Jan. 3, 1967 E. C. JACOBS 3,295,351

SELF-ADJUSTING STRIPPING FINGERS

Filed April 23, 1964 2 Sheets-Sheet 1

Fig. 1

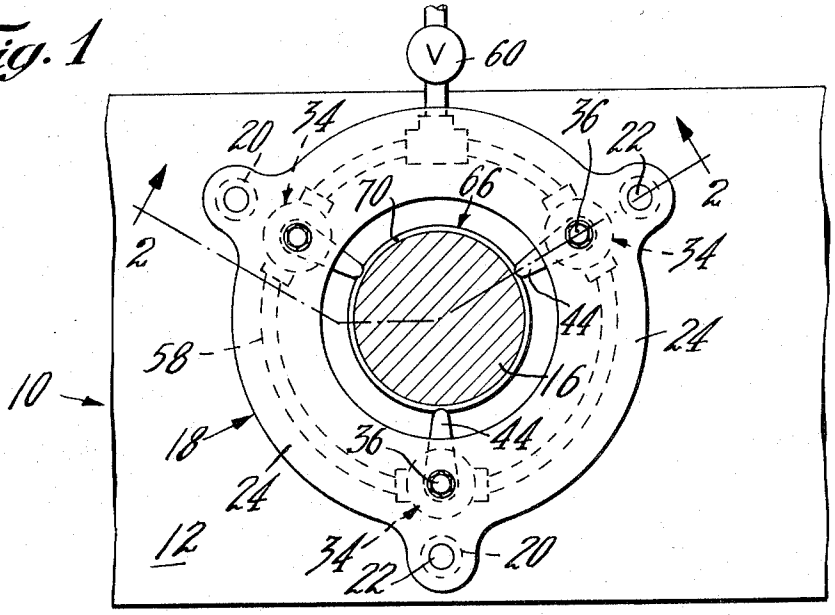
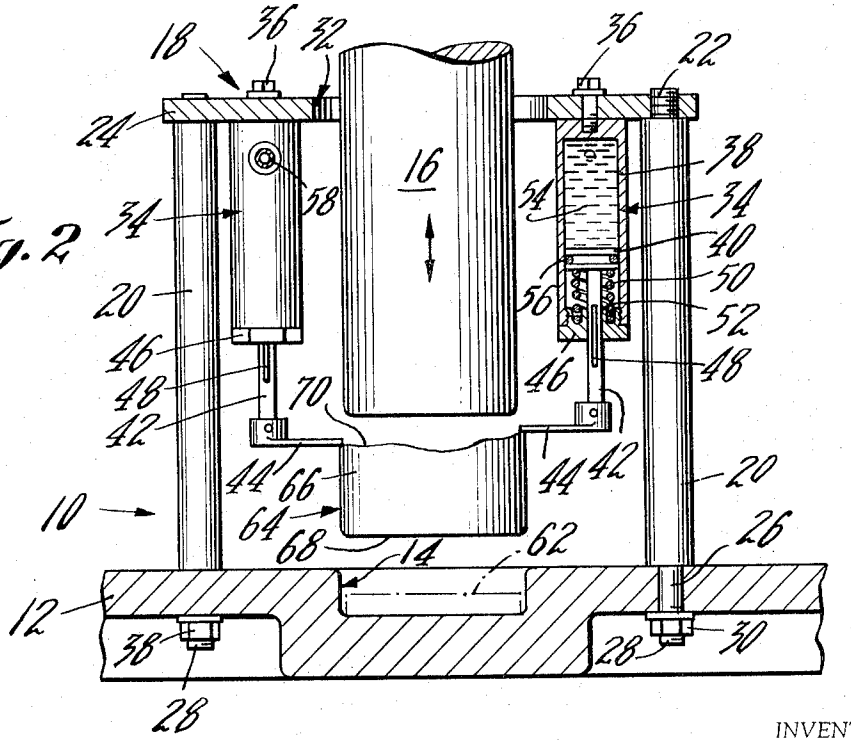



