent the collapsing of blanks during broaching or other operations thereon.

A still further object is to provide a blank receiving member which is collapsible for wall reinforcement incident to broaching or other tool operations.

Still a further object is to provide means which are purposed to collapse against the urge of the resilient member to effect wall reinforcement of blanks just prior to tool operations thereon.

An additional object is to provide novel means for enabling tool operations or thin-walled blanks which are designed for strength only within the physical use requirements thereon.

Other objects and advantages will appear from the following description of an illustrative embodiment of the present invention.

In the drawings:

Figure 1 is a fragmentary sectional view in elevation of the confronting parts of a punch

press with a means shown in association therewith for tool operation of thin-walled blanks in accordance with the teachings of the instant invention.

Figure 2 is a similar view of the device shown in Figure 1, the parts thereof being in their operating positions to effect broaching of the blank.

Figure 3 is a perspective view of the collapsible bushing shown in Figure 1.

Figure 4 is a view in elevation of a shearing tool constituting a step employed in the process.

Figure 5 is a view similar to Figure 1 with the parts shown reversed for tool operation upon a blank having a shoulder thereon.

Figure 6 is a similar view of the device shown in Figure 5, the parts thereof being in their operating positions to effect broaching of the blank.

Figure 7 is a sectional view in elevation of a thin-walled blank showing the deformation in dotted outline which results from broaching or other tool operation without wall reinforcement.

Figure 8 is a sectional view in elevation of a blank having a reduced neck to afford increased accessibility.

The structure selected for illustrating the teachings of a method embodying features of the present invention comprises a die shoe 10 of any suitable configuration mounted on the bolster plate 11 of a punch press (not shown) of standard construction. As shown, the die shoe 10 is provided with a cylindrical cavity 12 extending in a vertical direction for partial extent therethrough to receive a die bushing 13 which, in this instance, is provided with a frusto conical bore 14 converging in a downward direction.

The die bushing 13 is adapted to receive a collapsible bushing 15 which has a frusto conical exterior 16 corresponding in shape with the bore 14 of the die bushing 13 to serve as a complement thereto. The collapsible bushing 15 is slotted longitudinally through the walls thereof as at 16, in this instance along 120° radii to define complementary sections 17, 18 and 19, in this instance three, although the number thereof may vary to meet the requirements of commercial practice. The bushing sections 17, 18 and 19 are maintained in yielding association to assume an expanded position owing to spiral springs 20 which are disposed therebetween for reception in confronting circular depressions 21 which are disposed transversely for communication with the adjacent edges defining the slits 16. In consequence thereof, the spring 20 will normally urge the sections in expanded relation to effect

the wedging elevation thereof in the die bushing 13.

The collapsible bushing 15 is interiorly bored to define a cylindrical cavity or socket bore 22 which communicates proximate the bottom thereof with a similarly shaped, but smaller bore 23 serving as an avenue of chip discharge to a passage 24 provided in the die shoe 10 in axial communication therewith. To this end, the bolster plate 11 is also provided with a passage 25 somewhat larger in diameter than the passage 24 for aligned communication therewith to enable the chips to be discharged to the floor or receptacle placed therebeneath as may be desired to effect the reception thereof.

As shown, the socket bore 22 of the collapsible bushing 15 merges in the smaller bore 23 to present a shoulder 26 for the reception of a tubular blank 27 thereon to effect the support thereof in the bore or socket of the collapsible bushing 15. The bushing 15 is maintained within the die bushing 13 by means of a die retainer disc 28 which is circular in configuration for receiving apertures 29 circumferentially spaced around the periphery thereof for the reception of threaded studs 30 therethrough. The studs 30 engage correspondingly threaded holes 31 provided in the die shoe 10 to detachably join the die retainer disc 28 in position thereon so that the counterfaced bore 32 thereof will be in alignment with the cylindrical cavity 12 provided in the die shoe 10.

As a result, the collapsible bushing 15 is projected within the counterfaced bore 32 owing to the urge of the springs 20 which effect the wedging elevation thereof for a predetermined limit defined by the retainer disc 28. In this position, the collapsible bushing 15 is at the extreme limit of its upward movement corresponding with a sufficiently expanded socket 22 to freely accommodate and receive the blank 27 therein for support upon the shoulder 26. It is to be noted that the retainer disc 28 is provided with an axial bore 33, which is chamfered as at 34 for enabling the ready projection of the blank 27 therethrough for reception in the socket 22 of the collapsible bushing 15.

