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BUTTON MANUFACTURE

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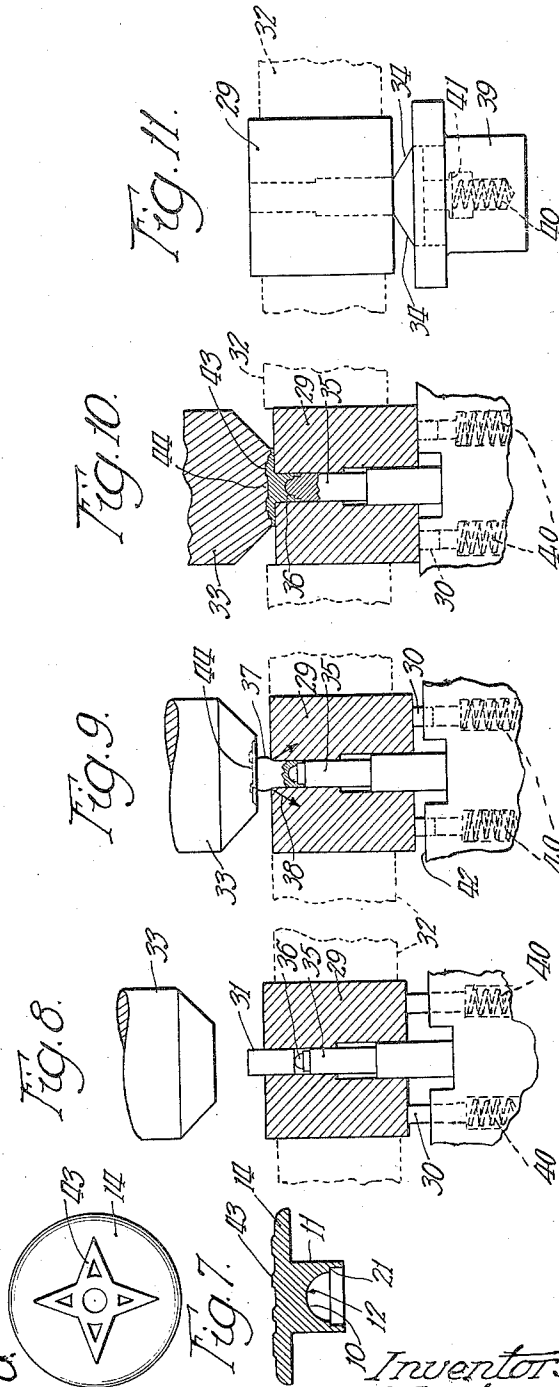
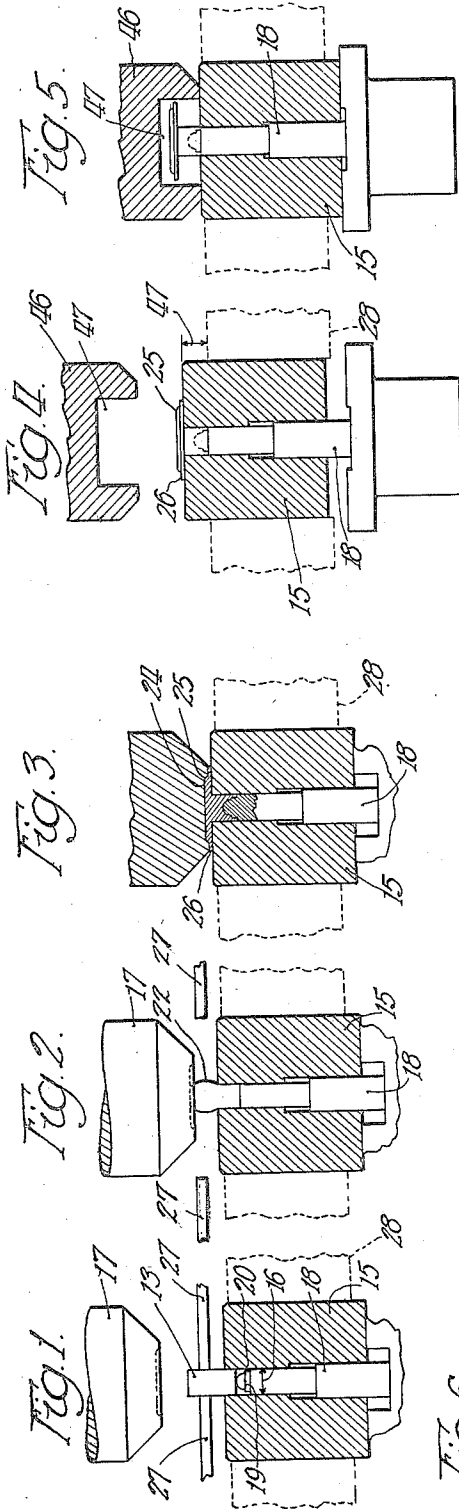


Fig. 6.