Fig. 2




INVENTOR.
EDWARD CHARLES JACOBS
BY
Donald A. Kaul
ATTORNEY

Jan. 3, 1967 E. C. JACOBS 3,295,351

SELF-ADJUSTING STRIPPING FINGERS

Filed April 23, 1964 2 Sheets-Sheet 2

Fig. 3

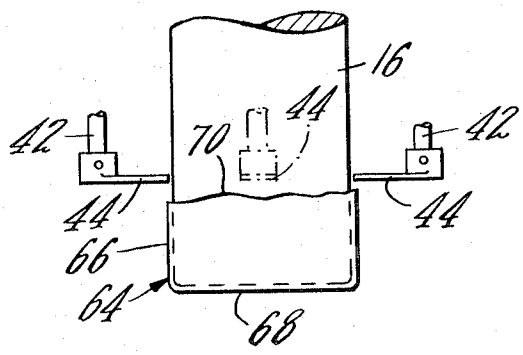
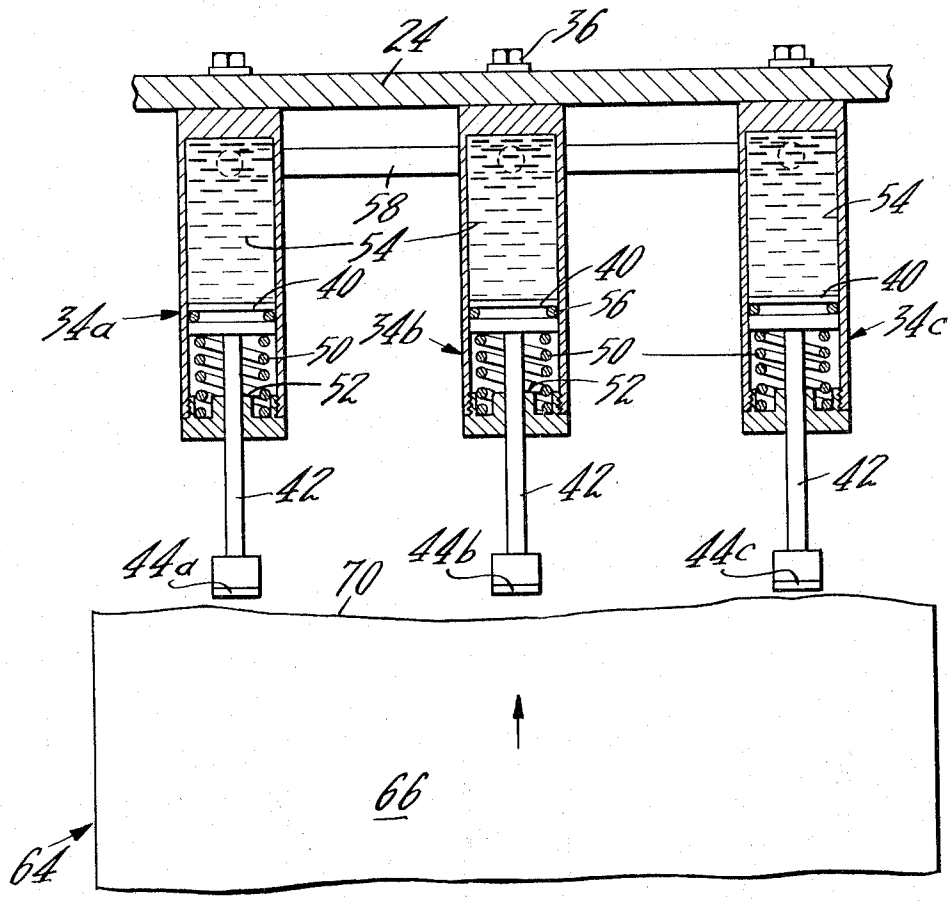



