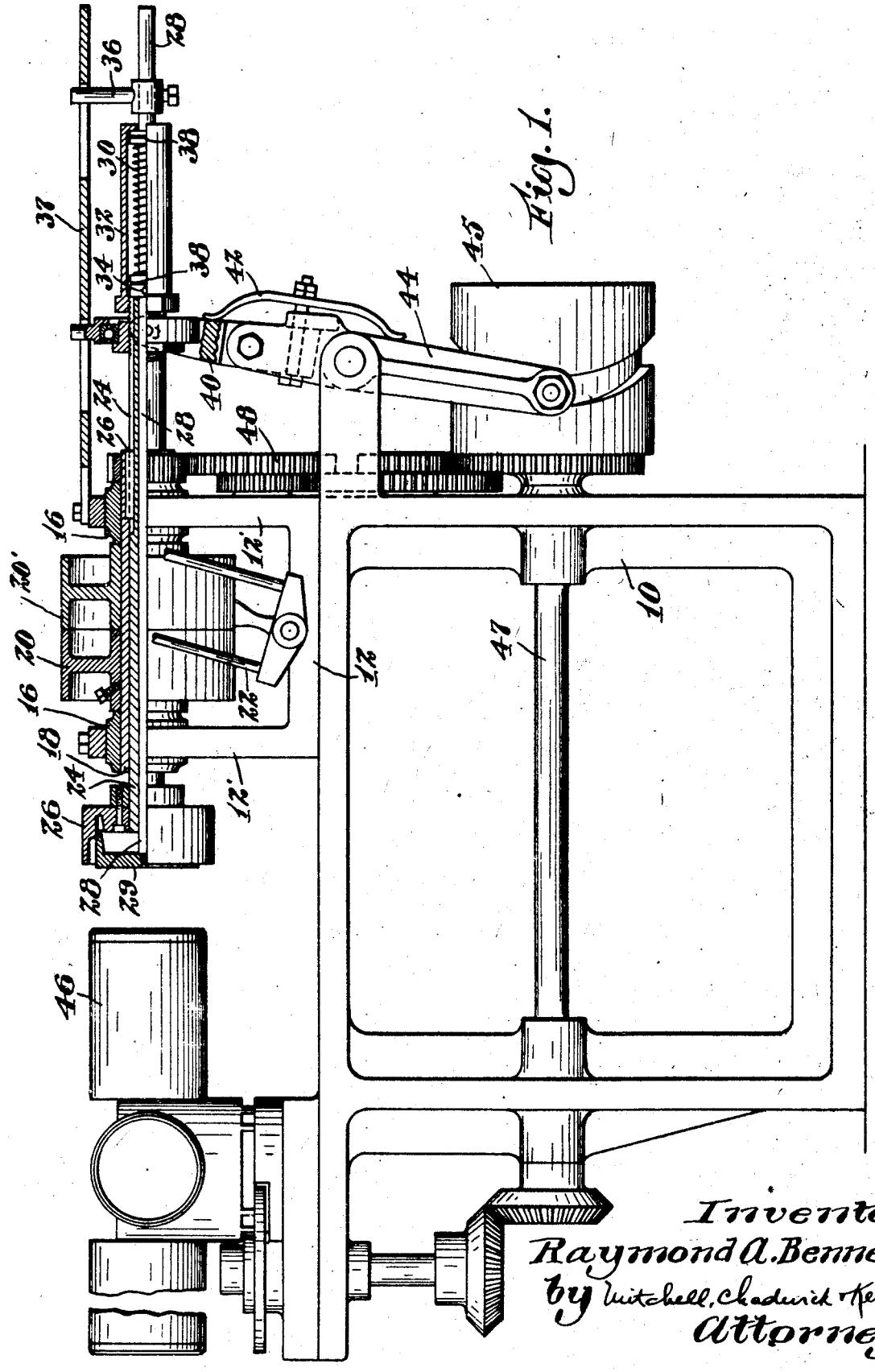
April 26, 1932. R. A. BENNETT 1,855,216

APPARATUS FOR MAKING PAPER CANS AND THE LIKE

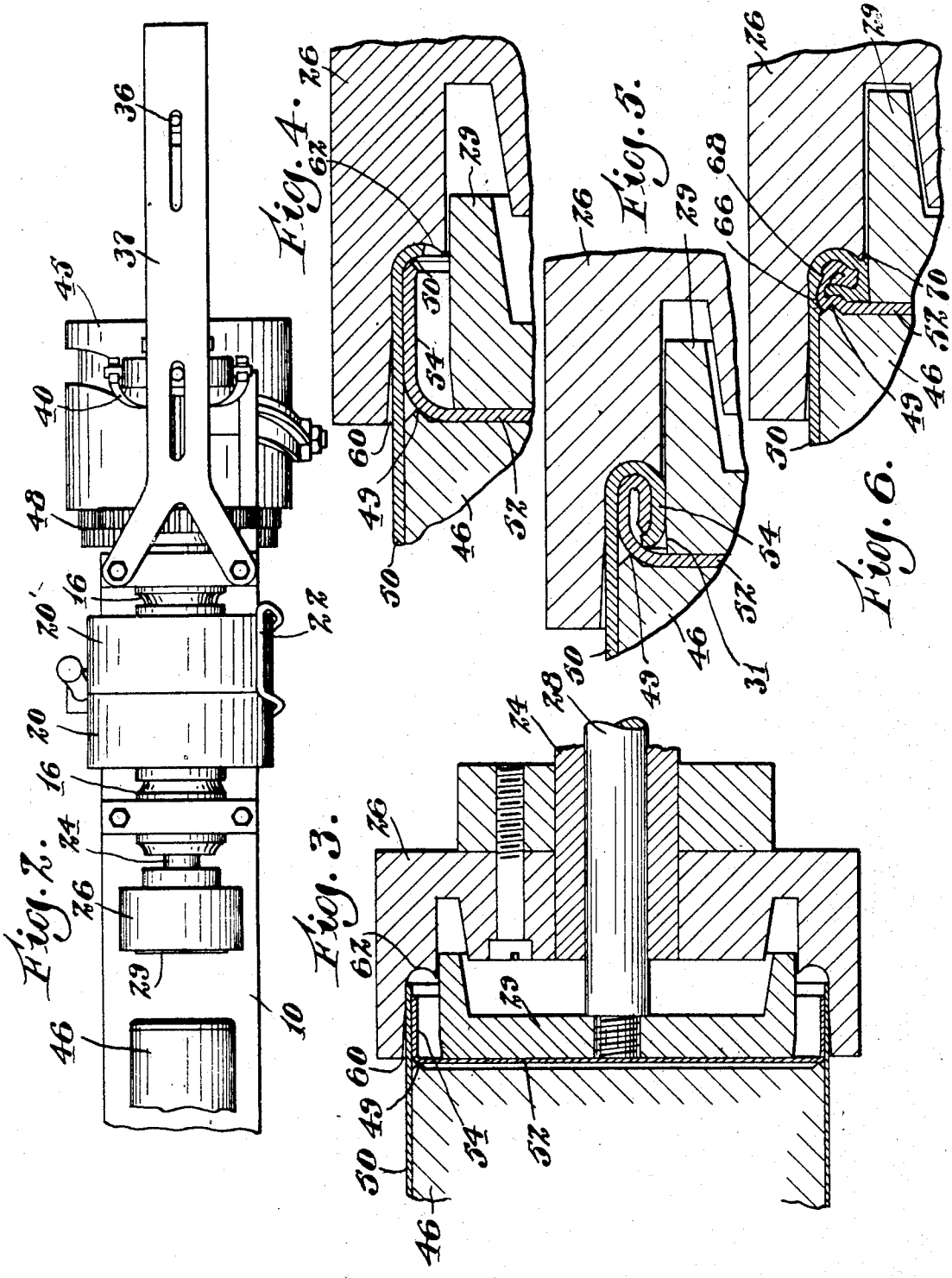
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APPARATUS FOR MAKING PAPER CANS AND THE LIKE

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UNITED STATES PATENT OFFICE

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APPARATUS FOR MAKING PAPER CANS AND THE LIKE

Application filed June 13, 1927. Serial No. 198,388.

This invention relates to improvements in apparatus for making paper cans and the like. More especially it relates to apparatus for fastening a disc closure in the end of a tube.

The invention provides a joint between the tube and the closure disc which is both tight and secure, in an absolute sense;—that is, so tight that I have not been able to force liquid out from a can thus closed, by leakage through this joint, although in every other type of paper can known to me I have been able to do that.

Heretofore the tightness of this joint has depended upon either the fit of the edge of a plain disc against the tube surrounding it or upon the crimping of the flange of a flanged disc with the end of the can body. Apparatus of the present invention makes a joint which combines these types, there being both a crimped flange and also a tight fit to the tube of what may be called the "edge" of the circular part of the disk, i. e., by a bead at the corner between the flange and body portion of the disk.

