United States Patent [19]

Paramonoff et al.

[11] **3,886,781**

[45] **June 3, 1975**

[54] **FORCE EQUALIZED EXTERNAL STRIPPER FOR METALWORKING MACHINES AND THE LIKE**

[75] Inventors: **Elpidifor Paramonoff**, Los Angeles; **Ralph M. Main**, San Pedro, both of Calif.

[73] Assignee: **Standun, Inc.**, Compton, Calif.

[22] Filed: **June 19, 1974**

[21] Appl. No.: **480,620**

[52] **U.S. Cl.** **72/344**; 72/427

[51] **Int. Cl.** **B21d 45/00**

[58] **Field of Search** 72/344, 345, 346, 361, 72/427

[56] **References Cited**

UNITED STATES PATENTS

2,327,936	8/1943	Slater	72/344
2,345,857	4/1944	Newell	72/344
3,295,351	1/1967	Jacobs	72/344
3,390,565	7/1968	Smith et al.	72/344

Primary Examiner—Richard J. Herbst

Attorney, Agent, or Firm—Mahoney, Schick & Cislo

[57] **ABSTRACT**

A stripper surrounds an axially moving ram carrying a tubular article to be stripped therefrom by engagement of a leading edge thereof. A multiplicity of circumferentially adjacent stripper fingers are normally urged forwardly to a preset maximum forward position by individual finger reciprocal pistons which move relatively freely rearwardly from each individual finger engagement with the article leading edge as determined by the leading edge contour. Rearward movement of the finger pistons against a preset volume of liquid forces a portion of the liquid through a header into a liquid collector until substantially all of the fingers have been contacted by the article leading edge, after which, the collector bottoms positively opposing any further liquid flow therein creating through said liquid and finger pistons a positive reverse force stopping rearward movement of said fingers in their individual then rearward positions to strip the article. Various components can be incorporated assisting in stripping once stripping commences, detecting commencement of stripping and detecting lack of an article to be stripped.

26 Claims, 12 Drawing Figures

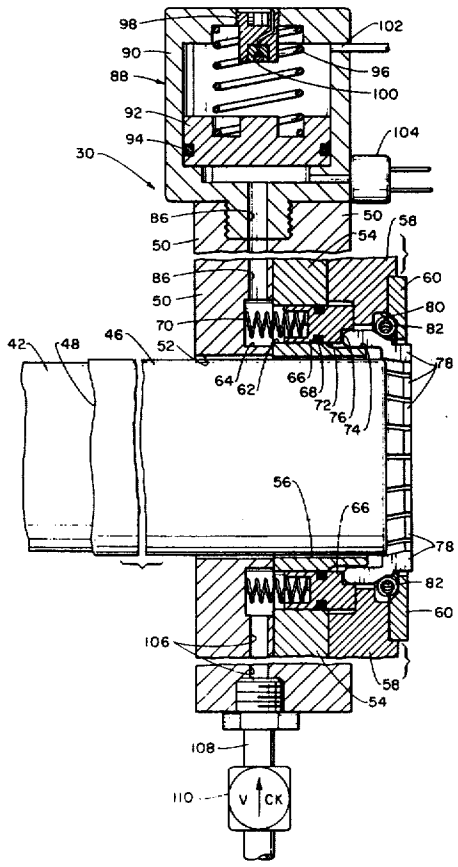


Fig. 1.

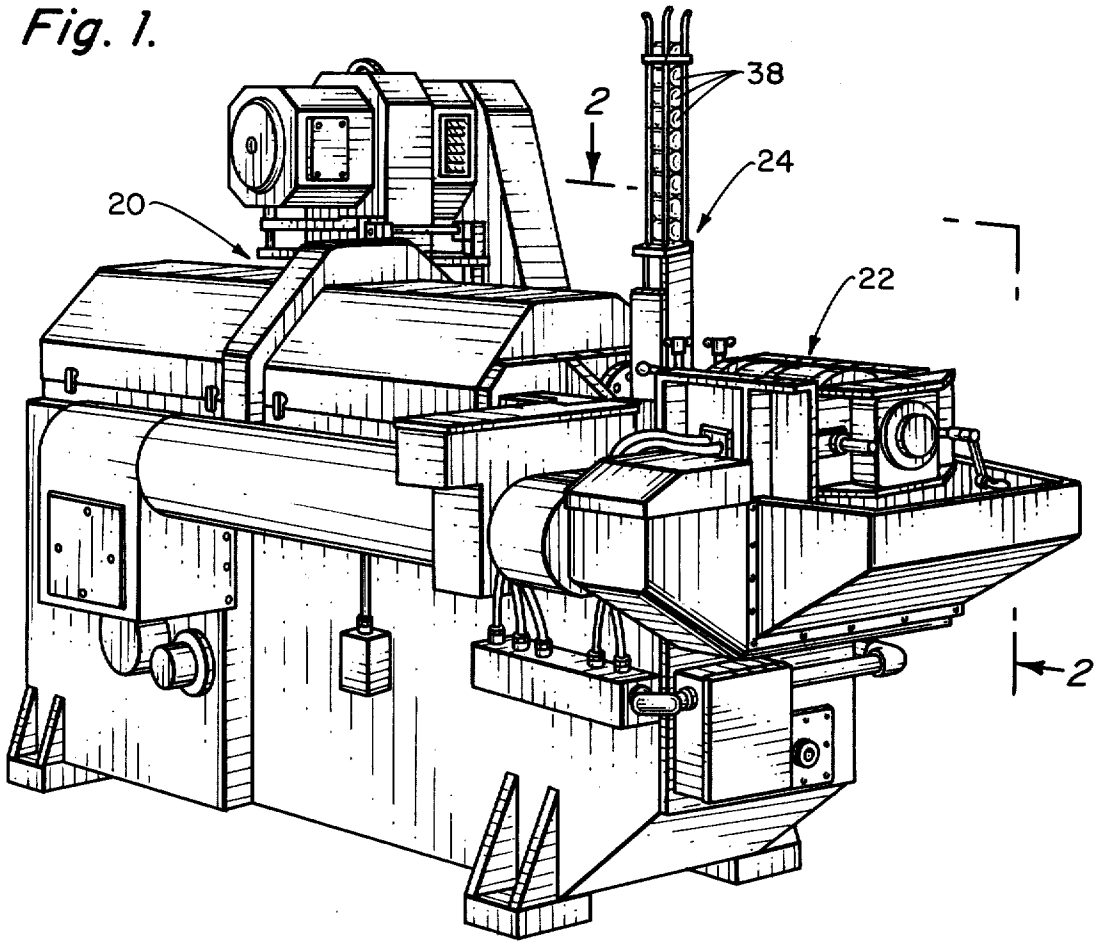


Fig. 2.

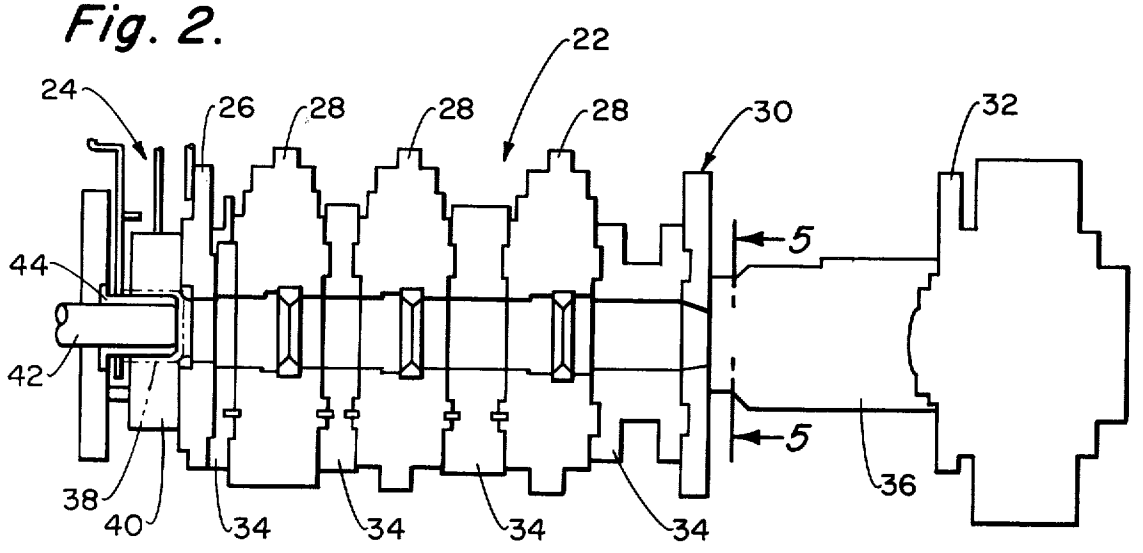


Fig. 3.

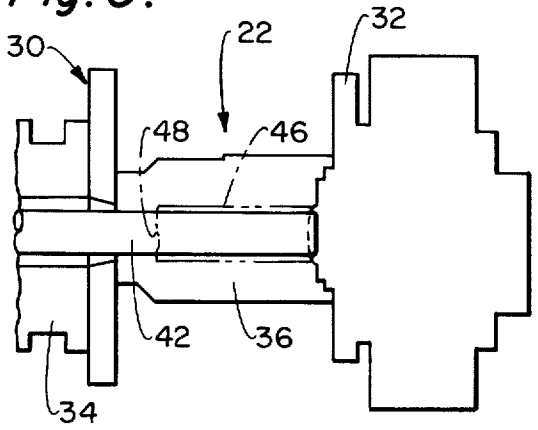


Fig. 4.

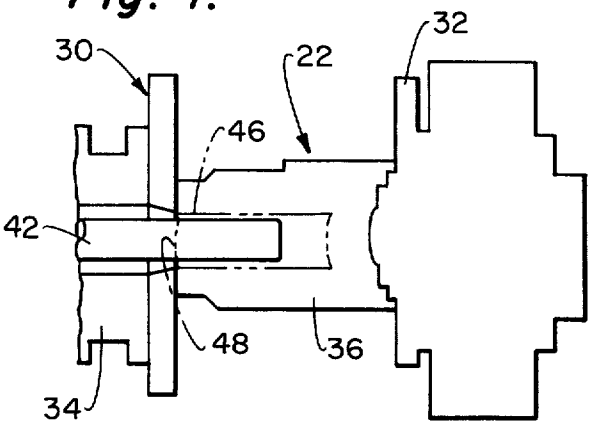


Fig. 5.