Fig. 4




INVENTOR.
EDWARD CHARLES JACOBS
BY
Donald A. Kaul
ATTORNEY

United States Patent Office 3,295,351 Patented Jan. 3, 1967



3,295,351

# SELF-ADJUSTING STRIPPING FINGERS

Edward Charles Jacobs, Wauconda, Ill., assignor to American Can Company, New York, N.Y., a corporation of New Jersey

Filed Apr. 23, 1964, Ser. No. 361,941
6 Claims. (Cl. 72—344)

This invention relates to an apparatus of the type wherein a metal shell is formed upon a punch and wherein stripping fingers are provided for removing the shell from the punch and more particularly it relates to a plurality of self-adjusting stripping fingers.

In the manufacture of extruded tubular metallic articles such as containers, it is common practice to initially provide the metal in the form of a slug which is placed in a shaped die cavity. A shaped punch is juxtaposed to the die in alignment with the cavity. When the punch and die are moved relative to one another with sufficient speed and force, the punch enters the die cavity and strikes the metal slug, thus causing the slug to flow around the punch to form a "shell" thereon. That portion of the metal which flows upward along the shank of the punch comprises the side walls of the shell and that portion of the metal which remains trapped between the end of the punch and the bottom of the die cavity comprises the end wall of the shell.

The above-described extrusion process and conventional drawing produce a container or shell having generally smooth and satisfactory end and side walls; however the terminal edges of the side walls, which form the top edge of the shell, are usually non-uniform and non-planar. This is often referred to as being an "irregular profile" at the upper end of the shell and this irregular profile is created by the fact that one portion of the side wall may flow slightly higher on the shank of the punch than the portion immediately adjacent it. The result is a top edge formed of small interconnected irregular peaks and valleys which create an undulating formation which comprises the irregular profile.

In the subsequent formation of the shell into a finished container body, the irregular profile is suitably machined into a smooth top edge. However, before such machining can take place, it is necessary to remove the shell from the punch, and this removal operation has heretofore been a problem. The conventional way of removing an extruded shell from the punch has been to utilize some form of stripping members which come into engagement with the shell as the punch retracts or moves relatively away from the die cavity and which apply pressure to slide the shell off of the punch. Attempts were made to utilize stripping fingers to accomplish such a removal operation and to have such fingers engage the top edge or profile of the shell, but due to the fact that this top edge usually had an irregular profile, the fingers tended to tip or cock the shell and thus caused it to stick or bind on the punch. Other types of stripping members, such as jaws to engage the opposite side walls of the shell, required the use of auxiliary actuating mechanism and thus were more expensive, more complicated and generally less satisfactory than stripping fingers.

It is, therefore, an object of the present invention to overcome the difficulties and deficiencies associated with the prior art and to provide an improved stripping mechanism for a shell on a forming punch.

Another object of the present invention is to provide stripping fingers in an apparatus for removing an extruded article from the punch element and for accomplishing such removal without causing the article to bind or stick upon the punch.

Another object of the present invention is to provide stripping fingers which are self-adjusting and self-leveling and thus capable of engaging an uneven or irregular profile on the upper edge of an article and which are suitably interconnected so that no removal of the article can occur until all fingers are in engagement with the upper edge.



Numerous other objects and advantages will be understood from the following description, which, taken in connection with the accompanying drawings, discloses a prefered embodiment thereof.

The foregoing objects are attained by providing spaced stripping fingers disposed about the periphery of a shell forming punch and adapted to engage the upper edge of an article formed upon the punch. Each of the stripping fingers is mounted upon one end of a piston rod and the piston at the opposite end of the rod is reciprocable with a cylinder. All of the stripping finger pistons are spring biased to an equal height and all of the stripping finger cylinders are completely filled with hydraulic fluid above this height. The cylinders are interconnected to one another to permit hydraulic fluid flow from one into the others.

