

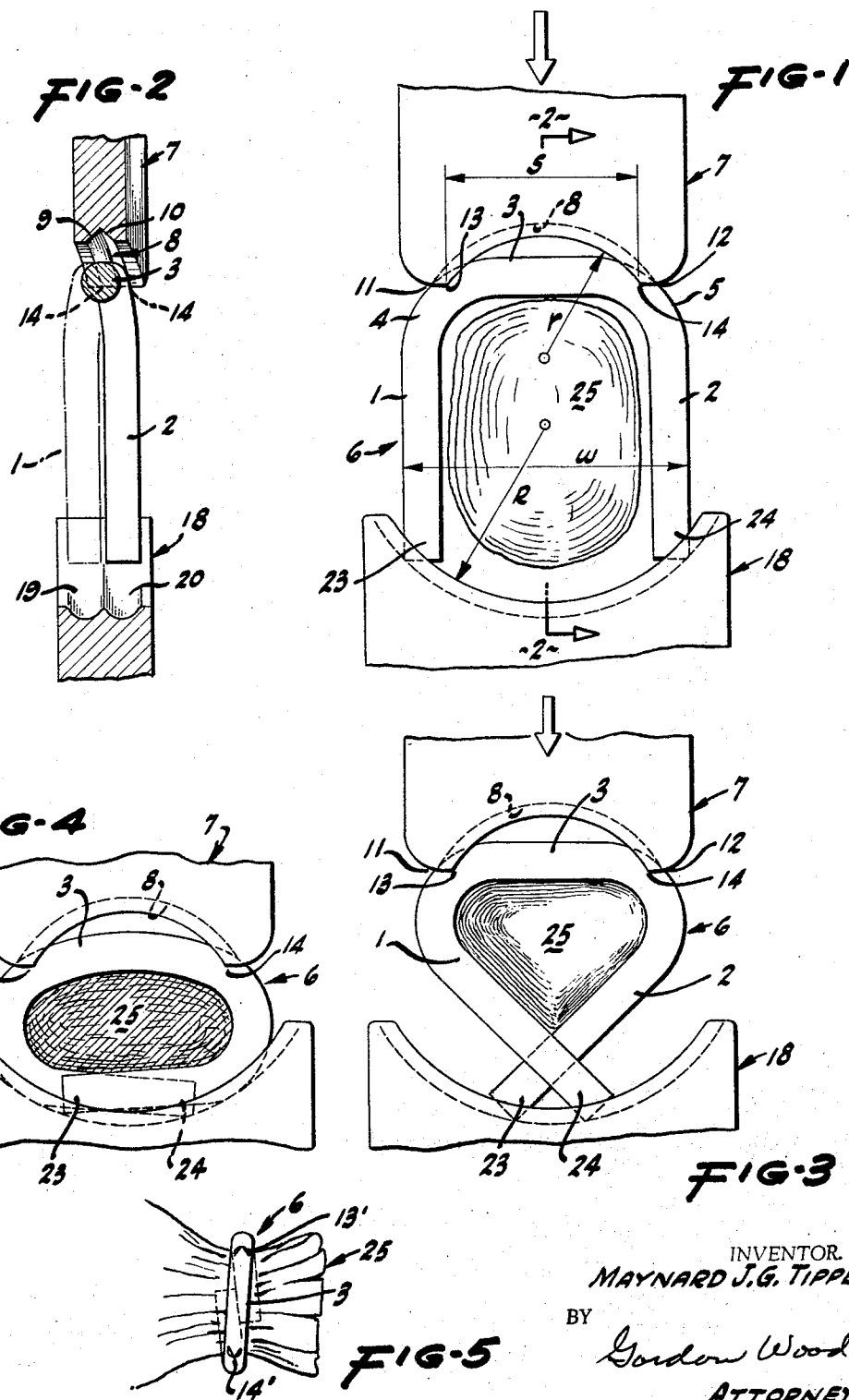
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METHOD OF APPLYING CLIPS

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METHOD OF APPLYING CLIPS

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This invention relates to a method of applying a closure or seal to articles such as the ends of flexible casings and is a continuation-in-part of Serial No. 262,761, filed March 4, 1963, now abandoned, Serial No. 367,536, filed May 14, 1964, now Patent No. 3,210,835, and Serial No. 380,260, filed June 30, 1964, now Patent No. 3,224,083.

The main object of the present invention is the provision of a method of achieving an effective seal around a casing or the like and especially when it is required to effect an airtight seal such as is essential in those applications wherein a foodstuff is sealed in a flexible plastic bag and the air evacuated therefrom. It will be understood in this connection that a closure which is satisfactory for gathering and closing off the end of a bag or casing may not provide the tightness required when it is necessary to maintain airtightness as in vacuumized casings, bags and the like.