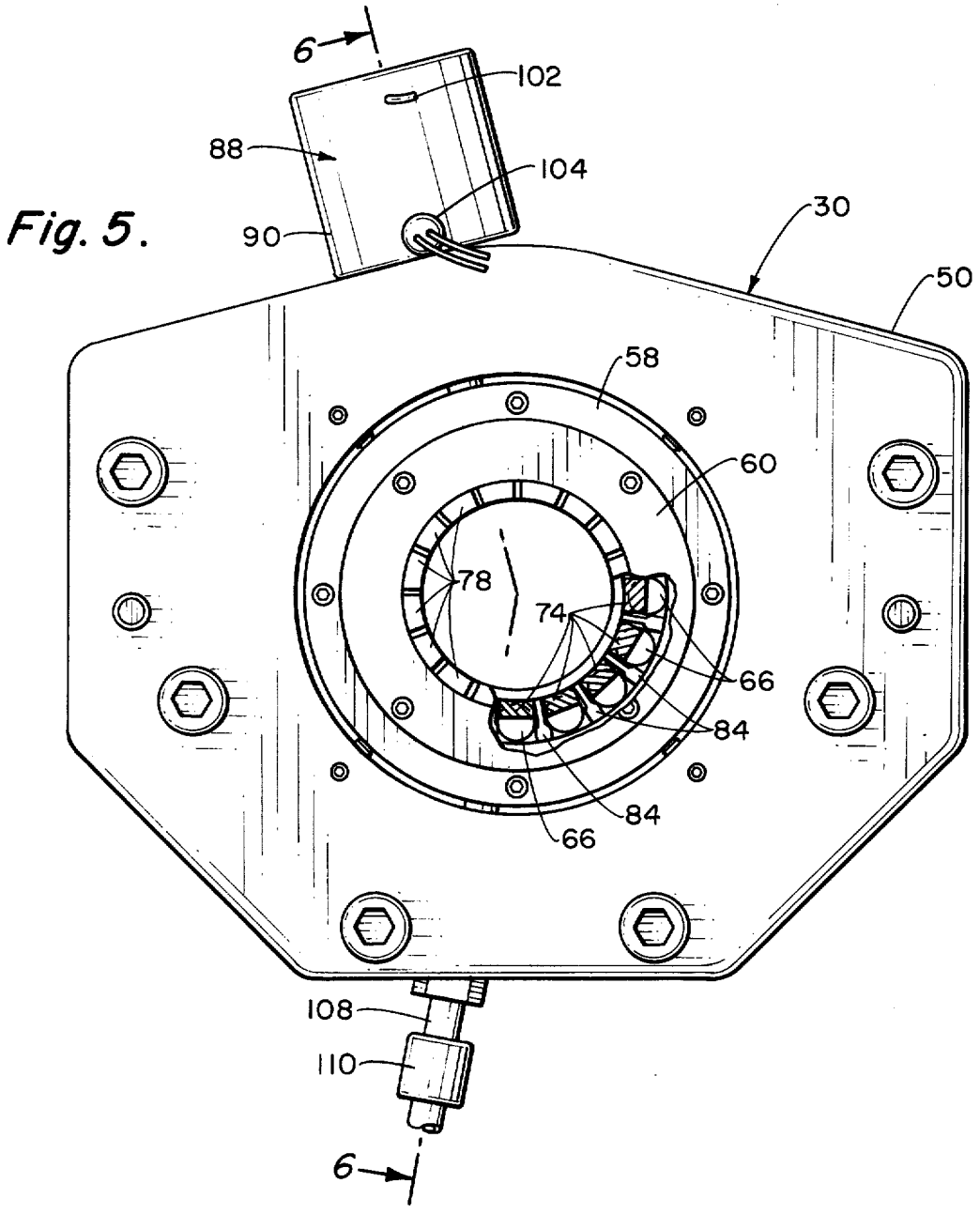


Fig. 6.

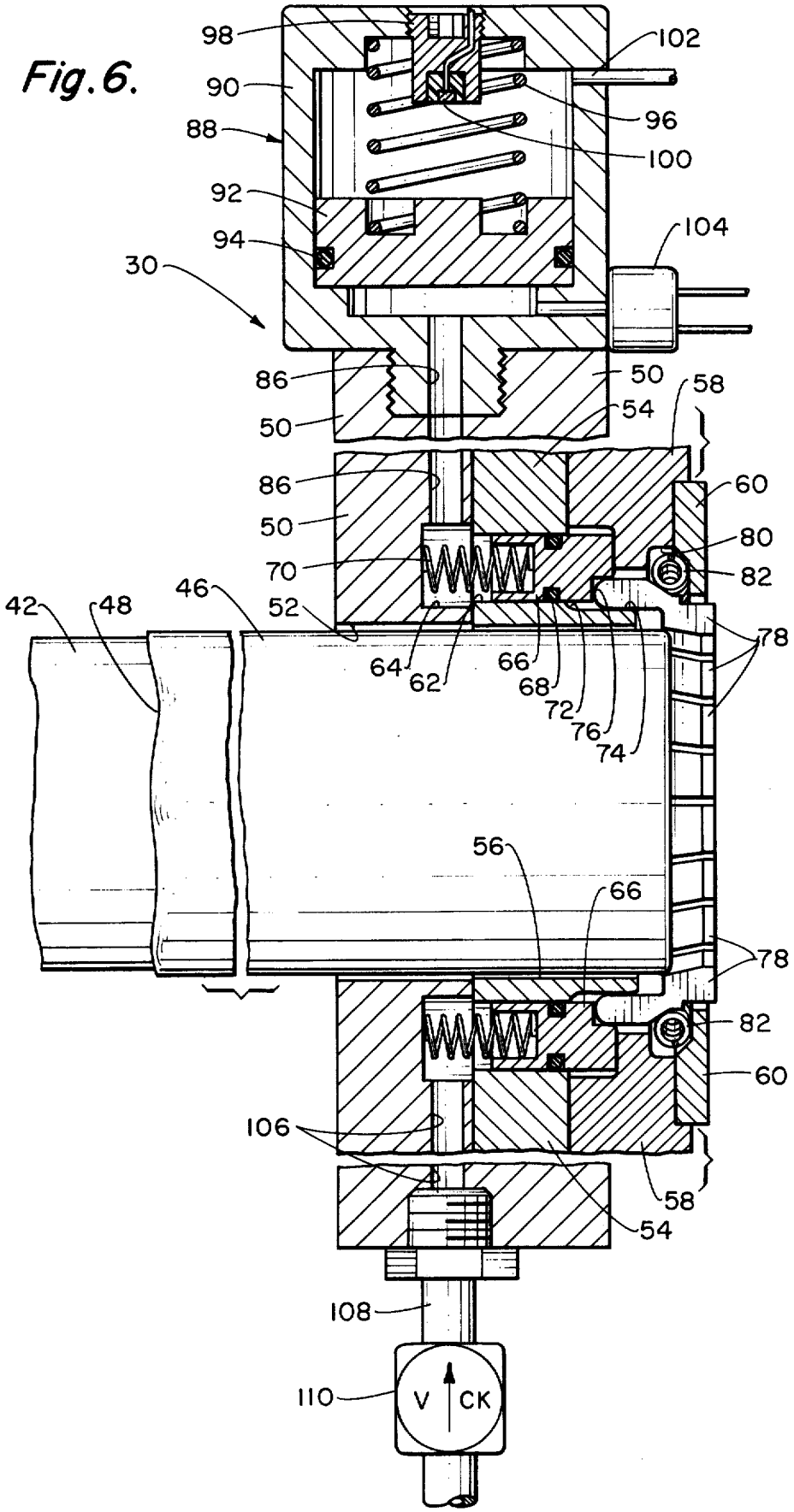

98
102
90
96
88
100
92
104
94
30
86
50
50
54
58
86
60
50
80
70
82
46
42
48
52
78
64
62
66
68
72
76
74
56
66
78
82
60
106
58
54
108
110
V
CK

Fig. 7.

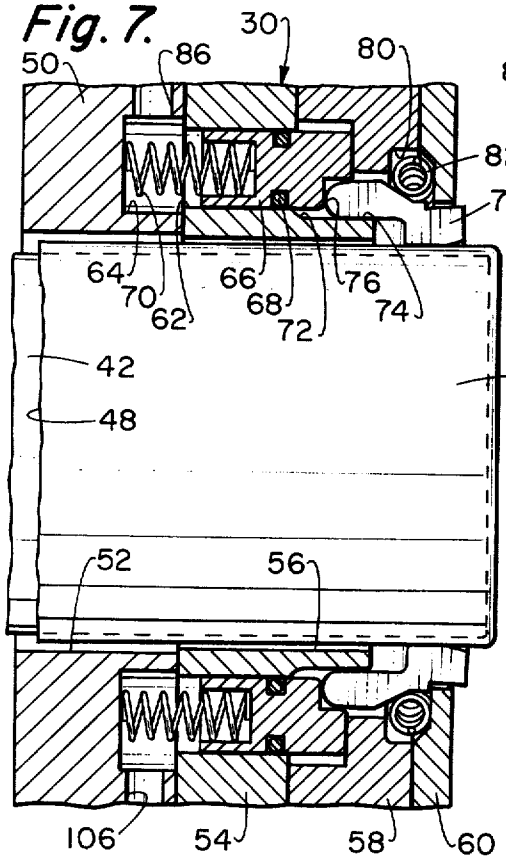


Fig. 8.

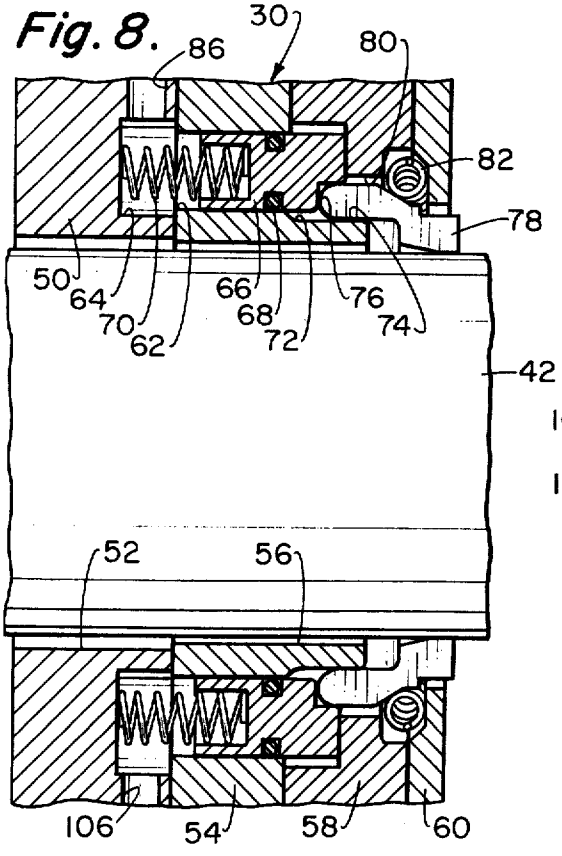


Fig. 9.