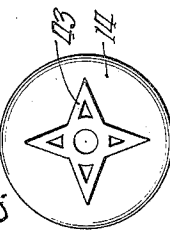


Fig. 8.

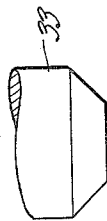


Fig. 7.

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BUTTON MANUFACTURE

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5 Claims. (Cl. 79—3)

This invention relates to the manufacture of solid metal buttons and, among other objects, aims to simplify manufacturing processes and reduce manufacturing costs.

5 The nature of the invention may be readily understood by reference to the processes of manufacture illustrated in the accompanying drawing and described in the specification.

In said drawing:

10 Fig. 1 is a section, more or less diagrammatic in character, through the forming dies and associated parts, showing the arrangement of the button blank at the beginning of the forming operation;

15 Fig. 2 is a similar view showing the blank in an intermediate stage of formation;

Fig. 3 is a similar view showing the relation of the dies upon completion of formation;

20 Fig. 4 is a sectional view of an arrangement for removing the finished button from the die;

Fig. 5 is a similar view of the same structure just after the removal of the button;

25 Fig. 6 is a plan view on an enlarged scale of one form of completed button having an embossed head;

Fig. 7 is a sectional elevation of the button;

30 Figs. 8, 9, and 10 are views similar to Figs. 1, 2, and 3 respectively, of a process in which the die surrounding the blank is moved relative to the blank during the forming operation to expose successively greater amounts of the blank to the heading operation; and

Fig. 11 is an elevation showing the die supporting riser and depressible riser cams.

35 Solid buttons made by the inventive process are characterized by a die recess or cup (e. g. the cup 10—Fig. 7) formed in the end of that portion of the blank providing the shank 11 of the button, which die cup serves to bend or upset the pronged attaching fastener. In the case of attachment by a double pronged fastener the prongs are bent or upset by the curved surface 12 of the die cup around a bar or its equivalent extending transversely across the die cup. Single pronged fasteners are upset directly or indirectly by the curved die surface 11 so that the prong cannot be withdrawn through the small opening into the die cup through which the fastener prong enters. In the case of single prong fasteners it is frequently desirable to place an insert or filler in the die cup so that a long prong will be held even though it is upset only for a short distance at its extremity. The fastener prongs are generally made of steel so as to penetrate without bending, any desired number of thicknesses of hard,

close textured cloth, and therefore require an equally hard or harder die surface to upset them. Aside from the advantage of low cost, by making the button from a solid steel blank an adequately hard die surface is provided by the die cup formed in the steel blank itself and without the addition of other elements which would be necessary to assist in upsetting a fastener prong if the button were formed of softer metal. On the other hand the formation of buttons from steel presents problems not encountered in the fabrication of the buttons from softer and more ductile metal.

In the illustrative method a rod-like blank 13 is cut from a soft steel rod (e. g. about $\frac{1}{4}$ " in diameter and having a carbon content of approximately .05 to .15 of 1%) whose diameter is substantially that intended for the shank of the finished button. The length of the blank cut is appropriate to the desired diameter of the head 14 of the finished button. In other words, the diameter of the button head may be governed largely by the selected initial length of the blank without materially altering the character of the forming operations or of mechanical devices employed therein.

25 The rod-like blank 13 of predetermined length is inserted in a die block 15 (Fig. 1) which in this instance is slightly greater in diameter than the diameter of the blank. For example, the internal diameter 16 of the die may be .2575 inch to receive a blank of a diameter of .25 inch. This relationship of diameters not only makes it possible to position the blank merely by dropping it in the die but also facilitates certain of the forming operations presently described.

35 The blank projects a substantial portion of its length from the end of the die 15 (see Fig. 1), the volume of the projecting portion of the blank being adequate to provide metal to form the head of the button. The diameter of the button head is determined in the present case largely by the volume of that portion projecting from the die. The balance of the length of the blank is confined within the die and held against substantial lateral expansion.