When the conventional extrusion or drawing operation takes place, an article having an uneven upper edge is formed on the punch. After the article is completed, the punch is moved relatively to the spring fingers to bring them into contact with the upper edge of the article. When the first spring finger engages the highest spot on the uneven upper edge, it is pushed upward by this edge thereby moving its interconnected piston upward in its associated cylinder. This upward piston motion causes hydraulic fluid to be transferred out of the cylinder and into the other cylinders, thus pushing their pistons and interconnected spring fingers downward toward the upper edge. When a second spring finger contacts the upper edge, it too rides upward, thus transferring fluid to any remaining cylinders and moving their spring fingers down toward the edge. Finally, when all of the spring fingers have engaged the upper edge of the article, continued relative movement causes the article to be stripped axially off the punch without any cocking or binding. When the article has been removed, the springs beneath each piston bias their associated pistons back to their original positions, thus leveling the fingers and preparing them for a new stripping operation.

Referring to the drawings:

FIGURE 1 is a plan elevational view of the stripping fingers and punch in accordance with the principles of the present invention;

FIGURE 2 is a sectional view taken substantially along line 2—2 of FIGURE 1 and illustrating the fingers stripping an extruding article from the punch:

FIGURE 3 is a fragmentary view of the article on the punch just prior to engagement of the stripping fingers; and

FIGURE 4 is a developed view, partly in section, of the stripping fingers and their manner of sequential engagement with the article upper edge.

As a preferred or exemplary form of the present invention, FIGURE 2 illustrates an extrusion apparatus generally designated **10** and having a die member **12** with a cavity **14** therein and a punch member **16** juxtaposed above the cavity, and being of a slightly smaller cross-sectional size than the cavity. Either the die member **12** or the punch member **16**, or both, are suitably affixed to reciprocable platens, not shown, which permit the said members to be reciprocated relative to one another. As a result of such reciprocation, the punch member **16** selectively enters into the die cavity **14**.

A stripper mechanism generally designated **18** is mounted in spaced juxtaposition to the die member **12** by means of three equally spaced posts **20** which are disposed about the periphery of the die cavity **14**. One end of each post **20** is threaded, as shown at **22**, for mating

engagement with an associated threaded aperture in a stripping finger mounting plate 24. The opposite end of each post 20 is reduced in diameter, as shown at 26, and is positioned within a similarly sized aperture in the die member 12. The end of the reduced diameter portion 26 is provided with threads 28 which are adapted to receive a nut 30 which engages the post to the apparatus 10.

The mounting plate 24 is provided with a central aperture 32 of a size large enough to freely accommodate the punch member 16. A plurality of stripping fingers units generally designated 34 are disposed about the periphery of the aperture 32 and are affixed to the undersurface of the mounting plate 24 by means of mounting bolts 36. Each unit 34 is formed of a cylinder 38, a piston 40 reciprocable within the cylinder 38, a piston rod 42 depending from the piston 40 and projecting downwardly beyond the end of the cylinder, and a stripping finger 44 mounted on the downwardly projecting end of the piston rod 42. The cylinder 38 is provided with a removable lower end 46 which is threadably engaged with the remainder of the cylinder body and within this lower end, a groove or slot (not shown) is provided for accommodating a raised ridge or integral key 48 formed on the piston rod 42. This key and slot cooperate to prevent rotation of the piston rod 42 and thus assure that the stripping finger 44 always extends radially toward the punch member 16, as shown in FIGURE 1.

A compression spring 50 is located within each unit 34 surrounding the piston rod 42 and extending between the end 46 and the undersurface of the piston 40. The lower end 46 of the cylinder 38 is provided with at least one internal shoulder 52 extending upward toward the piston 40. The purpose of this shoulder 52 is to provide a stop or seat for the piston 40, and between this piston seat and the base of the end 46, space is provided for the spring 50 to be completely compressed without being crushed and deformed by the piston 40.