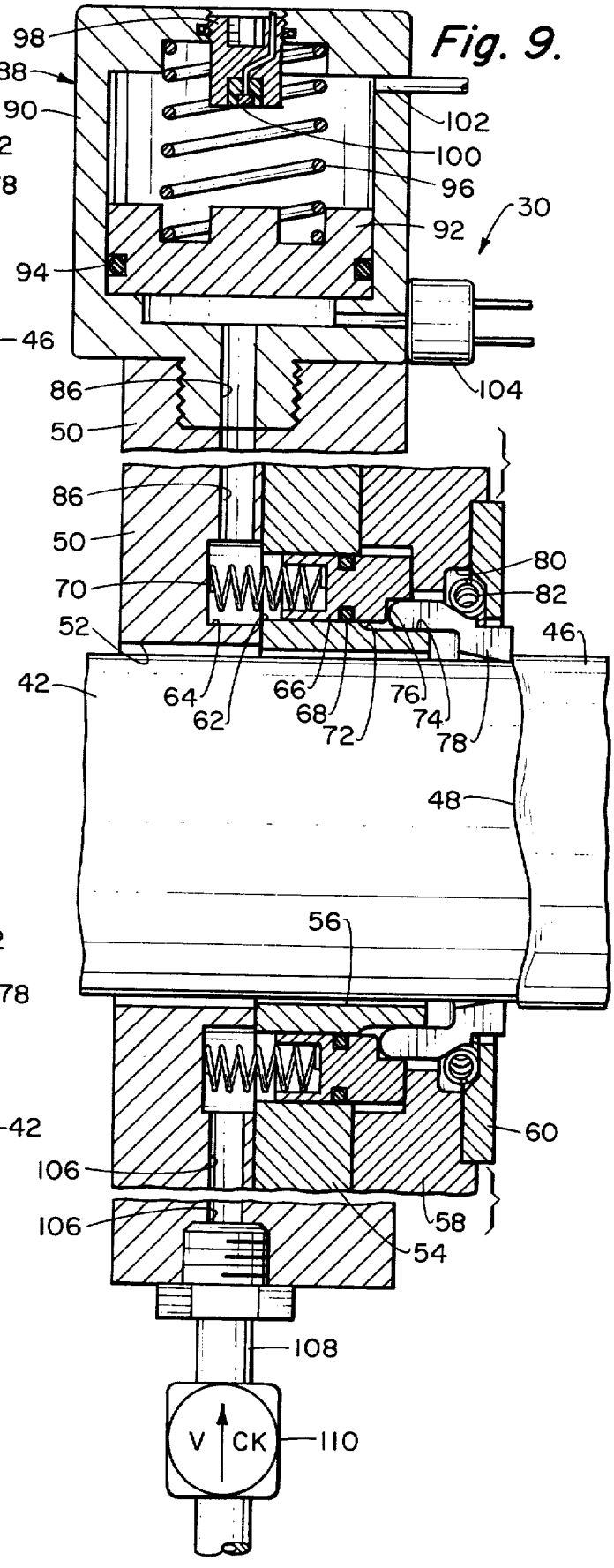


Fig. 10.

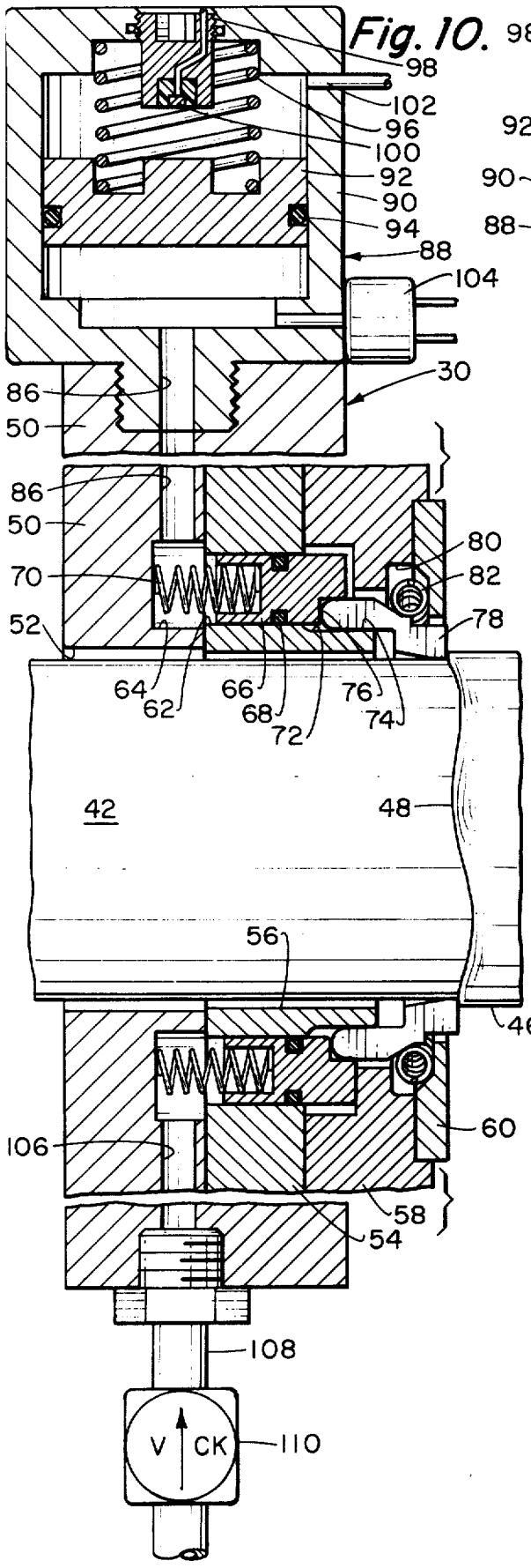

98
102
96
100
92
90
94
88
104
30
86
50
86
50
70
80
82
52
78
64
62
66
68
72
76
74
42
48
56
46
106
60
58
54
108
V
CK
110

Fig. 11.

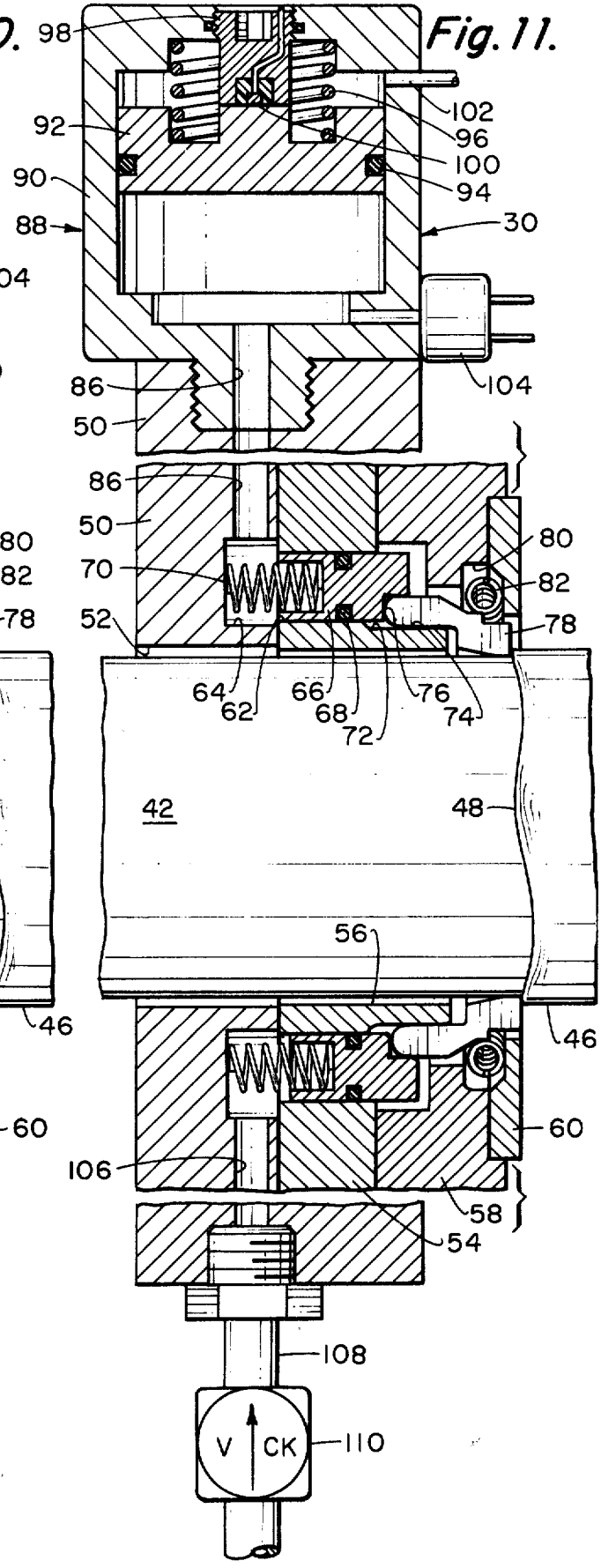
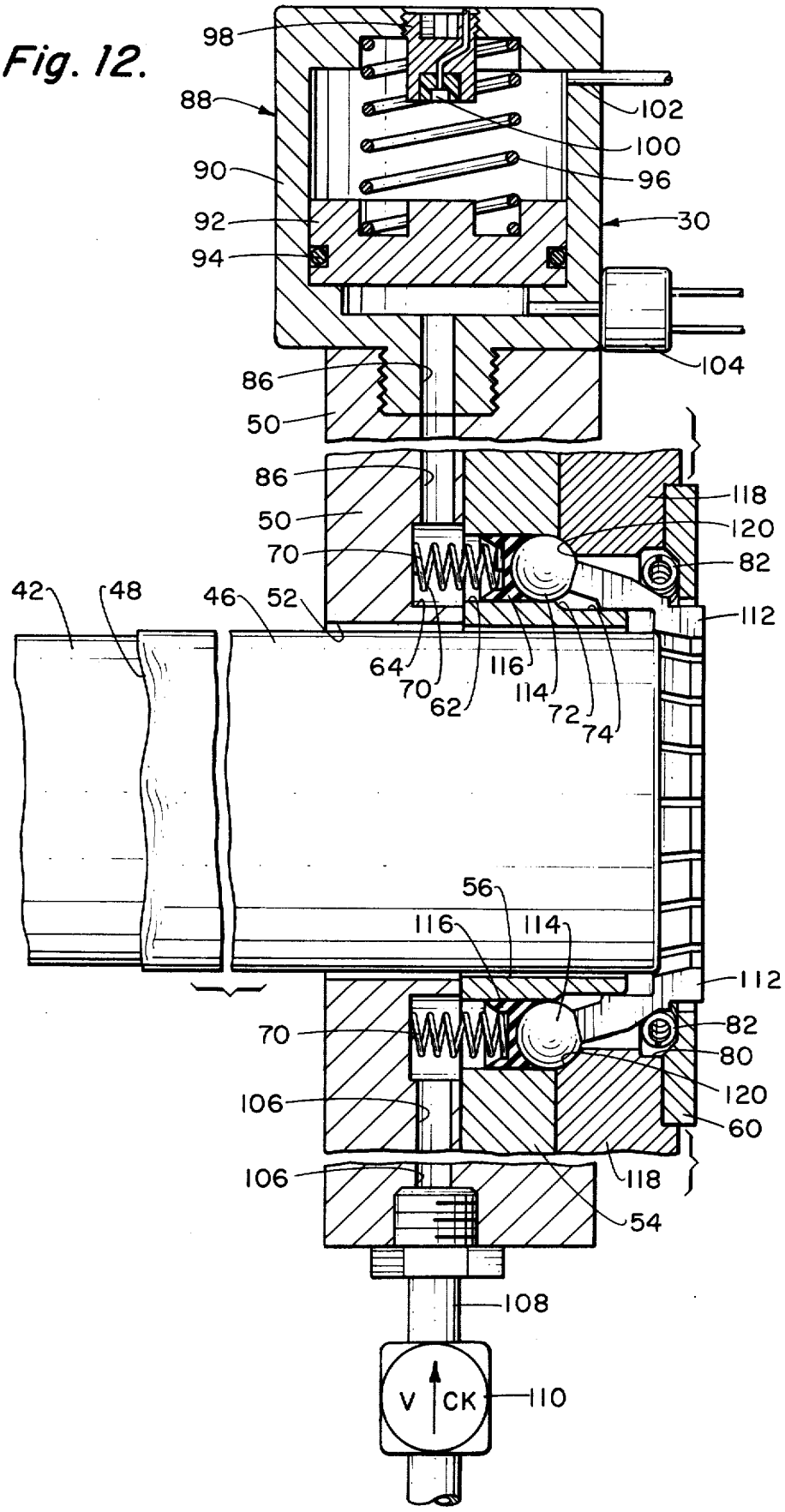

98
102
92
96
100
90
94
88
30
104
86
50
86
50
70
80
82
52
78
64
62
66
68
72
76
74
42
48
56
46
106
60
58
54
108
V
CK
110

Fig. 12.