40 To form the button the exposed end of the blank is struck by a heading tool herein shown in the form of a reciprocating header 17 which may advantageously be carried on a slide or crosshead and driven by a crank. The initial impulse of the heading blow (see Fig. 2) results in the substantial formation of the die cup 10 in the opposite end of the blank by the die punch 18 whose end is shaped as at 19 to form the die cup. In this case the die punch is provided with a shoul-

der at 20 which forms the shoulder 21 just inside the rim of the cup and which serves to seat a transverse bar or other fastener prong engaging device to cooperate with the fastener in attaching the button. During the foregoing operation the blank moves slightly into the die as it forms over the end of the die punch 18, and this action is facilitated by the fact that the blank is slightly smaller than the die which enables the metal to move more easily over the end of the punch. As the die cup nears completion, the resistance builds up to such a point that the force of the header 17 is concentrated on the exposed portion of the blank (which now is somewhat shorter than the initial projection—see Fig. 1), to flatten and complete the formation of the head. During the initial partial formation of the die cup some lateral expansion of the exposed portion of the blank of course takes place, as shown at 22, Fig. 2, but this expansion is not so great as to interfere with the movement of the blank into the die to complete the formation of the die cup. As shown in Fig. 2, despite the enlargement of the projecting portion of the blank, there nevertheless remains a substantial downward component of force which carries down the metal and completes the formation of the cup. It should be understood that the distance between the end of the blank and the bottom of the punch is somewhat exaggerated in Fig. 2 to facilitate illustration. Upon completion of the die cup, the header encounters such a great resistance as to develop a very large force which is entirely concentrated upon the complete flattening of the head and the final formation of the button, see Fig. 3.

To hold the blank against dislodgment (if the die have lateral movement) and particularly to center the blank on the die punch, any appropriate blank holding device may be employed. A pair of fingers 27 are here shown engaging the blank from opposite sides to hold it square with the die and die punch. The fingers are withdrawn after the header has engaged the blank.

In the present instance the lateral expansion of the button head is unconfined and the thickness of the head is determined by the distance to which the header approaches the upper face of the die. In the case of steel the resistance to lateral expansion is so great that the close approach of the die will not result in such a rapid flow of metal that the head would be excessively thin, as might be the case in acting upon soft and ductile metals. Indeed, the steel itself affords protection against excessive thinning of the button head through faulty adjustment of the approach of the header, since resistance to further thinning of the button head below a thickness of approximately fifty-thousandths of an inch builds up so great as probably to absorb any excess energy in the header or result in causing the machine to yield. The approach of the header to the die may be adjusted to effect all practical or desirable changes in thickness of the button head.

The cold formation of the button hardens the formed surface 12 of the die cup so that it is substantially harder than the hardness of the original soft steel blank—soft steel has the property of being superficially hardened by cold forming operation of the character herein described.

Since neither the header nor the die limit the lateral expansion of the head of the button, the same dies may be used to make buttons of varying head diameters—using merely blanks of correspondingly varying lengths. The header face

however would require change in some instances. If in the larger headed buttons any irregularities occur in the diameter of the button head (particularly where the head is embossed with a design which is non-symmetrical relative to the button head), the button head may be sized or trimmed by appropriate sizing or trimming dies so as to provide a round head of accurate diameter. In that case it is desirable to make the button head slightly larger than desired by using a slightly longer blank. As here shown the face of the header is centrally recessed as at 24 to provide a button head with a rounded beveled upper margin 25 (a conformation desirable in trimmed button heads not covered with a decorative shell in order to avoid any sharp top edge produced by trimming) and the excess diameter of the button (to be trimmed off) occurs in a relatively thin rim 26, termed "flash" which may be more easily trimmed off. Because of the thinness of the rim the amount of metal in the "flash" is quite small. This arrangement also allows for unintentional variations in blank lengths, excess metal simply going into the "flash" without endangering the dies, and being trimmed off. Small headed buttons originally are sufficiently accurate not to require sizing, the unrestricted lateral expansion of the button head under the action of the header resulting in a remarkably true circular shape. The heading operation also results in the forming of a smooth, substantially polished, hard surfaced head with naturally rounded edges.

