FIG. I

FIG. II

FIG. III

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METAL STAMPING DIE

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This invention relates to stamping dies, of the sort used to imprint distinguishing characters in metal bodies. Dies of this sort usually have square shanks at their forward end with cutting edges arranged to produce a character. The rear ends of the shanks present striker faces that receive blows to drive the cutting character into the surface of the metal.

In particular, my invention relates to stamping dies for marking bodies of hard metal, such as steel, the composition of which has been so hardened as to make it highly resistant to penetration. In order that stamping dies be capable of cutting clear and easily legible characters in metals so resistant to penetration, it has been necessary to use stamping dies which are harder than the metal on which they are used.

One specific problem with which I concerned myself is the stamping of armor plate having a hardness of about 40 to 50 on the Rockwell scale. The dies used for cold-stamping in such metal should therefore be hard in the order of about 60 to 64 on the Rockwell scale. When the nature of the work has required the use of dies coming within the higher hardness ranges, this requisite high order of hardness previously has caused serious difficulties. It has been past experience that a highly hardened die tends to chip badly, and even to break, under the blows of a hammer. Chipping causes at least such deformation of the rear, or striking, face of the die that it is impossible to cut characters of sufficient depth. As chips fly when broken from the die shank, they frequently cause injury to persons doing the stamping.

Even as concerns the stamping itself the problem presented by great hardness of the metal to be stamped is not wholly solved by providing a die substantially harder than the metal on which it is used. In using a metal-stamping die having a high order of hardness, and this is particularly so when the metal stamped is so hard as to present high resistance to penetration, the force of blows struck on the rear, or striker, face of the die shank is not transmitted properly to the cutting or stamping face of the die and to the work. Because of the great rigidity of a highly hardened die, it tends to bounce a hammer with which it is struck rather than to transmit and usefully to apply to the work the force of the hammer blows.

The primary object of my invention is to provide a stamping die which has a cutting, or stamping, face so hard that the die is capable of cold-stamping characters in metal bodies to the hardness of which the die is in superior order accommodated; coupled with such novel organization of the die structure as greatly to decrease probability of breakage, chipping, or other destructive effect of hammer blows in use of the die, and causes the die to act effectively in transmitting the force of hammer blows from its rear, or striker, face through the die shank to the cutting face of the die and to the work.

A further and corollary object of my invention is to obtain the properties above set forth, incorporated in a stamping die made to stamp characters in metal having the property of hardness in particularly high order, such as the armor plate stamping in which has been above discussed.

In the accompanying drawing:
Figure I is a longitudinal, sectional view through the center of a stamping die arranged in accordance with this invention.
Figure II is a plan view of the stamping die shown in Figure I.

My invention is based in part on the observed fact that a stamping die made of relatively mild steel, such as steel having a Rockwell hardness within the approximate range of 30 to 40, will absorb a blow and transmit it through the die shank and to a cutting edge at the other end of the shank without causing a rebound of the die or of the hammer that strikes it. My invention is also in part based on the fact that a striking surface of such softness will not chip when struck and that a shank so composed does not break readily.

Of itself, a soft shank is not suitable for use in a cutting tool used on highly hardened metal, as, under the severe impacts necessary to drive the cutting face into high-hardness metals, the soft shank mushrooms at its striking surface. Mushrooming at the rear, or striker, face of a stamping die is dangerous to the operator, in that it produces weak projecting flange portions on the end of the shank, which portions tend to fly forcibly when broken off during use of the die. Repeated grinding at the striker end of the die shank, to remove damaged metal, progressively shortens the die, and decreases its useful life. I am familiar with Patent No. 2,218,569 issued to Frank F. Mooney, and have had experience with dies made in accordance with the disclosure of that patent. I have found, however, that in making metal stamping dies, the shanks of which are highly hardened throughout their length, the striking hammer rebounds badly and...
the die shanks tend to fracture even though the organization disclosed in the Mooney patent be employed.

The structure shown in the drawing permits advantage to be taken of the desirable qualities of a soft striking body, while avoiding its disadvantages features.

Referring to Figures I and II, the shank of a steel stamping die designated generally by reference numeral 1 is provided with a forward and a rearward end, as shown in Figure 2. In the forward region 3 of the die shank 1, the steel of the shank is hardened, as for example, to about 60 to 62 Rockwell hardness. The forward, highly hardened region 3 of the die shank naturally includes the cutting edge or character 3 of the die and also shows the highly hardened region extending upwardly a substantial proportion of the shank length. This high hardness at the cutting end of the die, as has been explained, permits the die character to be driven into metal which is so hard as to present high resistance to piercing action. As explained, the cutting hardness of the die is relative with respect to the hardness of the metal in which the marking is cut or stamped. It is, however, an important aspect of my invention that this relatively greater cutting hardness of the die can be carried into the higher hardness ranges, such as the hardness range of 60 to 64 for the cutting hardness of the die, and even higher.