98
88
90
92
94
102
100
96
30
104
86
50
86
50
70
118
120
82
112
42
48
46
52
64
70
62
116
114
72
74
56
116
114
112
70
82
80
120
106
60
106
118
54
108
V
CK
110

FORCE EQUALIZED EXTERNAL STRIPPER FOR METALWORKING MACHINES AND THE LIKE

BACKGROUND OF THE INVENTION

This invention relates to a force equalized external stripper for use on metal working machines and the like of the type having a movable ram with a tubular article thereon required to be stripped therefrom during such ram movement. More particularly, the stripper includes a multiplicity of circumferentially adjacent fingers engaging the leading edge of the tubular article during ram movement, the fingers uniquely moving relatively freely rearwardly on an individually determined basis upon engagement by the article leading edge. Initially, the individual stripper fingers are so moved rearwardly as determined by the particular contour of that article leading edge until substantially all of the fingers are so engaged, after which, all of the fingers are positively stopped at their then individual rearward positions and exert a uniform stripping force completely around the article leading edge to carry out the stripping operation. Various supplemental components may be incorporated to exert an additional positive assisting force against the fingers to aid in stripping once stripping has commenced, or to detect the exact instant of commencement of each stripping operation, or to detect lack of an article to be stripped, the signals from the latter detections being further useable to show machine malfunction.

A great multiplicity of various forms of stripping devices for stripping tubular articles from axially moving rams in metalworking machinery have heretofore been provided. Considering the general concept broadly, a large number of these prior stripping devices have included the same general stripping function, that is, a frame mounts a multiplicity of circumferentially adjacent stripper fingers surrounding the axially moving ram carrying the tubular article to be stripped therefrom and movement of the ram ultimately causes the article leading edge to contact several of the fingers causing the stopping of the article while the ram continues to move and thereby forcing the article axially from the ram. Depending on the particular metalworking operations including the size of the article to be stripped, the metal thickness of the article at the time of stripping, the adherence of the article to the ram at the time of stripping and the materials from which the articles have been formed, this form of stripping operation can be relatively easy or extremely difficult, particularly keeping in mind that the stripping operation must take place without any appreciable article damage being caused thereby.

A prime example of a major use of stripping devices of the type herein involved is in machinery for manufacturing cup-like, metallic can bodies, that is, can bodies having an open upper end, tubular sidewalls and a bottom wall integral with the sidewalls. Such can bodies are usually formed of either aluminum or tinplate and as finally formed have metal wall thicknesses of merely a few thousandths of an inch. Typically, the usual manufacturing procedure would be to first blank and draw a larger diameter shallow cup in a blank and draw apparatus, redraw if necessary followed by a series of wall ironing operations to form into a relatively deep final shape in a bodymaker, and finally trim the sidesalls to exact final length in an appropriate trimmer, resulting in a can body useable for containing liquid beverages and the like.

Stripping the larger diameter shallow cups from the ram of the blank and draw apparatus will normally not present any great difficulty. At this stage of manufacture, the metal is of greater thickness, the forming forces are less severe and particularly the shallowness of the cup produced results in less gripping or adherence of the formed cups on the drawing ram. For these reasons, despite relatively high speeds, conventional strippers may be used and satisfactory stripping is accomplished without damage to the large diameter shallow cups.

In the final forming step with use of the bodymaker, however, a completely different situation is presented. Whether a redrawing step followed by a series of ironing steps or merely the series of ironing steps are required, the smaller diameter relatively deep final can bodies required to be produced greatly increase the overall area of gripping on the ram as well as the severity of gripping forces. This, combined with the can body metal wall thicknesses of merely a few thousandths of an inch makes the stripping operation in the bodymaker quite critical and very difficult.

Stripping in the bodymaker of these relatively deep and thin-walled can bodies is even more critically aggravated by the fact that wall ironing of the shallow cups into the relatively deep can bodies cannot be accomplished without producing some degree of scalloping at the final can body open ends, that is, the axial length of the can body side wall varies between lesser and greater axial wall height progressing around the circumference of the can body open end. Despite this scalloped can body open end, however, it is this relatively thin can body open end surface against which all of the forces by the stripping fingers of the stripper must be applied in order to stop the motion of the can body in order that the moving ram will withdraw therefrom to release the can body from the ram in the stripping operation.

In effect, as the ram forces the can body through the last of the wall ironing dies in the can body forming motion, the end portion of the ram and the finished can body passes axially through the stripper with the multiplicity of circumferentially adjacent stripping fingers pivoting outwardly to permit such passage. The ram motion then reverses, returning the can body toward the stripper fingers which have now pivoted back inwardly closely adjacent the ram surface and block return passage of the can body engaging the can body open end surface or edge attempting to stop further motion of the can body stripping it from the ram as the ram continues such return motion through the stripper.

Most of the prior stripper constructions, although having a multiplicity of circumferentially adjacent stripper fingers, have had all such stripper fingers mounted virtually immovable axially although necessarily radially pivotal. Thus, with the can body open ends having scalloped end surfaces or edges, the higher portions of the scallops will be the first to contact stripper fingers and unless the can body wall curls or otherwise permanently distorts severely damaging the final can body, these first contacted portions of the can body will be the only portions contacted and the remaining stripper fingers will never come into contact with the can body open end edge. The obvious result is that the pressures or forces required for stripping can and usu-

ally are concentrated at a few locations requiring the relatively thin can body wall in those locations to absorb the entire stripping force and since scalloping is not predictable, such stripping forces could be exerted quite unevenly about the particular can body. As an overall result, therefore, the use of most of the prior stripper constructions in modern metallic can bodymakers has been completely unsatisfactory and has produced damaged can bodies, frequent damaged tooling and the requirement of frequent interruption of mass production operations for machine and tooling maintenance.

One prior form of stripper has been provided in an attempt to solve these problems created by scalloping of cup-shaped articles by mounting the stripper fingers backed by a small thickness of resilient material such as rubber, plastic or the like. The basic concept is to thereby provide each of the stripper fingers with some self-adjustment axially or parallel to the ram movement so that the various stripper fingers may adjust to the scalloping variances of the metal edge being contacted. One of the major difficulties with this form of solution is that the stripper fingers can still only self-adjust an extremely small amount since to ultimately obtain the stripping forces required, the resilient material backing of the stripper fingers must be a relatively small thickness. Furthermore, with any degree of scalloping, the stripping forces exerted by the stripper fingers must vary appreciably around the circumference of the stripper with the stripper fingers compressing the resilient material varying amounts and the consequent resilient material reaction exerting varying forces dependent on the degree of compression.

With the characteristics of resilient material under compression in mind, it is fundamental that as a force is applied to the resilient material compressing the same, the reactive forces increase rapidly so that the movement required to compress the same to a relatively severe degree is extremely limited and movement of stripper fingers backed thereby is thereby extremely limited. Furthermore, this same characteristic means that a stripper finger moving a maximum amount in such compression will exert a quite large reactive force while a stripper finger moving only a slightly lesser amount in such compression will exert a far less reactive force due to the swift buildup of such forces for resilient material in compression. This prior stripper form has, therefore, not been satisfactory in solving the problem involved.

Still another prior form of stripper has made use of hydraulic fluid for backing the stripper fingers in an effort to permit limited movement thereof prior to exerting the required stripping forces in order to compensate for the varying scalloping of the metal edge required to be contacted for stripping. This construction includes an hydraulic cylinder at each stripper finger with the finger bearing against a reciprocal piston thereof. Each piston prior to contact by the metal edge during the stripping operation is originally positioned substantially midway of its particular cylinder and the pistons, in turn, are backed by a hydraulic fluid in a closed hydraulic fluid circuit, a common header freely communicating with each of the cylinders.

The overall effect is that each of the pistons is free to move axially or parallel of the ram limited amounts in both axial directions urging or being urged by the hydraulic fluid in the closed hydraulic fluid circuit and the individual stripper fingers are provided with the consequent movement of their particular piston movement. With the scalloping of the metal edge on the article being stripped, the first stripper finger contact will be at a raised metal edge portion and that particular finger will be begun to be moved axially in the direction of ram movement. In view of the closed hydraulic fluid circuit, such individual stripper finger movement with consequent piston movement will cause one or more of the uncontacted fingers through their piston reactive movements to move axially in the opposite axial directon, compensating for the first finger movement until, theoretically, all of the fingers will adjust axially in one direction or the other into contact with the scalloped metal edge, at which time, the full stripping force will be exerted to carry out the stripping operation.

In superficial observance, this latter stripper form would appear to have solved the major problems involved. Each of the stripper fingers is permitted individual movement in order to compensate for the varying scalloped metal edge of the article being stripped and, theoretically, once all of the fingers have been adjusted to conform and make contact with the variable metal edge, a collective force is applied by all of the fingers in concert to carry out the stripping operation. However, there are still two major problems which exist when the particulars of the action — reaction forces and movement are considered.

One of these problems is that with the closed hydraulic fluid circuit, when the first of the stripper fingers is contacted by a high point on the scalloped metal edge of the article being stripped with the article and ram continuing to move, this finger begins to move in the same direction as the movement of the article and ram which, reacting through the closed hydraulic fluid circuit, causes one or more of the uncontacted fingers to move in the reverse direction. Even assuming that only one uncontacted finger is moved in the reverse direction by the contacted movement in the article and ram direction, this still creates a double frictional force as a result of that one contacted finger movement. The usual situation, however, with the more common degree of scalloping of the metal edge of the article being contacted, is that when the first stripper finger is contacted, there are a great number of fingers that have not been contacted so that the reaction through the closed hydraulic fluid circuit is to begin reverse movement of a great number of uncontacted fingers resulting in a vast compounding of the frictional force resistance to finger movement. Thus, considering the extremely high article and ram speeds in modern production machinery, the ram moving at a rate in the order of 150 to 175 reciprocal strokes per minute, the stripper fingers with this frictional retardation simply are too sluggish in movement in most practical instances so that full contact with all of the stripper fingers does not take place and the stripping force is not uniform about the circumference of the thin metal edge to be contacted.

The second major problem with this form of stripper is created by the fact that when the first stripper finger to be contacted takes place, a certain impact force is transmitted to the particular location on the article metal edge being contacted which begins movement of this first finger with the ram and article movement. Since the commencement of movement of the first finger contacted creates a reaction through the closed hy-

draulic fluid circuit and brings reverse movement of one or more of the uncontacted fingers, these uncontacted fingers when finally contacted by the article metal edge are moving in the opposite direction of such metal edge movement very significantly increasing the impact force of contact. Again keeping in mind the extremely high speeds of ram and article movement at the time of stripper finger contact and greatly increasing this speed against the reversely moving latter contacted fingers, while adding to this the fact that the article metal edge being contacted is extremely thin, only a matter of a few thousandths of an inch, it is seen that the impact force consequences can be and frequently are quite serious. Thus, as the result of improper or less than full finger contact and the possibilities of extreme impact forces at the time of contact, frequent article damage takes place during the stripping operation in the use of this prior form of stripper.