The foregoing method is not limited in its application to specific means, but may be performed as here shown in a dial or turret machine in which a series of dies 15 (generally a continuous circularly arranged series of dies) are carried in a dial or turret 28 and successively presented to or brought into register with the header 17; or the process may be performed by the single operation header type of machine in which alternate heading and charging and discharging operations are performed on a single die or gang of dies.

In Figs. 8 to 11 is illustrated a means and method for progressively exposing greater amounts of the blank to the head forming action of the header. As here shown the die 29 at the time of the heading operation is supported upon or brought into register with a yielding support in the form of spring-pressed cams 30 which raise the die 29 until only a small portion 31 (see Fig. 8) of the blank is exposed above the top of the die, the blank being mainly confined by the die against lateral expansion. For convenient operation the die or dies (if there be a plurality of them) are located in a turret 32 by which it (or they) may be brought into operative alignment with the header 33 and cams 30. The latter are provided with inclined approach surfaces 34 up which a die may ride to the position illustrated in Fig. 8. The die slidably fits in a hole or recess in the turret and is therefore movable relatively thereto under the action of the riser cams.

When the header 33 first strikes the exposed end of the blank its energy is initially employed substantially entirely in the formation of the die cup by the die pin or punch 35 whose upper end 36 is given the contour desired to be produced in the end of the blank. As here shown this contour is similar to that of the die punch 18. The initial confining of the major portion of the blank within the die insures that the button head formation will not progress substantially until ade-

quate force and energy have been transmitted to the die punch 35 to form the die cup completely and accurately. Thus the die cup is formed before the metal at the end of the blank has been made harder by the head forming operation. Aside from this however, the reverse sequence of formation (i. e. substantially forming the button head before forming the die cup) would require movement or flow of metal substantially through a right angle, that is from the head back into the shank of the button, something which if not impossible would require a tremendous force.

The length of the exposed portion 31 of the blank is somewhat greater than the length of the blank which moves into the die during the formation of the die cup. That is, the top of the blank never comes flush with the top of the die, but a small section remains projecting. Upon completion or substantial completion of the die cup, the resistance then encountered by the header results in the concentration of the forces to effect the lateral expansion as at 37 of the small residual amount of the blank still projecting from the die (see Fig. 9). Such lateral expansion develops downwardly directed forces (indicated by the arrows 38 in Fig. 9) which cause the die to be progressively stripped down over the blank against the yielding force of the springs supporting the riser cams, exposing successive increments of the blank to the head forming operation (see Figs. 8, 9 and 10) and resulting in a gradual spreading of the metal which minimizes the danger of splitting or cracking of the metal as the button head is flattened.

This progressive exposure of the blank also permits a greater initial concentration of energy on the formation of the cup (since the major portion of the blank is confined against spreading) and this insures the complete and accurate formation of the cup before any substantial flattening of the blank. If flattening of the head were premature, it would be much more difficult for reasons given above to continue or complete the formation of the cup or to insure uniformity in cup formation.

As here shown (Fig. 11), the riser cams are movably supported within riser blocks or supports 39 upon adequately heavy springs 40. Upward movement of the riser cams is limited by shoulder stops 41. The riser cam springs 40 are sufficiently strong to hold the die against downward movement except under the stripping action of the progressively expanding blank (see Fig. 9) which carries the die downwardly until it is arrested by engagement with the top face 42 of the support 39.

An analogous arrangement for effecting a progressive depression of the die under the lateral expansion of the blank may readily be embodied in the so-called header type of machine in which the header acts upon a single die or gang of dies instead of upon a succession of dies as in the turret or die machine.

When the downward movement of the die is arrested by engagement with its support 39, the final energy of the header is concentrated in the final flattening of the button head between the header and the upper surface of the die (see Fig. 10). In the present case, the thickness of the head is determined by the distance to which the header approaches the upper face of the die, the button head being permitted substantially free lateral expansion.

If it be desired to rabbet the under edge of the

button head rim to receive the crimped margins of the common metal covering shell, the upper face of the die may be recessed to provide a shoulder which forms the rabbet when the button head spreads to the edge of the recess. In that case the edge of the button head need not be beveled or rounded by the die, since even if a sharp edge be formed on trimming to size, it is covered by the shell.