Above the piston 40, the cylinder 38 is completely filled with some suitable hydraulic fluid medium 54, such as oil, water, or other similar liquids. A suitable seal, such as an O-ring 56, is provided between the sides of the piston 40 and the walls of the cylinder 38 to assure that the fluid 54 will not leak past the piston and into the lower spring-containing portion of the cylinder. The various cylinders 38 are interconnected to one another by conduit means 58, as shown in FIGURE 1, and in normal operation each cylinder is filled with the same volume of fluid 54 and the conduit means 58 is likewise completely filled with fluid. Thus, any upward movement of a piston 40 will necessarily result in some fluid being forced out of its associated cylinder and into the remaining cylinders. This causes the pistons in these remaining cylinders to move downward and it will thus be appreciated that any movement of one piston 40 will result in substantially simultaneous responsive movement of the other pistons 40. A valve 60 can be provided in the conduit means 58 for connecting the conduit means and cylinders to a suitable source of hydraulic fluid 54. In normal operation, the valve 60 is closed to prevent any back-flow of the fluid 54.

In performing the extrusion operation, a pellet or slug 63 of aluminum, or other suitable article-forming material, is placed within the die cavity 14. As previously indicated, the die member 12 and the punch member 16 are reciprocable relative to one another. In the preferred form of the invention, the die member 12 is fixed and the punch member 16 is movable, but the reverse can be true without departing from the spirit and scope of the present invention. The punch member 16 is driven into the die cavity with sufficient force and speed to cause the slug 62 within the cavity to flow upward along the shank of the punch 16 to form a tubular article generally designated 64. The article has side walls 66 which are formed along the punch shank and a bottom wall 68 which is formed between the bottom of the punch and the bottom of the cavity. The upper edge of the side walls 66 is designated 70 and forms the upper profile of the article 64.

As can be seen in FIGURE 3, the article 64 remains adhered to the punch 16 after the punch retracts from the die cavity 18. Further movement of the punch 16 causes the stripping fingers to engage the upper edge 70 of the article 64 and as the punch continues to move relatively past these fingers, the fingers serve to strip or slide the article off the punch, as shown in FIGURE 2.

As can be seen in FIGURES 2 through 4, the upper edge 70 is shaped irregularly and as a result, the various stripping fingers 44 do not simultaneously come into engagement with this edge. If the stripping fingers 44 were fixed and non-movable, the one that would come into first engagement i.e., that finger aligned with the highest profile portion, would immediately apply pressure to strip the article 64 from the punch 16. This would cause the article to tip or cock slightly on the punch and the edge portion opposite the finger-engaged edge portion would tend to bite into the shank of the punch, with the result that the article 64 would become stuck or bound upon the punch.

To prevent such a condition from occurring, the stripping fingers are interconnected as described, so that when pressure is applied, it is simultaneously applied by all fingers. This can be best described in connection with FIGURE 4 wherein the stripping finger units are identified as 34*a*, 34*b* and 34*c* having respectively stripping fingers 44*a*, 44*b* and 44*c*. It can be seen that prior to engagement with the edge 70, all pistons 40 and thus all stripping fingers 44 are held at the same height or level by means of the springs 50. Above the pistons 40, each unit and their interconnecting conduit means 58 is completely filled with hydraulic fluid 54.

As the article 64 moves upward toward the fingers, the highest portion on the profile 70 is beneath the finger 44*c*. When this profile portion engages the finger 44*c*, it causes the finger to move upward, thus forcing fluid out of the unit 34*c* and into the other units 34*a* and 34*b*. This causes the fingers 44*a* and 44*b* to move downward toward the edge or profile 70. The next finger to engage the edge is 44*a* and after such engagement the finger 44*a* is moved upward by the edge 70. This causes fluid 54 to flow out of the unit 34*a* and since such fluid cannot enter unit 34*c*, which is itself expelling fluid, all such fluid enters unit 34*b* thus forcing finger 44*b* downward toward the edge 70. When finger 44*b* finally engages the edge 70, all three fingers are in engagement with the edge, and further movement of the article 64 is prevented since the fingers now are applying equal pressure about the shank of the punch. Thus, as the punch 16 moves further, the fingers cause the article 64 to strip or slide off its shank, as shown in FIGURE 2. Once the article has been stripped or removed, the springs 50 cause all three fingers to again return to the same level, as shown in FIGURE 4, and a new extrusion operation can commence.

