Sept. 5, 1944. D. A. BENNER 2,357,306

PUNCH

Filed April 24, 1943

Fig. 1.

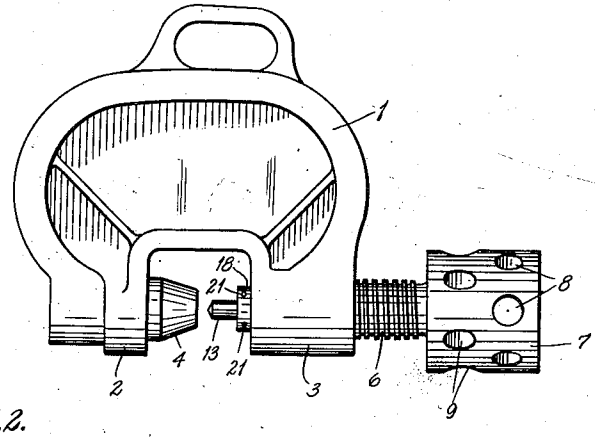


Fig. 2.

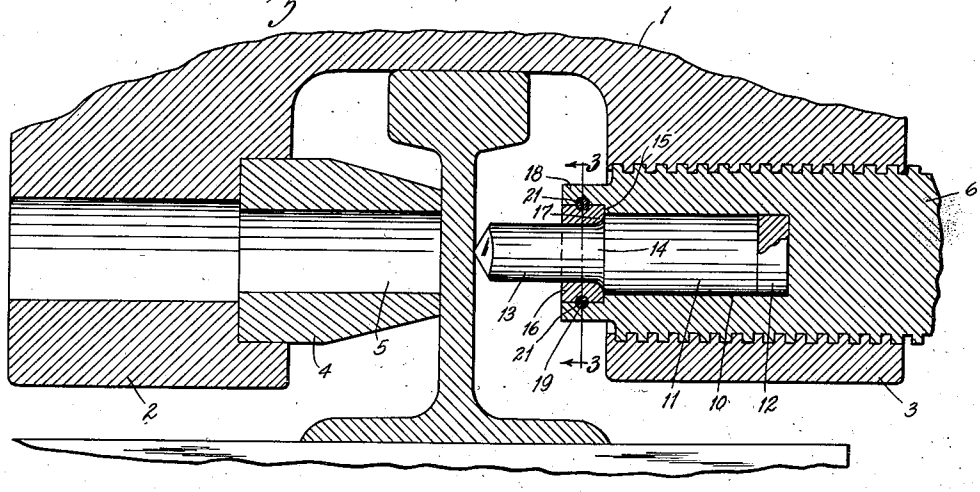


Fig. 3.

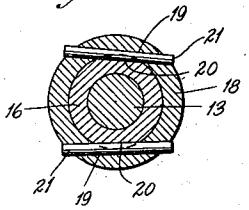


Fig. 4.

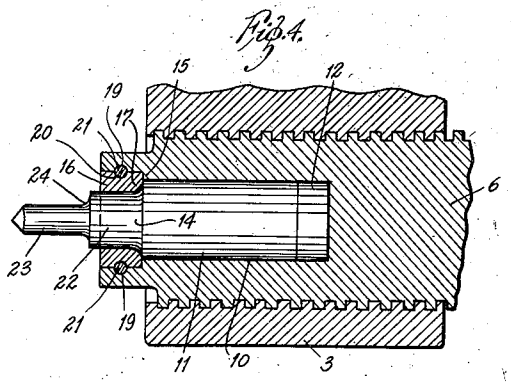
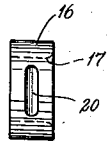


Fig. 5.



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2,357,306

PUNCH

Dale A. Benner, Alton, Ill.

Application April 24, 1943, Serial No. 484,344

4 Claims. (Cl. 164—101)

This invention relates to punches; and has special reference to a punch bit and screw assembly for use in punches of the general type disclosed in my prior patents, No. 2,202,513 and No. 2,202,514, granted May 28, 1940.