The present invention is concerned with the type of operation shown generally in the above cited applications wherein a generally U-shaped staple or clip is mechanically wrapped around the article to be sealed and wherein the free ends of the legs of the clip pass each other during the clenching operation and are finally disposed in side by side relation. This type of closure, which is essential to effect a high degree of airtightness, is referred to herein as a "cross over" clip.

Another object of the invention is the provision of a method including a clip of special design which is deformed in a predetermined exact manner so as to provide, at intermediate points in its deformation, a substantially uniform tightening effect around the article to be sealed. It will be understood in this connection that in the case of plastic casings the plastics presently being used are extremely tough and resilient and offer a tremendous amount of resistance to deformation and compression. By the present invention intermediate shapes are given to the clip which achieve a kind of garrotting effect so that the resisting pressure of the folds of the plastic casing end tends to act uniformly radially outwardly against the encircling form given to the clip. In this manner a more effective compression action results creating a seal that is less likely to leak. After the tightening effect of the clip on the plastic casing has been achieved and relatively great radially inwardly directed forces are applied thereto, the clip is then deformed further by flattening the same thereby considerably reducing the cross sectional area bounded by the clip and thus enhancing the compressive forces exerted on the plastic. This method of deforming the clip not only results in an equalization of the forces applied to the plastic but also ensures that optimum sealing is achieved.

Other objects and advantages will be apparent from the following specification and from the drawings.

FIG. 1 is a semischematic side view showing a punch and die constructed in accordance with the present invention with the clip interposed therebetween at a point at which the clip is merely engaged by the punch and die but no force is being applied thereto.

FIG. 2 is a vertical cross section through the apparatus of FIG. 1 showing the construction of the punch and die.

FIG. 3 is a view similar to FIG. 1 showing the clip

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surrounding a gathered casing and in an intermediate deformed position.

FIG. 4 is a view similar to FIG. 3 showing the relative relationship of parts when the clip has been deformed to its final flattened condition.

FIG. 5 is a fragmentary side elevation of a casing and showing the clip applied thereto.

The undeformed clip 6 of the present invention is shown in FIG. 1 and it is seen that the same comprises a pair of opposed legs 1, 2 which are connected together at one of their corresponding ends by a crown 3 joined to said legs by curved junctures 4, 5. The legs 1, 2 are straight and may be considered parallel except that it is preferable that they flare outwardly slightly at their free ends to facilitate passage of the clip along the feed track (not shown). The crown piece 3 is straight and may be considered perpendicular to the axes of legs 1, 2. The junctures 4, 5 are formed to a relatively sharp radius but one that is sufficiently large so as not to distort the wire excessively during the bending operation of forming the clip. The clip is preferably cold worked to the shape shown.

The punch generally designated 7 is formed at its leading end with a V-shaped groove 8 having perpendicularly intersecting sides 9, 10 as shown in FIG. 2 and the longitudinal extent of the outer side of said groove 8 is formed to a radius "r" as indicated in FIG. 1. Outwardly of the grooved portion of the punch 7 are laterally extending shoulders 11, 12 which intersect groove 8 at pairs of relatively sharp points 13, 14 (FIG. 2). It will be noted that the geometry of the groove 8 and the clip that cooperates therewith is such that four pressure points are established insofar as the engagement of punch 7 with the clip is concerned. These points are points 13 adjacent shoulder 11 and points 14 adjacent shoulder 12. It will be apparent that this structure provides an effective and stable connection between the punch 7 and the clip 6 as the latter is translated along the track toward the die indicated generally at 18.

The die 18 is formed with a pair of adjacent parallel grooves 19, 20 of arcuate cross section (FIG. 2) which are formed along their lengths to a radius indicated at R (FIG. 1). It is important that the spacing between the grooves 19, 20 be substantially equal to the diameter of the wire from which the clip 6 is formed. By this structure, when the free ends of the clip cross over during the clenching operation, they are disposed in closely adjoining side by side relationship to effect maximum strength. From FIG. 1 it will be apparent that as punch 7 urges the clip 6 toward die 18 the free ends 23, 24 respectively of the legs 1, 2 are urged toward each other because of the curvature of the grooves 19, 20 so as to effect the general shape shown in FIG. 3. At this point it will be noted that the legs 1, 2 of the clip 6, in addition to encircling the casing 25, also raise the latter to ensure against interference of the ends of the legs with the casing. As pressure is continued to be applied by punch 7, the closed ring formed by clip 6 becomes smaller in lateral extent until the radially outwardly directed forces of resistance of gathered casing 25 equals the inwardly directed forces applied thereto by the clip tending to shape the clip to a circular form. Thereafter, further movement of punch 7 toward the die 18 results in the clip being flattened to the position of FIG. 4 so that the area encircled by the clip is considerably reduced. This reduction in the area encircled by the clip naturally results in a considerably greater amount of sealing effect being imparted to the article 25.