It is thought that the invention and many of its attendant features will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction, and arrangement of parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In an apparatus having a relatively movable punch member upon which an article is formed:

a plurality of stripping fingers disposed about said punch member for engagement with said article; and

means interconnecting said stripping fingers whereby directional movement of any one of said fingers causes responsive opposite directional movement of

at least one of the remaining fingers to thus cause all fingers to be in engagement with said article before said fingers apply pressure to strip said article from said punch member.

2. In an apparatus having a relatively movable punch member upon which an article is formed:

a plurality of stripping finger units spaced equally about said punch member;

said stripping finger units each including a cylinder, a piston reciprocable within said cylinder, and a stripping finger attached to said piston;

said stripping fingers extending radially toward said punch member for engagement with said article;

said cylinders being interconnected to one another by conduit means;

hydraulic fluid filling said conduit means and each of said cylinders on one side of said pistons;

said stripping fingers being movable upon engagement with said article to cause said pistons to move within their respective cylinders and to transfer fluid through said conduit means until all of said stripping fingers are in engagement with said article whereby said article is stripped from said punch member.

3. An invention as defined in claim 2 but further characterized by biasing means within each of said cylinders normally biasing said pistons toward said hydraulic fluid.

4. An invention as defined in claim 2 wherein said stripping fingers are attached to said pistons by means of piston rods which depend from each piston and project beyond the end of said cylinder for engagement with said stripping fingers.

5. An invention as defined in claim 2 but further characterized by means for preventing rotation of said stripping fingers.

6. An article forming apparatus comprising:

a die member having a cavity therein;

a punch member movable relative to said die member and dimensioned to fit within said cavity;

said cavity being adapted to receive a slug of material which, when struck by said punch member, forms and article which adheres thereto; and

means for stripping said article from said punch member;

said means including a plurality of stripping fingers



spaced equally about the periphery of the punch member, extending radially toward said punch member, and adapted to engage the upper edge of an article adhered to said punch member;

said means also including piston and cylinder means mounting each of said stripping fingers;

said piston and cylinder means including an elongated tubular cylinder having an aperture in one end thereof and a piston slidable within said cylinder and having a depending piston rod which projects through said aperture and beyond said cylinder;

said stripping fingers being mounted upon the projecting ends of said piston rods;

spring-biasing means beneath said pistons extending between the apertured end of each cylinder and the face of each piston from which said piston rod depends;

conduit means interconnecting said cylinders adjacent their non-apertured ends;

said spring-biasing means normally biasing all of said pistons and thus all of said stripping fingers to the same level;

hydraulic fluid contained within said conduit means and within each of said cylinders;

said hydraulic fluid normally completely filling said conduit means and each of said cylinders above said pistons;

said stripping fingers being movable axially of said punch member when engaged by said article;

said axial movement of any one of said stripping fingers causing a responsive oppositely directed axial movement of at least one other of said stripping fingers until all of said stripping fingers engage said article whereby they move said article axially of said punch member to strip it therefrom.

**References Cited by the Examiner**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,345,857 | 4/1944 | Newell | 72—344 |
| 2,369,260 | 2/1945 | Slater | 72—344 |
| 2,528,577 | 11/1950 | Catlin et al. | 72—344 |

CHARLES W. LANHAM, *Primary Examiner.*

H. D. HOINKES, *Assistant Examiner.*