Now then, to suitably shape or otherwise tool the blank 27 for imparting the desired formation thereto or, in this instance, to effect the interior broaching thereof to define nut engaging corners 35 for a partial extent therethrough, the blank 27 is situated in the socket 22 of the collapsible bushing 15. It is to be noted that the blank 27 is provided with an interior bore 36 in any suitable manner for coaxial alignment with a broaching tool 37 which is held for movement with a ram 38 of a punch press by means of a broach holder 39 of standard construction which is fixed thereto in any suitable manner.

The ram 38 of the punch press is reciprocated in any suitable manner in accordance with the dictates of commercial practice for movement of the broach 37 in a vertical rectilinear path for guidance by a stripper plate 40 which is provided with a bore 41 somewhat larger than the peripheral extent of the broach 37 which freely moves therethrough. In consequence thereof, the descent of the broach 37 will cause the engagement of the top edge of the blank 27 for initial wedging of the collapsible bushing 15 within the frusto conical bore 14 of the die bushing 13 to cause the approach of the bushing sections 17, 18 and 19 against the urge of the springs 20

until the blank 27 is tightly grasped to reinforce the walls thereof.

Continued descent of the broach 37 will effect its passage through the bore 36 of the blank 27 to correspondingly shape the interior wall thereof, in this instance imparting nut engaging corners 35. The stresses created within the blank 27 incident to the broaching operation will be withstood by the collapsible bushing 15, thereby relieving the thin-walled blank 27 thereof without any deformation therein. On that account, the wall thickness of the blank 27 need not be determined by the stresses exerted thereon incident to tool operations, since such ordinarily create the bulging tendency indicated in dotted outline in Figure 6 without any auxiliary lateral support or reinforcement.

With this arrangement, the blank 27 is grasped by the bushing 15 which collapses against the urge of the springs 20 to tightly embrace the periphery thereof owing to the descent of the collapsible bushing 15 within the die bushing 13. This is effected responsive to the initial approach of the broach or tool 37 in contact with the blank 27 which descends therewith until tightly grasped by the collapsible bushing 15 which is held in position by the die bushing 13 to resist further displacement. As a consequence, the broach 37 proceeds through the bore in a manner indicated in Figure 2 to form chips 42. When the broach 37 descends to an extent sufficient to effect the displacement of the collapsible bushing 15 arrested by the bottom 12' of the cylindrical cavity 12 provided in the die shoe 10, and then proceeds through the interior bore 36 of the blank 27 to its extreme predetermined position, the chips 42 are distended inwardly and the broach 37 recedes owing to the corresponding movement of the punch press ram 38.

The chips 42 are sheared or otherwise removed from their joinder with the bore 36 of the blank 27 by means of a cylindrical tool 43 which has a shank 44 thereof adapted to be received in a holder similar to the broach holder 39 to repeat the movement of the broach 37 so as to shear the chips 42 from the bore 36. It will thus be apparent that thin-walled blanks or sockets may be broached or otherwise processed without any possible rupture or destruction. It is obvious, therefore, that heretofore such devices could not be broached or subjected to tool operations unless the walls were of such thickness to withstand the stresses incident thereto. This usually required a thicker design which not only was expensive but was disadvantageous from the standpoint of precluding maximum accessibility in restricted locations for nut turning or other purposes.

It may be found necessary or highly desirable to similarly broach or otherwise subject blanks with reduced necks to tool operations. In such event, a tubular blank 45 having a reduced neck 46 designed for interior broaching, is positioned in a bottom die 47 having a cavity 48 to effect the reception thereof for support upon a shoulder 49. A passage 50 extends entirely through the bottom die 47 in communication with the interior of the blank 45 to enable the discharge of the chips therethrough, it being noted that the bottom die 47 is telescopically received in a socket 51 shaped to conform therewith in a die shoe 10'. A filler washer 52 is disposed within the cavity 51 of the die shoe 10' for support of the bottom die 47 thereon for interchangeable use with the die bushing 13 described in the previous embodiment.

In consequence thereof, the die shoe 10' may be the same as the die shoe 10 employed in connection with the heretofore described embodiment of the invention. In this particular instance, the ram 38' carries an adaptor 53 which has a threaded shoulder 54 depending therefrom to receive a broach holder 55 thereon in threaded engagement therewith. As shown, the broach holder 55 is provided with a central bore 56 which receives the shank 57 of the broach 58 there-through, there being a shoulder 59 upon the shank of the broach 57 to preclude the removal thereof through the bore 56 so as to effect the fixed securing thereof by turning the broach holder 55 to its extreme position of movement in threaded engagement with the threaded shoulder 54 of the adaptor 53. The broach holder 55 is provided with countersunk holes 60 on both sides of the adaptor shoulder 54 to receive studs 61 there-through which depend therefrom so that the threaded extremities 62 thereof will receive a stripper plate 63 in threaded engagement therewith.