OBJECTS AND SUMMARY OF THE INVENTION

It is, therefore, an object of this invention to provide a force equalized external stripper for metal working machines and the like useable in stripping tubular articles from axially moving rams wherein all of a multiplicity of circumferentially adjacent stripper fingers surrounding the ram are each individually movable axially in the direction of ram movement or rearwardly upon initial contact as urged by said leading edge until substantially all of the fingers have been so contacted, after which, all of the fingers have exerted thereon a substantially immovable reactive force collectively in the then individual rearward movement positions of each of the fingers causing the fingers to collectively strip the article from the ram during continued ram movement. The stripper fingers during their individual adjusting movement in exactly adjusting to the particular article leading edge contour move only in the axial direction of ram and article movement and are mounted to exert a minimum reactive force against the article leading edge during such movement so that frictional forces created during finger movement are maintained at a minimum and the impact forces of the article leading edge contacting the fingers is maintained at a minimum despite extremely high speeds being involved. Once the individual adjustment of the stripper fingers in conforming to the exact contour of the article leading edge has taken place, the exertion of the substantially immovable reactive force against all of the fingers collectively causes such fingers to equally exert stripping forces completely around the article leading edge so that the article is stripped from the ram during continued ram movement with a minimum of force concentration at any one location on the article leading edge.

It is a further object of this invention to provide a force equalized external stripper of the foregoing general type and having the foregoing general attributes wherein, in a preferred form, each of the stripper fingers is backed by a piston which collectively react against a preset volume of liquid. The liquid is contained such that it is permitted free flow upon flow urging thereof by individual piston movements as urged by each particular piston's finger being contacted and moved by the article leading edge. After substantially all of the fingers have been contacted by the article leading edge, further liquid flow is positively blocked and the liquid exerts the substantially immovable reactive force against the individual finger pistons and thus against the individual fingers in their then adjusted positions causing each of the fingers to exert a substantially equal reactive force against the article leading edge to strip the article from the ram during the continued ram movement.

It is still a further object of this invention to provide a force equalizing external stripper of the foregoing general type and making use of the foregoing piston and free flowing liquid concept wherein, again in the preferred form, the positive blocking of the liquid free flow is accomplished by a positive bottoming liquid collector connected in flow communication with the liquid reacted upon by the individual finger pistons. The liquid collector is such that it is normally urged to a minimum liquid containing state reacting against the preset volume of liquid and causing the liquid to urge all of the individual finger pistons and thus the fingers to maximum forward positions or in the direction opposite of the ram and article movement prior to such fingers being contacted by the article leading edge. As the fingers are individually contacted by the article leading edge and urged rearwardly urging the individual pistons rearwardly or in the direction of ram and article movement, the pistons individually react against the liquid and cause flow thereof into the liquid collector. After all of the fingers have been contacted by the article leading edge, the individual finger pistons have forced an amount of liquid into the collector causing the collector to reach a maximum liquid accepting condition, at which time, the collector positively bottoms and positively resists further liquid entrance which creates the substantially immovable reactive force through the liquid to the pistons and fingers collectively causing the fingers to collectively strip the article from the ram during the ram continued movement.

It is also an object of this invention to provide a force equalizing external stripper of the foregoing general type and having the unique stripper finger individual self-adjustment depending solely on stripped article leading edge contour wherein directly following the application of the immovable reactive force by the fingers to collectively commence the stripping operation, a further assisting force may be applied to the fingers while such fingers maintain their individually adjusted relationships for urging the fingers in the article stripping direction or the direction opposite ram continued movement to aid in carrying out the stripping operation. For instance, after each of the stripper fingers has been moved rearwardly or in the direction of ram and article movement in establishing their self-adjustment positions dependent on the article leading edge contour and the substantially immovable reactive force has been applied against the fingers collectively in their then individual adjusted positions, a compressed gaseous fluid force reacting collectively against the fingers urging such fingers in the article stripping direction opposite the ram movement may be applied to not only aid the immovable reactive force against the stripper fingers commencing the stripping action, but also to positively urge the stripper fingers in the stripping direction for a more positive continuation of the stripping action. In the case where the relatively free flowing liquid concept of the present invention is used, the compressed gaseous fluid force may be applied directly against the liquid once the liquid has been blocked from further flow and has applied the substantially im-

movable reactive force so that the liquid transmits the positive assisting force therethrough to each of the fingers during the continuation of the stripping operation.

It is an additional object of the present invention to provide a force equalizing external stripper of the foregoing general type and having the unique stripper finger self-adjustment depending solely on the stripped article leading edge wherein various forms of detection means may be incorporated for detecting the exact instant of application of the immovable reactive force against the fingers to commence the stripping operation. This information provided by the detectors may be advantageously used for many purposes in controlling operation of the particular metalworking machine incorporating the unique stripper principles of the present invention. For instance, by precisely detecting the exact commencement of the stripping operation and electronically matching this information with the timed movement of the machine ram, it is possible to instantaneously determine that the article being stripped has a length less or greater than that required, or lack of reception of such detection information could provide the information that no article was positioned on the moving ram to be stripped. In either of these examples, the information derived may be used to indicate that that machine is functioning properly or that or a preceding machine in a production line is malfunctioning.

Other objects and advantages of the invention will be apparent from the following specification and the accompanying drawings which are for the purpose of illustration only.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a typical metallic can body former incorporating a preferred embodiment of the force equalized external stripper of the present invention;

FIG. 2 is an enlarged, fragmentary, somewhat diagrammatic vertical sectional view looking in the direction of the arrows 2—2 in FIG. 1 and showing the tool pack of the can body former of FIG. 1 specifically incorporating the preferred embodyment of the stripper of the present invention;

FIGS. 3 and 4 are views similar to FIG. 2 illustrating progressive positions of the machine ram prior to and during the stripping operation;

FIG. 5 is an enlarged, fragmentary, vertical sectional view looking in the direction of the arrows 5—5 in FIG. 2 and showing the stripper in rear elevation, part in section;

FIG. 6 is an enlarged, fragmentary, vertical sectional view looking in the direction of the arrows 6—6 in FIG. 5 showing the ram of the can body former progressing through the stripper in the ram can body forming stroke carrying a can body thereon;

FIG. 7 is a view taken from FIG. 6 but with the ram and can body passing further through the stripper and pivoting stripper fingers thereof radially outwardly to permit such passage;

FIG. 8 is a view similar to FIG. 7 but with the ram further through the stripper and the can body beyond;

FIG. 9 is a view similar to FIG. 6 but with the ram now in its return stroke and the can body just beginning to contact the first of the stripper fingers;

FIG. 10 is a view similar to FIG. 6 but with the ram and can body progressed, the can body fully contacting and adjusting the stripper fingers and the can body moving the stripper fingers therewith;

FIG. 11 is a view similar to FIG. 6 but the ram still further progressed and the stripper fingers stripping the can body therefrom; and

FIG. 12 is a view similar to FIG. 6 and in the same position as FIG. 6 but illustrating a second or alternate embodiment of the stripper of the present invention.

DESCRIPTION OF THE BEST EMBODIMENTS CONTEMPLATED:

For the purpose of providing the environment for the force equalized external stripper of the present invention, a typical metallic can body former is shown in FIG. 1 and includes a ram drive assembly generally indicated at **20**, a die pack generally indicated at **22** and a cup feed assembly generally indicated at **24**. As shown in FIG. **2**, the die pack **22**, in turn, includes a redraw die ring **26**, a series of wall ironing rings **28**, a stripper generally indicated at **30** constituted by a preferred embodiment of the present invention and a doming or bottom forming die **32** positioned with usual spacers **34** and frame **36**. With the exception of the stripper **30**, the can body former is of typical construction, not a part of the present invention, and is formed of usual materials satisfactory for the intended purposes and by usual manufacturing procedures, all well known to those skilled in the art.

In general operation of the can body former, preformed, relatively shallow, metal cups **38** of aluminum or tinplate are fed downwardly, one at a time, in the cup feed assembly **24** to a part positioning yoke **40** (FIG. **2**) while an axially reciprocal ram **42** driven by the ram drive assembly **20** is in a withdrawn position to the left of the part positioning yoke **40** just completing the ran withdrawal or return stroke and beginning the ram working stroke. Prior to the ram **42** reaching the stage of its working stroke shown in FIG. **2**, a redraw blankholder **44** axially enters the open end of the cup **38** then positioned in the part positioning yoke **40** and forces the closed end of the cup against the redraw die ring **26** of the die pack **22** positioning the cup exactly axially aligned with the redraw die ring and the path of axial movement of the ram **42**. Immediately thereafter, the ram **42** starting its working stroke moving axially to the right as shown in FIG. **2** enters the redraw blankholder **44** and the cup **38** retained positioned thereby engaging the closed end of the cup and beginning the redrawing and wall ironing operation in the working stroke of the ram.

As the ram **42** progresses in its working stroke, it carries the particular cup **38** progressively through the redraw die ring **26** and the wall ironing rings **28**, relatively freely through the stripper **30** and axially against the doming or bottom forming die **32** to the position shown in FIG. **3**. At this stage, the shallow, larger diameter cup **38** has been reduced in metal thickness to a few thousandths of an inch, reduced in diameter to tightly grip the end portion of the ram **42** and increase very significantly in length so as to now constitute a relatively thin-walled and relatively deep final can body **46**. The axial impingement of the final can body **46** against the bottom forming die **32** forms the closed end of the can body into a recessed, domed shape but more important for purposes of consideration relative to the present invention, the cup open end due to the previous wall ironing now has an axially uneven or axially scal-

loped thin annular edge **48** which is quite unpredictable in exact contour, although is relatively predictable as to limitations of maximum axial variation in a properly operating can body former.

In any event, the impingement of the can body **46** against the bottom forming die **32**, completes the working stroke of the ram **42** and the ram reverses axially beginning its withdrawal or return stroke, that is, to the left as shown in FIG. **3**. As shown in FIG. **4**, the ram **42** is progressing in its return stroke moving axially away from the bottom forming die **32** carrying the can body **46** and as will be hereinafter explained more in detail, as the annular edge **48** of the can body open end reaches the stripper **30**, it is engaged by the stripper axially stopping the can body **46** while the ram **42** continues axial movement to strip the can body from the ram. Upon disengagement or release from the ram **42**, the can body **46** is picked up by usual conveyor means, (not shown) and transported away from the can body former to have final manufacturing operations performed thereon including trimming the side walls to exact final length.

In order to more completely appreciate the environment of the stripper improvements of the present invention, it should be kept in mind that a modern can body former of the type shown operates at speeds in the order of 150 to 175 reciprocal strokes of the ram **42** per minute so as to carry out 150 to 175 can body forming and stripping operations per minute. Furthermore, during the stripping operations, the thin-walled can bodies **46** must be stripped from the ram **42** without any appreciable malformation. The following trimming operations are likewise extremely precise operations and depend on final can bodies **46** exactly predictably formed and free of any malformations including malformations of the thin annular edges **48**.