In the portable punches disclosed in said patents, the punch bits are rotatively attached to the inner ends of screw shafts by rotation of which shafts the punch bits are moved longitudinally with said shafts to perform their intended operations. In the punches of said patents, the bit and screw assemblies comprise punch bits having shanks mounted in sockets in the inner ends of the screw shafts, and said shanks are provided with circumferential grooves substantially reducing the cross-sectional area thereof, and engaging retaining pins secured in the shafts and extending through said grooves for the purpose of preventing withdrawal or detachment of the bits and leaving the bits rotative relative to the screw shafts. These circumferential grooves quite considerably reduce the cross-sectional area or diameter of the bit shanks, and substantially weaken the shanks of the bits at the grooves. In consequence of the tremendous pressures and forces which are exerted on the ends or tips of the punch bits and which pressures and forces are translated or transmitted back to the weaker points of the bit shanks at said grooves, the bits are sometimes broken at said weaker points. In addition, it has occurred that the retaining pins are sometimes broken under the pressures, stresses and forces which must be overcome when the screw shafts are rotated and moved longitudinally to withdraw the punch bits from the holes formed thereby, resulting in disalinement of the bits relative to the screw shafts, and sometimes resulting in stripping the threads on said screw shafts. These difficulties have presented serious problems in the satisfactory operation and use of punches having weakened portions created by or resulting from the formation of said circumferential grooves in the bit shanks which receive the retaining pins.

Objects of the present invention are to provide an improved punch screw and bit assembly which will overcome the difficulties mentioned and which have resulted from the presence and existence of the aforesaid circumferential grooves in and around the punch bit shanks; to provide an improved punch screw and bit assembly having the punch bit mounted coaxially in the end of the longitudinally movable screw shaft of a punch of the general type disclosed in said patents, with the punch bit shank of uniform diameter and unweakened by any circumferential groove, etc., and provided with a circumferential thrust bearing shoulder at the union of the shank and the punch bit tip engaging against a removable and replaceable retaining ring mounted in the end of the screw shaft for preventing outward withdrawal or displacement of the bit and leaving the bit freely rotative relative to the shaft during rotation of the shaft in either direction and during longitudinal movement of the shaft in either direction; and to provide novel means for optionally supporting bits provided with tips of different sizes or cross-sectional areas and shanks of a uniform or datum cross-sectional area in connection with the same shaft in a manner to withstand and resist the great strains, stresses and pressures to which the bits are subjected when in use, without likelihood of breaking the bits or stripping the threads on the shaft.

Another object of the invention is to provide an improved punch screw assembly comprising a screwthreaded shaft rotatively mounted in a frame for longitudinal movements when said shaft is rotated, and having a coaxial socket in one end, in combination with a bit having a shank rotatively mounted within and having a circumferential shoulder in said socket, and a retaining ring or collar removably mounted in the socket and engaging said shoulder to retain the bit in connection with the shaft, and means preventing securing of the retaining ring or collar in position in the shaft in any other than a predetermined or datum position for proper cooperation with the shaft and bit.

Other objects and advantages of the invention should be apparent from the following description, reference being made to the annexed drawing, in which—

Fig. 1 is a side elevation of an improved portable punch having my present invention embodied therein.

Fig. 2 is a greatly enlarged longitudinal sectional view showing the principal structural features of an embodiment of the present invention.

Fig. 3 is a cross-sectional view of the punch shaft, retaining ring, and punch, approximately on the line 3—3 of Fig. 2.

Fig. 4 is an enlarged sectional view showing a punch of a different size substituted for the punch of the size that is shown in Fig. 2.

Fig. 5 is a side elevation of the retaining ring detached from the punch.

As shown, the portable punch in which the present invention is embodied is of the type dis-

closed in my said prior patents, No. 2,202,513 and No. 2,202,514, of May 28, 1940. The portable metallic frame 1 is generally of C-shape, terminating in axially alined portions 2 and 3. A die 4 is mounted in the end portion 2 and has a bore 5 therethrough. A threaded shaft 6 is screwed through a threaded hole in the end portion 3 of the frame for rotary and longitudinal movements. The shaft 6 may be equipped with a cylindrical head 7 formed with series of diametrical holes 8 and 9, as disclosed in my said Patent No. 2,202,513, or may be of other form such as that shown in my said Patent No. 2,202,514. In either instance, the shaft 6 may be forcibly rotated, and consequently moved longitudinally, by engagement of an appropriate actuator with the head 7 or other formation on the outer end of said shaft.