The stripper plate 63 is provided with a bore 64 therethrough in axial alignment with the bore 56 which carries the broach 57, thereby permitting the latter to reciprocate freely therethrough. The bore 64 merges in a frusto conical bore 65 which is inclined to converge upwardly for the reception of a collapsible bushing 66 therein which is similar in all respects to the bushing 15 described in connection with the previous embodiment. In this instance, the collapsible bushing 66 is composed of sections 67 as heretofore described, there being a coil spring 68 disposed transversely therebetween for reception in aligned depressions 69 which communicate with the adjacent contacting edges of the sections 67. A bushing retainer disc or collar 70 is threaded or otherwise connected to the stripper plate 63 to retain the collapsible bushing 66 in position for wedging reaction with the frusto conical bore 65 provided therein.

To this end, the retainer collar 70 has a circular aperture 71 which is provided with a countersunk face 72 to define a shoulder for supporting the collapsible bushing 66 urged thereagainst by the coil springs 68 owing to the wedging reaction with the frusto conical bore 65. As shown, the bottom die 47 has a shoulder 73 formed thereon to project through the aperture 71 in the retainer ring or collar 70 to bear against the collapsible bushing 66 responsive to the descent of the ram 38'. In order to absorb the shock incident to the initial contact between the stripper plate 63 and bottom die 47, coil springs 74 envelop the studs 61 to normally space the stripper plate 63 from the broach holder 55.

With the descent of the stripper plate 63 in striking contact with the bottom die 47, the former recedes therefrom to compress the coil spring 74 in a manner disclosed in Figure 6. During the descent of the ram 38' the collapsible bushing 66 engages the shoulder 73 of the bottom die 47 so as to tightly embrace the reduced neck 46 of the blank 45 which is enveloped when approaching contact is effected. Further descent of the ram 38' causes the stripper plate 63 to move toward the broach holder 55 to compress the coil spring 74 while the broach 58 proceeds partially through the interior bore of the blank 45 for the desired distance until the springs 74 are totally or partially compressed as commercial

practice may deem it advisable or dictate. By so doing, the same function and effect is produced with the blanks 45 having reduced necks 46 of such thinness as to render the sockets completely or very advantageously accessible in restricted locations for nut turning or other purposes.

It must be appreciated that a novel method has been provided to broach or otherwise subject blanks to tool operations without the tendency of rupture or injury thereto which would otherwise result owing to the incapacity to withstand the stresses created therein. This affords a manner of broaching thin-walled blanks which heretofore were incapable of productions owing to the destructive effect of the stresses which exceeded the elastic limit and tension strength of the materials from which such blanks could be formed or produced. While several embodiments of the invention have been illustrated no particular structural arrangement is thought necessary in that such is capable of wide variation to solve specific problems to operations.

Various changes may be made in the embodiment of the invention herein specifically described without departing from or sacrificing any of the advantages of the invention as defined in the appended claims.

I claim:

1. In a device of the character described, the combination with a support for receiving a blank of a reciprocable head, a blank modifying tool carried by said head to confront the blank on said support, a stripper plate resiliently mounted on said head for movement in the path of a blank on said support, a normally expanded sectional bushing associated with said stripper plate to fit over said blank, said bushing effecting the grasp of said blank when contracted responsive to coacting with said stripper plate, and means in the path of said bushing to effect the contraction thereof during its movement relative to said blank.

2. In a device of the character described, the combination with a support for receiving a blank of a reciprocable head, a blank modifying tool carried by said head to confront the blank on said support, a stripper plate resiliently mounted on said head, there being a conical cavity in said stripper plate, a normally expanded sectional conical bushing complementary to said stripper plate cavity to fit over said blank in the path of said stripper plate, said bushing effecting the grasp of said blank when contracted responsive to coacting with said stripper plate, and means in the path of said bushing to effect the contraction thereof during its movement relative to said blank.

3. In a device of the character described, the combination with a support for receiving a blank of a reciprocable head, a blank modifying tool carried by said head to confront the blank on said support, a stripper plate resiliently mounted on said head, there being a conical cavity in said stripper plate, a normally expanded sectional conical bushing complementary to said stripper plate cavity to fit over said blank in the path of said stripper plate, said bushing effecting the grasp of said blank when contracted responsive to coacting with said stripper plate, and means on said support in the path of said bushing to effect the contraction thereof during its movement relative to said blank.

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