The rearward portion 4 of the die shank is substantially softer than the forward cutting end of the shank. I have discovered that a Rockwell hardness within the approximate range of 35 to 40 gives the above described desirable effects both in performance of the stamping and in resistance of the die to breakage and chipping. It is appropriate to a cutting hardness in the forward region 3 and character 2 both below and about the specifically named range of 60 to 64 Rockwell hardness. This diversity in the hardness properties of specified shank regions of the stamping die is obtainable in various ways known to those skilled in the tool-making art. One simple way of obtaining the desired effect is by a heat-hardening process, so controlled as to avoid glass hardness at the cutting end of the die, followed by a temper drawing and quenching operation performed solely on the region 6 of the die in which hardness in decreased order is desired.

In organizing my stamping die, I obtain the advantages of a relatively hard cutting region and a relatively soft striker region unattended by the disadvantages normally associated with those properties in a stamping die. This I do by binding protectively the relatively soft region of the stamping die shank. This protective binding in my stamping die takes the form of a sleeve element of suitable non-ferrous metal adequately integrated with the metal of the die shank at and adjacent the striker face on which it receives the blows of the striking hammer.

This sleeve element is included in the organization of my stamping die by reducing an extreme portion 5 of the relatively soft shank region 6 to a circular cross-section of lesser area than a cross-section through the major proportion of the shank length. This reduced portion extends downwardly from the rear or striker face 6 of the die, forms a shoulder 7 at its junction with the body of the die shank. Bonded to the metal of reduced shank portion 5 and shoulder 7, there is the protective binder sleeve 8, of suitable non-ferrous metal, surrounding the reduced shank portion 5 throughout its length but leaving the extreme end surface of the portion exposed.

Whereas various relatively tough and hard non-ferrous metals such as brass, silver, magnesium alloys and the like may be used for this element of the stamping die, it may be composed advantageously of a bronze of the harder and tougher sort, various formulae for which are known in the art of alloying copper. This protective sleeve element 8 has a welded bond with the metal of the die shank, so that it cannot be loosened in service by repeated hammer blows on the face 6 at the head of the die. This welded bond may be made by depositing metal from a welding wire at welding temperature, as by the use of electrical welding, a welding torch, or a metalizing gun.

In the organization of my stamping die, the rear end of the die shank is protected against chipping by its relative softness, and against mushrooming by the protective sleeve. It may be noted that although the sleeve gives adequate protection against mushrooming of a relatively soft striker face, and prevents chips broken from a relatively hard face from flying dangerously, such sleeve does not in any way prevent fracture analogous to chipping at the rear face of the die, if that portion of the die shank possesses a high order of hardness, such as hardness substantially exceeding 40 on the Rockwell scale. The relative softness of this portion of the die shank is thus cooperative with the sleeve in prolonging the useful life of the die. It includes also the improved transmission of marking forces which it provides. Reduction in the cross-section of the die shank in its portion 5 which forms shoulder 7, protects the weld between the sleeve 8 and the die shank against the effect of glancing blows, by permitting the sleeve to lie at least largely within the maximum lateral bounds of the shank and by providing backing for the sleeve against the shoulder.

Organized as above described, my stamping die is effectively usable to cut character or design on metal bodies, and in is exemplary of those which fall within the higher ranges of hardness, to cut characters in metal bodies, such as armor plates, which themselves have a high order of hardness. It is usable without the disadvantages and dangers met in using stamping dies which throughout their entire structure are either relatively hard or relatively soft, and has a useful life many times that of such other stamping dies.

Stamping dies in accordance with my invention may be used simply by holding them individually against the work by hand, and striking them as so held with a hammer. It is desirable, however, to mount a die or a plurality of dies in a frame which may be held against the work manually, and such frame is particularly advantageous when a distinguishing number which includes a plurality of digits is to be marked.

It is to be understood that many changes in the structural embodiment of my invention as herein shown and described may be made without going beyond the bounds of my invention as defined in the appended claims.

I claim as my invention:
1. A metal stamping die comprising a steel shank having a cutting end of greater hardness and a substantially softer rearward region including a portion of reduced cross-section ex-
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A metal stamping die comprising a steel shank having a cutting end of greater hardness and a substantially softer rearward region not substantially exceeding a Rockwell hardness of 40 including a portion of reduced cross-section extended forwardly from the rearward striker face of the die shank and terminating in a rearwardly presented shoulder at its junction with the main body of the die shank, and a sleeve of tough non-ferrous metal occupying the space within the bounds of the die shank delimited by the said rearwardly-presented shoulder and having a welded bond with the metal of the die shank therein.

3. A metal stamping die comprising a steel shank having a cutting end of greater hardness not substantially less than 60 in the Rockwell scale and a substantially softer rearward region including a portion of reduced cross-section extended forwardly from the rearward striker face of the die shank and terminating in a rearwardly presented shoulder at its junction with the main body of the die shank, and a sleeve of tough non-ferrous metal occupying the space within the bounds of the die shank delimited by the said rearwardly-presented shoulder and having a welded bond with the metal of the die shank therein.

4. A metal stamping die comprising a steel shank having a cutting end hard within the approximate range of 60 to 64 on the Rockwell scale and a substantially softer rearward region having hardness within the approximate range of 30 to 40 on the Rockwell scale including: a portion of reduced cross-section extended forwardly from the rearward striker face of the die shank and terminating in a rearwardly presented shoulder at its junction with the main body of the die shank, and a sleeve of tough non-ferrous metal occupying the space within the bounds of the die shank delimited by the said rearwardly-presented shoulder and having a welded bond with the metal of the die shank therein.

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