Particularly to an embodiment of the improved stripper of the present invention and referring for the moment to FIGS. **5** and **6**, the stripper **30** includes a housing **50** secured in the die pack **22** (FIG. **2**) in usual manner with an axially extending ram opening **52** thereof generally axially aligned with the axial path of travel of the ram **42** providing adequate clearance for the ram. Considering the side of the stripper **30** toward the bottom forming die **32** (FIG. **2**) or to the right as shown in FIG. **6** as the front side, a cylinder ring **54** is fully axially recessed within the front side of the housing **50** normally rearwardly tightly abutting the housing but selectively radially adjustable relative thereto so that a central ram opening **56** of this cylinder ring, although providing reasonable radial clearance, may be relatively precisely axially aligned with the axial path of movement of the ram **42**. Secured to and radially adjustable with the cylinder ring **54** tightly axially abutting the front surface thereof is a back retainer ring **58** and tightly axially abutting, but partially axially recessed within a front surface of the back retainer ring is secured a front retainer ring **60**.

A multiplicity of equally circumferentially spaced and axially extending cylinders **62** are formed in the cylinder ring **54** by appropriate openings therethrough. The cylinders **62** open fully rearwardly into an annular header **64** formed by an annular channel in the forward surface of the housing **50**. An axially reciprocal plunger or piston **66** is positioned in each of the cylinders **62** slidably axially sealed by an appropriate sealing ring **68**.

Each of the pistons **66** is backed by a relatively light compression spring **70** extending rearwardly thereof axially to the bottom of the header **64** in the housing **50**. The compression springs **70** normally urge or at least aid in urging the pistons **66** forwardly into axial abutment with the back retainer ring **58** within a rearward annular recess of the back retainer ring. The back retainer ring **58** terminates radially inwardly approximately midway of the pistons **66** and radially inwardly of the pistons and cylinders **62**, the cylinder ring **54** projects axially forwardly in a slightly radially recessed, annular finger positioning surface **74** facing radially toward the back retainer ring and also facing a generally circumferentially extending finger engagement notch **76** in the front surface of each of the pistons **66**, all as clearly shown in FIG. **6**.

A mulitplicity of circumferentially adjacent stripper fingers **78** are positioned, one rearwardly abutting each of the pistons **66** engaged within the finger engagement notches **76** of the pistons. The stripper fingers **78** at their rearward portions overlie and radially rockably abut the finger positioning surface **74** of the cylinder ring **54** extending forwardly spaced inwardly of the back retainer ring **58** and the front retainer ring **60** so as to be forwardly axially exposed radially inwardly of the front retainer ring. An annular spring pocket **80** opening inwardly toward the stripper fingers **78** is formed by the combination of a forward recess in the back retainer ring **58** and a rearward recess in the front retainer ring **60** with a garter spring **82** being positioned therein inwardly abutting all of the fingers. The stripper fingers **78** are maintained circumferentially separated and properly positioned relative to their individual cylinders and pistons **62** and **66** by appropriate spacers **84** seen in FIG. **5**.

Thus, with the pistons **66** of the cylinders **62** in their forwardmost positions forwardly abutting against the back retainer ring **58** as shown in FIG. **6**, these pistons retain the stripper fingers **78** in their forwardmost positions, while at the same time, the garter spring **82** constantly resiliently urges the stripper fingers radially inwardly to their innermost radial positions as determined by engagement of the rearward portions of the stripper fingers within the piston finger engagement notches **76** and against the finger positioning surface **74** of the cylinder ring **54**. In such positions, the stripper fingers **78** at their forward portions generally radially inwardly of the front retainer ring **60** are formed projecting radially inwardly into interference with the axial path of movement of the ram **42** as also shown in FIG. **6**. However, and in this respect common to most strippers, when the ram **42** and can body **46** pass axially therethrough in the ram working stroke or from left to right as shown in FIG. **6**, the stripper fingers **78** are free to pivot radially outwardly over the finger positioning surface **74** of the cylinder ring **54** and against the resilient urging of the garter spring **82** to permit such passage, while pivoting inwardly adjacent the ram after passage of the can body in can body axial blocking position ready for the reverse or return ram movement stripping operation.

The header **64** in the housing **50** common to all of the cylinders **62** from rearwardly of the pistons **66** is connected in free fluid flow through a passage **86** to a liquid collector generally indicated at **88** secured to the housing. The important purpose according to the principles of the present invention of the liquid collector **88**

is generally in movement thereof from a minimum liquid accepting condition into a maximum liquid accepting condition to accept a determined portion of a preset liquid volume with a minimum of resistance to the liquid flow and upon reaching the maximum liquid accepting condition, to positively resist further liquid flow therein transmitting a positive reactive force back through the liquid against any further attempted liquid flow. In the preferred form shown, for instance, in FIG. **6**, the liquid collector **88** is in the form of a cylinder **90** having a reciprocal piston **92** appropriately slidably sealed by a sealing ring **94**, the piston being backed by a compression spring **96** normally relatively lightly resiliently urging the piston into the minimum liquid accepting condition while permitting through minimum liquid flow force movement of the piston in the cylinder **90** axially to and against a selectively axially adjustable stop **98** determining the maximum fluid accepting condition. The minimum liquid accepting condition of the liquid collector **88** and piston **92** is shown, for instance, in FIG. **6** and the maximum liquid accepting condition thereof is shown for instance, in FIG. **11**.

The liquid collector **88** may also include a somewhat usual electrical probe **100** in the stop **98** positioned for contact and actuation by the piston **92** to transmit an electrical signal to appropriate controls for a purpose to be hereinafter explained. Furthermore, a gaseous fluid, preferably air, supply line **102** may communicate into the cylinder **90** rearwardly of the piston **92** in its maximum liquid accepting condition through which a supply of pressurized gaseous fluid or air may be transmitted into the cylinder at appropriate times as will be hereinafter described in detail. As a final possible adjunct to the liquid collector **88**, a pressure detector **104** may be connected communicating with liquid within the cylinder **90** or forwardly of the piston **92** as will be hereinafter described more in detail.

The header **64** is still further connected in liquid flow communication through a passage **106** with a liquid supply line **108**, the latter supply line having a usual check valve **110** therein permitting liquid flow therethrough into the passage and ultimately the header while positively blocking reverse liquid flow from the passage and header. The purpose of the liquid supply line **108** in the overall stripper concept of the present invention is to maintain within the closed liquid circuit of the stripper **30** a relatively precisely determined constant volume of liquid. That is to say, by directing a liquid through the liquid supply line **108** and check valve **110** into the header **64** under a relatively low pressure such as **10** to **15** psi with no axial force against the stripper fingers **78** so that all of the pistons **66** are at their forwardmost positions in the cylinder **62** and with the piston **92** of the liquid collector **88** in its forwardmost minimum liquid accepting condition urged by the compression spring **96** exerting a greater force against the piston creating a piston pressure slightly above the liquid pressure, all as shown for instance in FIG. **6**, the stripper overall liquid circuit from the supply line check valve **110** to the finger pistons **66** and to the liquid collector piston **92** will be liquid filled and contain an exact predetermined volume of such liquid. Furthermore, in view of the one direction flow operation of the check valve **110**, there can be no reverse flow in the supply line **108** and any rearward movement of any of the finger pistons **66** will cause a portion of that preset volume of liquid to flow into the liquid collector **88** moving the liquid collector piston **92** toward its maximum liquid accepting condition or toward the stop **98**. If slight leakage of the liquid within the stripper liquid circuit occurs during operation of the stripper **30**, however, such as slight leakage around the finger pistons **66**, such liquid leakage amount will be replaced automatically by additional liquid flowing through the check valve **110**.

In the particular environment of the stripper of the present invention as illustrated herein, that is, as used with the can body former as described, the liquid for the stripper **30** may be conveniently taken as a portion of the forming liquid as conventionally used in die pack **22** since such forming liquid is always present and is otherwise required. Likewise, this particular liquid supply can be provided at the desired low pressures. As an example, the forming liquid used from the die pack **22** may be a water soluble oil emulsion having a low viscosity so that the action of the stripper **30** to be hereinafter described in detail will not be sluggish and is substantially incompressible at the stripping pressures encountered. It is pointed out, however, that other liquids from other supplies could be used for the same purpose as long as the same or similar qualities are provided.

In the foregoing description of the various components of the stripper **30** incorporating the principles of the present invention, the various movements of the stripper fingers **78** with their pistons **66** and the liquid collector piston **92** have been described as "relatively freely movable," and the flow of the liquid within the stripper liquid circuit should likewise be similarly described as "relatively free fluid flow." As will be more clearly understood from the following description of the operating characteristics of the stripper **30** of the present invention, resistance to movement of the stripper fingers **78**, the stripper finger pistons **66** and the liquid collector piston **92** is maintained at a minimum from the practical standpoint including both friction and spring pressures so as to result in relatively free contained liquid flow. The pressures of the springs **70** against their pistons **66** and the spring **96** against the liquid collector piston **92** are only required and, for optimum results, are only predicated sufficient to return the various pistons to their forwardmost positions when no axial forces are directed against the stripper fingers **78** which would be the position shown in FIG. **6** while still permitting relatively free rearward movement of these pistons including relatively free liquid flow when axial forces are applied rearwardly against the stripper fingers. The pressure against the liquid in the liquid supply line **108** is also a relative minimum and is only required to be sufficient to urge further liquid into the stripper liquid circuit to maintain the predetermined or preset volume of liquid therein when leakage occurs.

As an example of the "relatively free" piston movements and liquid flow, and to place them in proper perspective to the stripping forces encountered in the illustrative can body former, with a production model of the stripper **30** incorporating the principles of the present invention, with the liquid circuit of the stripper having the required preset volume of liquid therein as urged by the liquid in the liquid supply line **108** under approximately 10 to 15 pounds per square inch, the stripper fingers **78** may be individually moved rearwardly from their forwardmost positions shown in FIG. **6** by human finger pressure. At the same time, it is known that approximately 1,000 pounds per square

inch or more must be exerted by the stripper fingers **78** against the thin annular edge **48** at the open end of the can bodies to commence the stipping thereof from the ram **42.** It is seen, therefore, that the "minimum reactive forces" exerted reversely or forwardly against the stripper fingers **78** and therethrough against the can body edge **48** by the piston movements and the liquid flow is minimal as compared to the ultimate stripping forces required at the actual commenencement of the stripping operation.

In operation of the embodiment of the stripper of the present invention above-described, after one of the can bodies **46** has been finally formed with the exception of the doming of the bottom wall by the bottom forming die **32,** the leading end of the ram carrying the can body in the ram working stroke enters the stripper **30** as shown in FIG. **6** moving from left to right. At the stage of movement shown in FIG. **6,** the can body **46** is just beginning to contact the stripper fingers **78** with such stipper fingers being in their radially inward pivoted positions. Furthermore, since there is no axial pressure or force against the stripper fingers **78,** these stripper fingers, as well as the finger pistons **66** and the liquid collector piston **92,** are in their forwardmost or normal "at rest" positions, the preset volume of liquid being contained in the liquid circuit of the stripper **30.**

Continuing the progressive movement of the ram **42** and can body **46** in the ram working stroke, as shown in FIG. **7,** the ram end and can body have passed axially partially through the stripper **30,** a portion of the can body now lying in radial interference with the stripper fingers **78** forcing the same to pivot radially outwardly to permit such passage. In the position shown in FIG. **8,** the can body **46** has passed beyond the stripper fingers **78** in the ram working stroke and the stripper fingers have pivoted back radially inwardly adjacent the outer surface of the ram **42** so that the ram may force the can body against the bottom forming die **32** and begin its retracting or return stroke still carrying the can body. In both of the positions shown in FIGS. **7** and **8,** all of the components of the stripper **30** remain in their at rest positions with the exception of the radial pivoting of the stripper fingers **78** since there is still no axial force against the stripper fingers.