The shaft 6 is axially alined with the die 4 and with the bore 5 through said die. The inner end of the shaft 6 is formed with a coaxial bore or well 10 in axial alinement with the bore 5. A punch bit having a shank 11 rotatively mounted in the bore or well 10, has its end abutting against a bronze thrust bearing disc 12 seated in the bottom of said bore or well 10. The shank 11 is formed integral with a punch tip 13. A rounded or cavetto shoulder 14, which may be approximately a quarter-round, is formed at the union of the shank 11 and tip 13. The beginning of said shoulder 14 at the outer end of the shank 11 is approximately even or in alinement with an annular shoulder 15 at the outer end of the bore or well 10. That is, when the shank 11 is within the bore or well 10 and in abutting contact with the disc 12, the beginning of the shoulder 14 at the outer end of said shank 11 is even with the internal annular shoulder 15.

A retaining ring 16 has an internal rounded portion 17 at one end complementary to the rounded shoulder 14 on the punch bit. The retaining ring 16 has a non-screwthreaded outer peripheral surface fitting within an extension 18 of the shaft 6 beyond the open end of the well or bore 10. The extension 18 has a non-screwthreaded inner surface and receives and supports the ring 16 around the tip 13 of the bit in a relationship in which the rounded or ovolo portion 17 at the end of the ring 16 fits closely against the complementary rounded shoulder 14 at the union of the shank 11 and tip 13 of the bit.

A number of holes 19 are formed through the extension 18 in planes transversely of the plane of the axis of the shaft 6 and of the axis of the bore or well 10. Said holes 19 intersect and open into the cylindrical space in which the ring 16 is received. The ring is formed with peripheral grooves 20 complementary to the holes 19 and arranged to form wall portions of said holes when the ring 16 is properly located with its rounded end 17 fitting against the rounded shoulder 14, but not otherwise. Pins 21 are driven into the holes 19 and the complementary grooves 20 after the ring 16 has been properly located and assembled in connection with the bit and within the extension 18. These retaining pins 21 hold the ring 16 within the shaft 6, prevent rotation of said ring, prevent endwise displacement of said ring relative to the shaft 6 and the punch bit 11—13, and leave said punch bit 11—13 freely rotative relative to said ring and relative to said shaft 6.

From the foregoing, it is apparent that the present invention attains all of its intended objects and purposes in an effective and satisfactory manner. It eliminates the difficulties before mentioned, and substantially prevents breakage and distortion of the bit when said bit is subjected to the severe pressures, stresses and forces applied thereto when in use. All portions of the bit from the end of the shank 11 that abut against the bronze thrust bearing disc 12 to the outer or exposed end of the ring 16 are laterally supported and have contacting journal bearing either within the bore or well 10 or within the ring 16. The objectionable weakening of the bit by grooves, etc. within the shaft 6 is entirely obviated, as a consequence of which breakage and distortion of the bit under the pressures, stresses and forces to which it is subjected are avoided.

As indicated in Fig. 4, the invention is designed and adapted so that bits of various sizes may be mounted and used selectively and interchangeably in the same portable punch device. Bits having tips of different sizes and having shanks of uniform predetermined or datum size to fit within the bore or well 10, and provided with tips of sizes other than the size of the tip 13, may be optionally and interchangeably used. Each interchangeable bit has a shank 11 of the same size and length as the shanks of other bits that are provided for optional and selective attachment to the shaft 6. The rounded shoulder 14 of each of said interchangeable bits has its beginning in alinement with the shoulder 15 so that, when the part 22 is extended through the ring 16, the rounded inner end portion 17 of the ring 16 fits against the complementary rounded shoulder 14. That is, the shank 11 and rounded shoulder 14 of each interchangeable bit are of identical size and form, and the parts 22 of all interchangeable bits of reduced sizes fit within the ring 16, just as the complementary portion of the bit tip 13 fits within the ring 16, as clearly shown and as already explained. A bit tip 23 of reduced cross-sectional area is integral with the end of the part 22 of each interchangeable bit, a circumferential shoulder 24 being provided at the union of the part 22 and the reduced bit 23. Thus, all bits are identical with the exception of the size of the bit tip, and the presence of the rounded shoulder 24 formed on all bits having tips of less size than the maximum size.

The interfitting rounded shoulder 14 and rounded internal portion 17 positively prevent error in assembly of any bit on or in connection with the shaft 6. That is, it is essential that the rounded portion 17 of the ring be properly placed against the rounded shoulder 14 of the bit in order to aline the grooves 20 with the holes 19. Unless the grooves 20 are alined with the holes 19, said holes are blocked by peripheral portions of the ring 16, and the insertion of the retaining pins 21 is thereby prevented. Therefore, the invention comprises an embodiment of means for preventing error in assembling any of the interchangeable bits including the ring 16 and pins 21 on or in connection with the punch mechanism. The illustration and description of two bits of different sizes is sufficient to enable those skilled in the art to which this invention appertains to understand the extended range of bits of different sizes that may be used on the same punch mechanism, the means for preventing error in assembly, and the means for eliminating weakness in and consequent breakage of the bits.