An important feature is that the invention makes it now for the first time possible to apply heavy swedging and creasing pressure in the crimping of the paper material, sufficient to make the joint actually tight. It provides for confining the material while being pressed, and confining it so closely that the pressure effects its acute deformation, beyond the elastic limit, giving it a permanent set, in a new and impermeable conformation. The invention comprises apparatus for making improved joints having the above and other advantages, some of which are mentioned hereinafter; and further purposes are to make the apparatus of a simple and durable construction; automatic in action, with certainty as to results; and easily managed by the attendant.

In the particular embodiment of the invention illustrated in the accompanying drawings, the apparatus comprises a fixed form called a plug, on which are placed the tubular can-body and the flanged-disk end-closure, toward and from which is movable a device for sealing them together. The body of the disk covers the end of the plug, and the cylindrical flange of the disk fits within the cylindrical end of the tube. These two lips, of the flange and of the tube, are to be sealed together by being crimped inward and moulded into a permanently impermeable mass. The device which cooperates with the plug to effect the sealing is opposite the plug and on the same axis with it. It comprises an annular spinning head or die for crimping the lips inward; within which is an axial spring plunger, preferably non-rotating, which prevents the escape of the material that is being crimped and compressed. The leading end of the plunger opposes, and is in shape preferably a counter-part of, the end of the plug except as to that part of the plug which is opposite the annular spinning die. In action, the spring plunger and the spinning die approach the disk on the end of the plug, with the plunger in the lead. The plunger engages the disk, presses it firmly against the end of the plug, and then, its advance being thus arrested, remains spring pressed in close contact with the disk while the annular die continues to advance and in so doing performs its crimping and compressing operation upon the paper lips. The cylindrical exterior of this plunger cooperates with the approximately cylindrical interior face of the outer wall of the die (which engages the outer face of the outer lip) to make the inner and outer side walls of a closed annular chamber having a length in the axial dimension which steadily diminishes as the die moves toward the plug. With the advancing of the die the lips of paper stock at first are crimped inward, in a manner already known, and are formed, without constraint other than that incidental to the crimping; but this formation later becomes severely compressed both in the radial direction and in the axial direction because of the diminishing axial dimension of the chamber within which the crimped lips are contained and the perfect resistance to radial escape afforded by the two said cylindrical walls. The dimensions of this chamber may be designed with reference to the length and thickness of paper lips which are to be crimped, so that the plunger will become tightly pressed against the plug

before material in the annular chamber is so far compressed as to tend to escape past the leading edge of the plunger. The plunger thereafter makes the chamber tight and affords radial support up to the limit of any pressure which it may be desired to apply, by further advance of the crimping head, without any contents of said chamber having possibility to escape. There may be special formation of that part of the end of the plug which constitutes one end of the chamber so that under the high pressure it will swedge the crimped material radially inward and outward to prevent any tendency of the lips to unroll after their supporting surfaces have been withdrawn. The other end of the chamber is made by the crimping die; and if the plunger be non-rotating, as in the preferred form herein illustrated, its exterior should have a very small clearance, a few one-thousandths of an inch, for example, a radial clearance of four one-thousandths, from the smallest dimension of the head which is rotating around it, so that there is not space for any substantial extrusion of the compacted paper stock to occur into the annular clearance between spinning head and plunger, but the pressing of the stock into the entrance of this clearance makes a stiff corner bead or crease in the stock. So constructed, an extraordinarily high pressure can be applied by the spinning head to compact the contents of the chamber, so as to make the paper fill every portion of the die chamber. This may deform the paper so acutely, and so re-shape it at its curves, that it remains set with no tendency to unroll or open. In consequence the joint becomes exceedingly rigid and is so tight as to resist any leakage through it.

It will be understood that details may be arranged in various ways, so that the drawings are to be considered more or less diagrammatical.

It is intended that the patent shall cover by suitable expression in the appended claims, whatever features of patentable novelty exist in the apparatus disclosed.

In the accompanying drawings:

Figure 1 is a side elevation of a machine for making paper cans embodying the present invention;

Figure 2 is a plan of the plug, and of the spinning head and driving mechanism therefor;

Figure 3 is a medial section of the plug, plunger and spinning head with the plunger in its initial engagement with the disk of the end closure; and

Figures 4, 5 and 6 are sectional views showing progressive relative positions of the plug, plunger and spinning head and illustrating the corresponding formations in the paper as the interlocking and crimping of the material occurs. These are to an extent diagrammatic, with certain clearance exaggerated.