After the end of the ram **42** has forced the can body **46** against the bottom forming die **32** and has reversed axial motion beginning its return stroke, the ram end and can body immediately axially reapproach the stripper **30** as shown in FIG. **9,** that is, moving from right to left as shown therein. In the stage of just beginning to contact the first of the stripper fingers **78** of FIG. **9,** that stripper finger being the upper finger where there is the maximum rise or scallop in the can body annular edge **48** while the lower stripper finger illustrated is still axially spaced from the can body annular edge. It will be noticed that the stripper fingers **78** lying pivoted radially inwardly adjacent the ram **42** as previously described are positioned to axially interfere with and block the return passage of the can body **46,** but since only bare initial contact with any of the stripper fingers is just taking place, all of the stripper fingers, their pistons **66** and the liquid collector piston **92** are still fully forwardly in their at rest positions.

Continuing return axial stroke movement of the ram **42** as shown in FIG. **10,** the upper stripper finger **78** is now being moved rearwardly by rearward urging of the can body annular edge **48** moving that stripper finger piston **66** rearwardly causing the contained liquid to begin liquid flow into the liquid collector **88** urging the liquid collector piston **92** rearwardly as shown. Furthermore, it would be assumed that other of the stripper fingers **78** not shown would at this stage, have been likewise contacted by the can body annular edge **48** depending on the exact contour of such annular edge so that further liquid flow into the liquid collector **88** could have been caused. In any event, as illustrated in FIG. **10,** the lower of the stripper fingers **78** is just being contacted by the can body annular edge **48** and will immediately commence its rearward movement.

Finally, assuming that the lower of the stripper fingers **78** shown is the last to be contacted by the can body annular edge **48** so that all of the stripper fingers have now been contacted, all of the stripper fingers have been moved rearwardly as shown in FIG. **11** and sufficient of the contained liquid will have been urged to flow into the liquid collector **88** causing the liquid collector piston **92** to bottom against the stop **98** and placing the liquid collector in maximum liquid accepting condition. At this moment of bottoming of the liquid collector piston **92,** further liquid flow from the stripper finger cylinders **62** through the header **64** into the liquid collector cylinder **90** is positively prevented or blocked creating a substantially immovable reactive force from the liquid collector piston **92** reversely back through the liquid to the stripper finger pistons **66** and against the stripper fingers **78** which prevents further axial movement of the stripper fingers and exerts the reverse axial stripping force against the can body annular edge **48** starting the stripping operation due to the continued axial movement of of the ram **42.** It will be particularly noted that at the time of this substantially immovable reactive force back through the contained liquid against the stripper finger pistons **66** and thus against the stripper fingers **78,** such force is exerted collectively against the stripper fingers in the then rearwardly adjusted positions of these stripper fingers as a perfectly conforming to the can body annular edge **48,** that is, the exact contour thereof. This is illustrated in FIG. **11** where the upper of the stripper fingers **78** first contacted has moved its piston **66** to the rearward extremities of its cylinder **62** while the lower stripper finger has only moved its piston rearwardly still spaced axially from its cylinder rearward extremity.

Thus, as the ram **42** continues its axial return stroke from the position shown in FIG. **11,** the stripper fingers **78** collectively complete the stripping of the can body **46** from the ram, each of the stripper fingers exerting substantially equal immovable reactive forces around the can body annular edge **48** so that substantially the entire of such annular edge is absorbing the relatively high stripping force or pressure. When the ram **42** has fully passed axially through the stripper fingers **78** in the ram return stroke completing the stripping of the can body **46** therefrom, the can body, now being free of the ram drops to a usual outfeed conveyor (not shown) of the can body former and is transported away for its trimming operation to be performed thereon. The stripper fingers **78** return to their positions as shown in FIG. **6** fully forward or at rest as urged by the stripper finger pistons **66,** the contained liquid and the liquid collector piston **92** returning to their at rest positions. The stripper **30** is, therefore, now ready for the next stripping operation and the ram **42** ultimately fully

withdraws and reverses starting its forming axial stroke to repeat the overall can body forming operation.

Referring back to the various auxiliary components of the stripper **30** previously briefly described, the electrical probe **100** may be used to be actuated by the liquid collector piston **92** contacting the stop **98** sending an electrical signal indicating the exact instant of such piston bottoming which is likewise the exact instant that the stripper **30** exerts the substantially immovable reactive force against the can body **46** to begin the stripping of the same from the ram **42.** By integrating this exact instantaneous signal of the electrical probe **100** into appropriate electrical and electronic components, it is possible to monitor operation of the can body former both as to proper functioning and malfunctioning or malfunctioning of a preceding production machine in the production line. For instance, by matching the timing of the electrical signal from the electrical probe **100** electronically against the exact movement of the ram **42** and electronically comparing the same with a predetermined limit range, proper length or short length or long length can bodies **46** may be detected and if the particular can body does not fall within the predetermined can body length range, the can body former may be immediately shut down until the source of malfunction is determined and corrected.

This same functioning may be accomplished with the pressure detector **104** previously briefly described. In other words, prior to movement of the stripper fingers **78** and during axial movement thereof until the instant of bottoming of the liquid collector piston **42** against the stop **98,** only the relatively low or minor pressures or forces against the contained liquid will be detected, but at the instance of the substantially immovable reactive force being exerted reversely through the liquid by the liquid collector piston bottoming, a very high pressure or force will be detected. Thus, the exact instant of detection of the high pressures or force by the pressure detector **104** can be integrated electronically to accomplish exactly the same purposes as the detection of the electrical signal of the electrical probe **100** previously described.

Furthermore, lack of an electrical signal from the electrical probe **100** or a high pressure detection by the pressure detector **104** during a return stroke of the ram **42** will indicate lack of any can body **46** on the ram which information might indicate that a production machine in the production line preceding the can body former is malfunctioning and requires shut down of the production line, all of which can be accomplished automatically. It is also pointed out that although the electrical probe **100** requires a location for actuation by the liquid collector piston **92** upon that piston bottoming against the stop **98** so that the electrical probe must be positioned for actuation in that general location, the pressure detector **104,** which is only detecting changes in pressure of the contained liquid could be at virtually any location where contained liquid exposure is accessible. The particular mounting of the pressure detector **104** at the liquid collector cylinder **90** as shown is, therefore, merely a convenient location.

The last of the auxiliary components of the stripper **30** briefly mentioned above is the air supply line **102** directed into the liquid collector cylinder **90** rearwardly of the piston **92.** The air supply line **102** may be used for directing a relatively low pressure supply of air into the liquid collector cylinder **90** rearward of the piston **92,** at least when the piston is in its forward minimum liquid accepting condition, to provide a contained volume of compressible air or other gaseous fluid compressed by the rearward movement of the piston and aiding the spring **96** in returning the piston back to its forwardmost position at completion of the stripping operation. Also, such relatively low pressure air or other gaseous fluid volume could be used for complete replacement of the spring **96,** both the compressing gas or the spring serving the same intended function in serving as compressible means with a light reacting force so as to create a light reactive force during rearward movement of the piston **92** and permit relatively free rearward movement of the stripper fingers **78,** yet of sufficient force to return the liquid collector piston back to its forward position upon completion of the stripping operation.

A further possible use of the air supply line **102,** and in which case it always must communicate with the interior of the liquid collector cylinder **90** rearwardly of the piston **92** and particularly when the piston **92** is in its bottoming position against the stop **98,** is as a relatively high pressure air or other gaseous fluid booster to aid in the stripping of a can body **46** once the liquid collector piston **92** has bottomed and produced the substantially immovable reactive force back through the contained liquid into the stripper fingers **78.** By directing a closely timed pulse of high pressure air or other gaseous fluid by appropriate well-known controls against the rearward side of the liquid collector piston **92** instantaneously with or immediately following the bottoming of the piston and the direction of the substantially immovable reactive force starting the stripping operation, the piston will be positively urged forwardly back toward its forwardmost position and this forward urging will be transmitted through the contained liquid back into the stripper fingers **78** tending to urge the stripper fingers in their exact relative adjusted positions to increase their urging of the particular can body **46** from the oppositely moving ram **42.** In this manner, the air or gaseous fluid high pressure pulse would serve as an assist in the stripping operation once the stripping operation was commenced and while still maintaining axial pressures against the can body **46** evenly distributed around the can body annular edge **48** as a result of the individually adjusted stripper fingers **78** according to the main principles of the present invention.

An alternate embodiment of the stripper **30** of the present invention is shown in FIG. **12** and the only differences therein relate to changes in the previously described stripper fingers **78** and the stripper finger pistons **66,** with a slight modification of the back retainer ring **58** to accommodate the foregoing changes. As shown in FIG. **12,** a multiplicity of circumferentially adjacent stripper fingers **112** are each preferably rearwardly secured to spherically shaped pistons **114** similarly forwardly and rearwardly reciprocal in the stripper finger cylinders **62,** but with a resilient or similar material sealing member **116** between each spherical piston and its spring **70.** Back retainer ring **118** is slightly radially outwardly relieved to accommodate the different shape of stripper fingers **112** and has an arcuate annular recess **120** at the corner thereof adjacent the spherical pistons **114** to receive and fix the forwardmost positions of the spherical pistons and their stripper fingers **112.**

Thus, the stripper fingers **112** serve the same purpose previously described and are radially inwardly and outwardly pivotal as controlled by the garter spring **82**, but in this alternate form, the stripper fingers pivot by pivoting the spherical pistons **114** within the cylinders **62**. The spherical pistons **114** likewise, with the cooperation of the sealing members **116**, serve the same reciprocal piston function of being moved rearwardly by axial pressure of a can body **46** on the end of the ram **42** to in turn cause rearward flow of the contained liquid and rearward movement of the liquid collector piston **92**, both the spherical piston and liquid collector piston movements being with minimal comparative reactive force against the stripper fingers **112** during the individual adjustments of the stripper fingers and their spherical pistons in conformance with the particular can body annular edge **48** as before described. One advantage that is presented by the particular form of spherical pistons **114** and their related sealing members **116** is that the contours of the spherical pistons do not have to exactly conform in sealing fashion to the internal contours of the cylinders **62** since the sealing members **116** serve the liquid sealing function and prevent more than slight quantities of the contained, preset volume of liquid from leaking past the spherical pistons and from the stripper **30**.

According to the principles of the present invention, therefore, a stripper **30** is presented which is a force equalized external stripper usable with metalworking machines and the like, whether in the first embodiment form or the alternate embodiment form. Such stripper presents a unique stripping concept which broadly is the contacting of and the initial rearward carrying of individual stripper fingers by conformance of these stripper fingers to the contour of the leading edge of the article being stripped and after substantially all of the stripper fingers have been so relatively adjusted, creating a substantially immovable reverse reactive force against such stripper fingers to stop movement of the same and cause them to react against the article leading edge to strip the article from a continuously moving ram. During the adjustment movement of the stripper fingers by the article to be stripped, minimal reactive forces are created against the stripper fingers so that such adjustment will be complete. Furthermore, with the following application of the substantially immovable reactive force against the stripper fingers after they have been individually adjusted and while they remain in their individually adjusted relative positions, the final stripping force is virtually equally distributed about the leading edge of the article being stripped so that the stripping force or forces may be equally absorbed about the article.