It should now be apparent that this invention attains all of its intended objects and purposes in a highly effective and economical manner.

I contemplate such other variations than those specifically suggested as may be required to adapt the invention for its various uses, and as are within the scope of the appended claims.

I claim:

1. In a punch including a rotary and longitudinally movable screw shaft having a coaxial socket in one end thereof, and a tubular portion integral with and projecting from the end of said shaft around and having a greater internal diameter than said socket; a punch bit comprising a cylindrical shank journalled in said socket so that said screw shaft can rotate with respect to the punch shank, a cylindrical portion of less diameter and cross-sectional area than said shank integral with and extending outwardly through said tubular portion in axial continuation of one end of said shank, a punch tip having the same diameter and cross-sectional area as said cylindrical portion integral with and extending outwardly from axial continuation of the outer end of said cylindrical portion beyond the end of said tubular portion of said shaft, a circumferential shoulder at the union of said shank and said cylindrical portion approximately even with the union of said tubular portion with said shaft; a combined bearing and retaining ring for said bit mounted in said tubular portion around and forming a bearing for said cylindrical portion of said bit and having its inner end engaging said shoulder, and detachable elements in said tubular portion engaging and holding said ring from rotation with respect to the screw shaft in either direction and also from outward displacement.

2. In a punch including a rotary and longitudinally movable screw shaft having a coaxial socket in one end thereof; a punch bit comprising a cylindrical shank journalled in said socket for rotation relative to said shaft, a cylindrical portion of less diameter and cross-sectional area than said shank integral with and extending outwardly from axial continuation of one end of said shank, a punch tip integral with and in axial continuation of the outer end of said cylindrical portion, and a rounded cavetto groove shoulder at the union of said portion and said shank; a tubular portion integral with and projecting from the end of said shaft around and having a greater internal diameter than said socket; a combined bearing and retaining ring for said punch bit secured in said tubular portion around and forming a bearing for said cylindrical portion of said bit and having a rounded ovolo internal end portion complementary to and engaging against said shoulder to hold said bit from longitudinal displacement, and detachable elements in said tubular portion engaging and holding said ring from outward displacement.

3. In a punch including a rotary and longitudinally movable screw shaft having a coaxial socket in one end thereof; a punch bit comprising a cylindrical shank journalled in said socket so that said screw shaft can have rotation with respect to said punch shank, a cylindrical portion of less diameter and cross-sectional area than said shank integral with and extending outwardly from axial continuation of one end of said shank, a punch tip integral with and in axial continuation of the outer end of said cylindrical portion, and an annular shoulder at the union of said portion and said shank; a tubular portion integral with and projecting from the end of said shaft around and having a greater internal diameter than said socket and provided with a non-screwthreaded inner surface; a combined bearing and retaining ring for said punch bit having a non-screwthreaded outer surface fitting against said inner surface mounted in said tubular portion around and forming a bearing for said cylindrical portion of said bit and having an end portion complementary to and engaging against said shoulder to hold said bit from longitudinal displacement, and detachable elements in said tubular portion of said shaft engaging and holding said ring from rotation with respect to the screw shaft in either direction and leaving said punch bit so that said screw shaft and ring can rotate with respect to the punch bit.

4. In a punch including a rotary and longitudinally movable screw shaft having a coaxial socket in one end, and a tubular portion integral with and projecting from the end of said shaft beyond and having a greater internal diameter than said socket and provided with a non-screwthreaded inner surface; a punch bit comprising a cylindrical shank rotatively journalled in said socket, a punch tip integral with the outer end of said shank, a circumferential shoulder at the union of said shank and said tip, a combined bearing and retaining ring for said bit having generally a non-screwthreaded outer surface fitting against said non-screwthreaded inner surface in said tubular portion around and forming a bearing for said tip and having its inner end engaging said shoulder, and detachable elements in said tubular portion engaging and holding said ring from rotation with respect to the screw shaft in either direction and also outward displacement and leaving said bit so that said shaft and said ring are rotative relative to it.

DALE A. BENNER.