It will be noted that the clip is "self adjusting" with respect to the casing in that the density of the gathered material becomes uniform throughout its cross sectional extent in response to the deformation of the clip, even

when clips of the same size are employed to encircle different amounts of casing material.

The cross sectional shape of the casing 25 shown in FIG. 1 is defined by slots in a pair of side plates (not shown) on opposite sides of the die 18. The main function of said slotted side plates is to prevent interference between clip and casing during the steps described herein.

It is essential to note that the behavior of the clip 6 as above described is attributable in greatest part to the proportions of the clip. In this connection and as a result of tests with clips of various sizes and appropriate punches and dies associated therewith it has been found that the overall width "w" of the clip, that is, the distance between the oppositely outwardly facing sides of legs 1, 2, should be in a range of 60 to 70 times the area of the wire from which the clip is formed. It will be apparent that a clip having too small a width does not have the flexibility required to deform the same by the above described process. If the width of the clip is too great buckling of the legs and crown takes place in an independent manner so that various portions of the clip do not act as a unit to form the closed ring shown in FIG. 3 but rather act independently and cannot be controlled by the simple apparatus preferably used. The overall length of the clip between the crown 3 and the free ends 23, 24 of the legs 1, 2 should be at least slightly greater than the width "w" but such length may be increased to some extent for articles of greater girth without impairing the sealing effect to any considerable degree.

One of the most important features of the above described apparatus is the provision of the pressure points 13, 14 established by the punch, and the geometry of the associated parts so that the spacing "s" between the two pairs of pressure points is equal to two-thirds of the overall width "w." In other words, the width "w" should be in the order of 50% greater than the spacing between the pressure points.

Another important dimension that should be controlled in order to achieve the desired effect is the radius R of the grooves 19, 20 of the die 18. Assuming that the clip 6 is proportioned as above noted, the radius R should be in the order of 35 to 45 times the area of the wire from which the clip 6 is formed. By designing the die to fit within these limits, the oppositely inwardly directed movement of the free ends 23, 24 is ensured so that the article may be completely encircled with the opposite end portions of the clip lying alongside each other.

The following table shows the salient dimensions (in inches) of some different sizes of clips and the associated dimensions of the punch and die as related to FIG. 1 and as constructed in accordance with the present invention.

	Clip 1	Clip 2	Clip 3
Wire diameter.....	.060	.118	.149
Cross sectional area of wire (A).....	.0064	.011	.0174
Width (w).....	.436	.687	1.18
Punch radius (r).....	.281	.313	.500
Die radius (R).....	.286	.437	.787
w/A.....	68.2	62.4	67.8
R/A.....	43.8	39.7	45.2

It is important to note that the intermediate shape of clip 6 as shown in FIG. 3 contributes to an effective seal in that radially inwardly directed forces in all directions

are applied to the article 25 so as to equalize the latter before the final squeezing operation of FIG. 4 takes place.

In FIG. 5 it will be noted that when assembled with the casing 25 the crown 3 of clip 6 is indented as indicated at 13', 14' by the pressure points 13, 14 respectively. Such indentations enhance the stability of the clip with reference to the punch and die as the clip undergoes the deformation above described.

The above very specific description of the preferred forms of the invention is not to be taken as restrictive as it will be apparent that various modifications in design may be resorted to without departing from the scope of the following claims.

I claim:

1. The method of forming a seal around a flexible resilient article by means of a generally U-shaped clip comprising the steps of:

providing, in straddling relation with said article, a generally U-shaped clip having a pair of opposed generally parallel legs and a relatively straight crown connecting corresponding ends of said legs with the junctures of said crown and legs formed to arcs of a circle,

engaging the crown of said clip at said junctures with a punch having a pair of spaced pressure points registering with said junctures at points inwardly of the oppositely outwardly facing sides of said legs,

deforming said clip by engaging the free ends of the legs of said clip with a die having a pair of parallel side-by-side grooves formed along their lengths to arcs of a circle and respectively receiving one of said ends therein, urging said punch and die toward each other thereby constraining said free ends to move toward each other along adjacent spaced parallel circular paths of travel, whereby said clip is deformed to the shape of a generally circular ring with the free end portions of said legs in side by side relation,

continuing to urge said punch and die together until said ring is partially flattened and simultaneously permitting said crown to bow outwardly between said pressure points in response to the resisting pressure of said article.

2. Method according to claim 1 wherein said die grooves are each formed to a radius in the order of from thirty five to forty five times the cross sectional area of the wire of the clip.

3. Method according to claim 1 wherein the spacing between said pressure points is about two thirds of the overall width of said clip between the oppositely outwardly directed sides of said legs.

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