Although specific embodiments of the stripper principles of the present invention have been illustrated and described herein, it is not intended thereby to limit the principles and broad concept involved to the exact embodiments herein. Rather, the unique concepts of the present invention should be broadly construed within the limitations of the appended claims and reasonable mechanical equivalents of the various elements defined. Additionally, the unique methods defined herein by operation of the mechanical embodiments should likewise be broadly construed.

We claim:

1. In a stripping device of the type wherein frames means mounts a multiplicity of circumferentially adjacent fingers about an axially reciprocal ram movable therethrough with said fingers engaging a leading edge of a tubular article on said ram and stripping said article from said ram during said ram movement; the improvements comprising: reactor means operably connected to each of said fingers for normally urging each of said fingers generally axially to a pre-set maximum forward position ready to be contacted by said article leading edge and exerting a minimum reactive force against each of said fingers during individual movement of each of said fingers rearwardly from contact of that finger by said article leading edge dependent on said article leading edge contour until substantially all of said fingers have been so contacted, said reactor means after substantially all of said fingers have been so contacted exerting a substantially immovable reactive force against all of said fingers collectively in the then individual rearward movement positions of each of said fingers to cause said fingers collectively to strip said article.

2. In a stripping device as defined in claim **1** in which said reactor means includes a pre-set volume of liquid forced into relatively free flow by each of said fingers during said individual movement of each of said fingers rearwardly from contact of that finger by said article leading edge, said free flowing of said liquid being blocked after substantially all of said fingers have been so contacted and exerting a substantially immovable reactive force against all of said fingers collectively to cause said fingers collectively to strip said article.

3. In a stripping device as defined in claim **1** in which said reactor means includes a piston operably connected to and movable with each of said fingers, each of said pistons reacting against a pre-set volume of liquid and exerting said minimum reacting force against each of said fingers rearwardly from contact of that finger by said article leading edge by relatively free flow of said liquid, said free flow of said liquid being blocked after substantially all of said fingers have been so contacted to exert a substantially immovable reactive force against all of said fingers collectively to cause said fingers collectively to strip said article.

4. In a stripping device as defined in claim **1** in which said reactor means includes a positive bottoming liquid collector operably connected receiving a portion of a pre-set volume of liquid reacting in free flow as forced by each of said fingers during said individual movement of each of said fingers rearwardly from contact of that finger by said article leading edge, said collector bottoming after substantially all of said fingers have been so contacted blocking said liquid free flow and exerting a substantially immovable reactive force through said liquid against all of said fingers collectively to cause said fingers collectively to strip said article.

5. In a stripping device as defined in claim **1** in which said reactor means includes a piston operably connected to and movable with each of said fingers, a positive bottoming liquid collector, a pre-set volume of liquid between each of said pistons and said collector, said collector receiving a substantially free flow of a portion of said liquid during said individual movement of each of said fingers rearwardly from contact of that finger by said article leading edge through reaction against said liquid by said pistons, said collector bottoming after substantially all of said fingers have been so contacted and exerting a substantially immovable reactive force against all of said fingers collectively by blocking said

liquid free flow to cause said fingers collectively to strip said article.

6. In a stripping device as defined in claim 1 in which said reactor means includes pressure fluid assist means operably connected for exerting a positive pressure force upon said exerting of said substantially immovable reactive force to exert an additional positive force against each of said fingers urging said fingers toward said pre-set maximum forward positions to thereby assist said fingers in collectively stripping said article.

7. In a stripping device as defined in claim 1 in which said reactor means includes pressure detector means operable for detecting said reactor means exertion of said substantially immovable reactive force against said fingers.

8. In a stripping device as defined in claim 1 in which said reactor means includes electrical probe means operable for electrically signalling said reactor means exertion of said substantially immovable reactive force against said fingers.

9. In a stripping device of the type wherein frame means mounts a multiplicity of circumferentially adjacent fingers about an axially reciprocal ram movable therethrough with said fingers engaging a leading edge of a tubular article on said ram and stripping said article from said ram during said ram movement; the improvements comprising: a cylinder on said frame means for each of said fingers and having a generally axially reciprocal piston forwardly operably connected to that finger, each piston being individually rearwardly movable in its cylinder from a normally urged pre-set maximum forward position by engagement of its finger by said article leading edge during movement of said article thereagainst for said stripping; a positive bottoming liquid collector connected in flow communication with each of said cylinders rearwardly of said piston having operating means therein movable between a normally urged minimum liquid accepting non-actuated position and a maximum liquid accepting bottoming position, said operating means in said bottoming position positively resisting entrance of further liquid into said collector; a total pre-set volume of liquid completely filling all of said cylinders rearwardly of said pistons with all of said pistons in said maximum forward positions and said collector in said non-actuated position and said flow communication between said cylinders and collector.

10. In a stripping device as defined in claim 9 in which said flow communication between said collector and said cylinders includes a common header connected in flow communication with said collector and each of said cylinders rearward of said piston.

11. In a stripping device as defined in claim 9 in which said collector includes a cylinder having an operating piston therein movable between said normally urged minimum liquid accepting bottoming position, said piston being moved from said non-actuated position to said bottoming position by the flow of said liquid into said cylinder as a result of said finger pistons being moved rearwardly in their cylinders by engagement of said fingers by said article leading edge, said collector piston upon moving to said bottoming position resisting entrance of further liquid into said collector and creating an immovable reactive force through said liquid to said finger pistons to cause said fingers collectively to strip said article.

12. In a stripping device as defined in claim 9 in which said collector includes a cylinder having an operating piston therein movable between said normally urged minimum liquid accepting non-actuated position and a maximum liquid accepting bottoming position, said piston being moved from said non-actuated position to said bottoming position by the flow of said liquid into said cylinder as a result of said finger pistons being moved rearwardly in their cylinders by engagement of said fingers by said article leading edge, said collector piston upon moving to said bottoming position resisting entrance of further liquid into said collector and creating an immovable reactive force through said liquid to said finger pistons to cause said fingers collectively to strip said article, compressable means in said collector cylinder tending to urge said operating piston to said non-actuated position and said liquid from said collector cylinder, said compressable means compressing during movement of said collector operating piston to its bottoming position as forced by said liquid entering said collector cylinder forced by said finger pistons moving rearwardly from said article leading edge engaging said fingers.

13. In a stripping device as defined in claim 9 in which each of said finger cylinders has a compression spring therein rearwardly of said piston normally tending to urge said piston to said pre-set maximum forward position and compressing rearwardly upon said finger of that piston being engaged by said article leading edge during movement of said article thereagainst.

14. In a stripping device as defined in claim 9 in which said collector includes assist means actionable upon said operating means reaching said bottoming position for exerting a positive force against said operating means tending to move said operating means back toward said non-actuated position, said assist means positive force being transmitted through said liquid and said finger pistons to said fingers tending to assist said fingers in said article stripping.

15. In a stripping device as defined in claim 9 in which pressure detector means is operably connected for sensing positive pressure exerted by said liquid.

16. In a stripping device as defined in claim 9 in which electrical sensing means is operably connected to said collector for sensing and producing an electrical signal upon said collector operating means reaching said bottoming position.

17. In a stripping device as defined in claim 9 in which said pistons in said finger cylinders are generally spherical in configuration.

18. In a stripping device as defined in claim 9 in which said pistons in said finger cylinders are generally spherical in configuration and have said fingers secured thereto and movable therewith in both reciprocal and pivotal movement.

19. In a method of stripping a tubular article from an axially moving ram by engaging a leading edge of said article by a multiplicity of circumferentially adjacent fingers; the steps of: normally urging said fingers forwardly each to a pre-set forward position ready for individual finger engagement by said article leading edge; individually engaging said fingers by said article leading edge dependent on the particular contour of said article leading edge; permitting relatively free individual rearward movement of said fingers upon engagement by said article leading edge; after substantially all of said fingers have been contacted by said article leading

edge, positively stopping rearward movement of each of said fingers in its then rearward position determined by movement and contour of said article leading edge stripping said article from said ram during continued axial movement of said ram.

20. In a method of stripping as defined in claim **19** including the further step of after said positively stopping rearward movement of each of said fingers in its then rearward position, positively urging said fingers forwardly toward their pre-set forward positions while maintaining each finger in the same position relative to the other fingers to further aid in stripping said article from said ram during said continued axial movement of said ram.

21. In a method of stripping as defined in claim **19** in which said step of permitting relatively free individual rearward movement of said fingers includes the backing of said fingers by a liquid with said finger rearward movement causing a relatively free liquid flow; and in which said step of positively stopping rearward movement of each of said fingers includes the blocking of said liquid flow causing a positive reactive force against said fingers and said fingers against said article leading edge to strip said article from said ram during continued axial movement of said ram.

22. In a method of stripping as defined in claim **19** in which said step of permitting relatively free individual rearward movement of said fingers includes the backing of said fingers by a pre-set volume of liquid and permitting relatively free flow of said liquid into a liquid collector as urged by said individual rearward movement of said fingers caused by said engagement by said article leading edge; and in which said step of positively stopping rearward movement of each of said fingers includes the bottoming of said liquid collector stopping flow of said liquid and creating a reactive force through said liquid to positively stop rearward movement of each of said fingers and thereby strip said article from said ram during continued axial movement of said ram.

23. In a method of stripping as defined in claim **19** in which said step of permitting relatively free individual rearward movement of said fingers includes the backing of each of said fingers with a separate relatively freely rearwardly movable piston and moving each finger and its piston rearwardly as urged by engagement by said article leading edge; and in which said step of positively stopping rearward movement of each of said fingers includes the positive stopping of rearward movement of each of said pistons with said piston reacting against and stopping its finger thereby stripping said article from said ram during continued axial movement of said ram.

24. In a method of stripping as defined in claim **19** in which said step of permitting relatively free individual rearward movement of said fingers includes the backing of each of said fingers with a separate relatively freely rearwardly movable piston and backing all of said finger pistons with a preset volume of liquid relatively freely flowable into a movable liquid collector, said liquid flowing into said movable liquid collector upon urging against said liquid by said rearward movement of said finger pistons caused by finger rearward movement upon engagement by said article leading edge; and in which said step of positively stopping rearward movement of each of said fingers includes the bottoming of said movable liquid collector positively terminating the flow of said liquid into said collector to create a reactive force through said liquid and said finger pistons stopping rearward movement of each of said finger pistons and fingers thereby stripping said article from said ram during continued axial movement of said ram.

25. In a method of stripping as defined in claim **19** in which said step of permitting relatively free individual rearward movement of said fingers includes the backing of said fingers by a pre-set volume of liquid and permitting relatively free floww of said liquid into a liquid collector as urged by said individual rearward movement of said fingers caused by said engagement by said article leading edge; in which said step of positively stopping rearward movement of each of said fingers includes the bottoming of said liquid collector stopping flow of said liquid and creating a reactive force through said liquid to positively stop rearward movement of each of said fingers and thereby strip said article from said ram during continued axial movement of said ram; and in which said method includes the step of electrically detecting said liquid collector bottoming.

26. In a method of stripping as defined in claim **19** in which said step of permitting relatively free individual rearward movement of said fingers includes the backing of said fingers by a liquid with said finger rearward movement causing a relatively free liquid flow; in which said step of positively stopping rearward movement of each of said fingers includes the blocking of said liquid flow causing a positive reactive force against said fingers and said fingers against said article leading edge to strip said article from said ram during continued axial movement of said ram; and in which said method includes the step of pressure detecting the stopping of said liquid flow.

* * * * *