Decorative or other embossing 43 may be formed directly in the steel head of the button by engraving or cutting in the face 44 of the header whatever design it is desired to impress or emboss in the button head. The embossing may be given a very substantial relief (see Fig. 7) entirely adequate for all purposes. As the blank is flattened it spreads over the surface of the head and progressively (as contrasted with simultaneously) receives the design from the header. Apparently the progressive formation of the button head contributes materially to the clarity, regularity and accuracy of the embossing, as well as the ease with which it may be effected as contrasted with forming letters or designs (particularly in relief) in a button head which has already been flattened. By this means, the button head may be appropriately decorated or branded with a desired trade-mark without the added cost of affixing a separate covering shell. The button may of course be given any desired metal plating or enamel coating to protect the metal and to improve the appearance of the button.

In Figs. 4 and 5 is illustrated a convenient means of removing the formed button from the die. This operation requires some care in the manner of its execution since the shank of the button has been expanded slightly and tightly fits the die. As here shown the die punch is elevated and in turn elevates the die above the turret a distance at least equal to the height of the button. While the punch is thus supported, the die is engaged by a stripping tool 46 whose face is recessed as at 47 to clear the button which forces the die down into the turret and strips it off the button which is then left flush with the top of the turret and may be removed by any appropriate means after the stripper is raised. Obviously this method of stripping the die may be employed not only in a turret apparatus but in header types of machines. Apparently this method of stripping the button imposes less strain on the die punch than would result from holding the die and striking the punch to eject the button.

Obviously the invention is not limited to the details of the illustrative methods and apparatus herein disclosed since these may be variously modified. Moreover, it is not indispensable that all features of the invention be used conjointly since various features may be used to advantage in different combinations and subcombinations.

Having described our invention, we claim:

1. The method of making solid steel buttons which is characterized by confining a rod-like blank of substantially the diameter of the shank of the finished button, leaving a portion of the blank substantially less than the volume of the button head projecting from the die, engaging one end of said blank with a cup forming die, striking the opposite end of the blank to form a die cup in the end of the blank, and leaving said die free to recede upon the progressive flattening of the projecting portion of the blank whereby the blank is gradually subjected to the flattening action.

2. The method of making solid steel buttons which is characterized by confining a rod-like blank of substantially the diameter of the shank of the finished button, leaving a portion of the blank substantially less than the volume of the button head projecting from the die, engaging one end of said blank with a cup forming die, striking the opposite end of the blank with a header to form a die cup in the end of the blank, and yieldingly supporting said die whereby the same may be stripped down to expose successive portions of the blank by the progressive expansion of the exposed portion of the blank.

3. The method of making solid steel buttons which is characterized by confining in a die a rod-like blank of substantially the diameter of the shank of the finished button, leaving a portion of the end of the blank from which the button head is to be formed projecting from the die, engaging the opposite end of said blank with a cup forming die, striking the projecting end of the blank with a heading tool having a design engraved therein to be embossed on the button head, leaving said die free to recede on the progressive flattening of the projecting portion of the blank, the blow delivered by said tool forcing the blank over said cup forming die to form a die cup and progressively flattening the opposite end of said blank over the face of said design so that the latter is progressively embossed in the button head beginning at the center of the head and proceeding outwardly to the rim of the button, said die serving to confine the shank of the button against substantial lateral expansion when the blank is struck.

4. The method of making solid steel buttons of the character described which is characterized by confining in a die a rod-like blank of cold steel which is incapable of being extruded and is of sub-

stantially the diameter of the shank of the finished button and while the blank is thus confined forcing the same longitudinally over a cup forming tool to form a cup in the end of said blank, said die serving to prevent lateral expansion of the blank therein which would interfere with the movement of the blank in forming the cup, thereafter causing a substantial portion of the opposite end of the blank to project from said die and while supporting the blank on said tool striking the said opposite end of the blank with a heading tool having a design engraved therein to be embossed on the button head and progressively flattening the opposite end of said blank over the face of said design so that the blank progressively is embossed with the design as the blank is increased in diameter during the flattening process.

5. The method of forming solid steel buttons from rod-like blanks of cold steel incapable of being extruded, said method being characterized by forcing one end of the blank over a cup forming tool to form a cup in said end of the blank and during the aforesaid cup forming operation surrounding a substantial portion of said blank with a die so as to prevent lateral expansion of said portion of the blank in order first to concentrate the forming energy in the formation of the said die cup and thereby to effect the formation of the die cup before any substantial flattening of the opposite end of the blank, and thereafter flattening said opposite end when the blank presents resistance to further movement upon the completion of the die cup, said flattening being continuous to form a relatively thin button head of substantial diameter relative to the diameter of the shank of the button.

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