Referring to the drawings, the machine frame 10 carries a yoke standard 12 whose arms 12′ support bearing collars 16 in which a hollow shaft 18 is journaled. Tight and loose pulleys 20, 20′ on this shaft provide for the reception of power from any suitable source which can be thrown on or off the machine by the belt shifter 22. The hollow shaft 18 contains a die-carrying sleeve 24 which extends through it, rotates with it, and carries on one end the annular spinning head or die 26. This sleeve 24 can slip longitudinally through the shaft 18 but is always forced to turn with it because of keys 26′ recessed at one end of the shaft, engaging with key ways on the sleeve.

A plunger rod 28 extends through the sleeve 24 and spinning head 26 where it terminates in a plunger head 29 which is a stout short cylinder with closed outer end. The diameter of this cylinder 29 is the merest trifle smaller than the inner diameter of the annular die 26 carried on the die-sleeve 24, so that it can move freely with respect thereto and yet these two surfaces are too close together for the paper to enter between them when under the very high pressure which is to be described. At the back end of the sleeve 24, the plunger rod 28 carries a coiled spring 30 of the compression type in a cage 32 secured to the back end of the sleeve 24, so that the sleeve 24 and spinning head 26 can continue to move forward after the progress of the plunger 29 has been stopped by its encountering the end of a plug 46. In this action the back end of the said cage 32 advancing with the said sleeve 24, compresses the spring 30 against a cross pin 34 on the arrested plunger rod 28. Rotation of the rod and plunger is prevented by a lug 36 engaging a slot in an arm 37 secured to the standard 12. Suitable thrust bearings 38 may be inserted to relieve friction. In this stage of action the annular spinning head 26 moves forward along the stationary plunger 29, reducing the axial length of the chamber around the plunger 29 in which the crimping is being accomplished. To advance the sleeve, and with it the plunger rod through the medium of the sleeve, and spring 30, a reciprocating arm 40 is fastened to the sleeve and is engaged by a rather strong bar spring 42 carried on one arm of a lever 44 pivoted on the frame and arranged to be rocked by a cam 45 on a shaft 47 which is driven by suitable gearing 48 forming a driving connection from the hollow shaft 18.

On the frame at the forward end of movement of the spinning head and plunger head, on the same axis therewith, is a plug 46 on which the can body 50 and its end closure 52 are mounted. This plug has an outside diameter corresponding to the inside diameter of the can body. Its face underlying the main body portion of the disk 52 may be flat

as shown, or may be dished-in if preferred, but near the edge of this face there is preferably a raised ring forming a beveled ridge 49. When the tube which is to constitute the can body 50 has been slipped onto this plug, and its end closure, which is then in the form of a disk 52 having an out-turned flange 54 extending axially toward the spinning head along the inside of the tube, has been seated against this ridge 49, the circular peak of the ridge is slightly nearer the axis of the plug than is the inner surface of the disk closure flange, 54.

With the tube 50 and its end closure 52, 54 on the plug, the cam 45 swings the lever 44 to move the plunger head 29 and spinning head 26 toward the plug, the plunger head passing easily within the flange 54 until it abuts against the disk surface 52. The diameter of the plunger head being appreciably smaller than the diameter of the ring ridge 49 the disk surface 52 is pressed against the face of the plug causing the edge portion of this disk to bend around the inner bevel of the ridge 49 as seen in Figure 4. The coiled spring 30 on the plunger rod should be strong enough to force the plunger head and the disk surface firmly against the face and ridge of the plug.

Although the plunger head and disk have thus become bottomed and the plunger's advance arrested, the spinning head continues to advance. This head has an annular recess with its entrance slightly beveled as at 60, to make sure of engaging outside of the can tube 50, and within is of the same diameter as the said outside surface of the tube until at its bottom 62 it curves inward and then forward to constitute a spinning die face, terminating very close to the plunger's convex cylindrical surface. As the head is moved forward by the cam, the cylindrical lips 50, 54 of the can body and its end closure are gradually turned inward by the rotating die bottom 62, crimped around and forced forward along the cylindrical surface of the plunger 29. The curving of these portions gives them a tendency to curl so that when the leading edge of the can body lip 50 reaches that surface of the disk 52 which is bent outward over the ridge 49 on the plug, this leading edge slips outward along the disk up against the flange 54 as shown in Figure 5.

The spinning head continues to advance; and because the crimped edges of tube and closure are now enclosed on all sides in a chamber of diminishing dimension, the spinning head soon begins powerfully to compress the rolled or crimped lips of the body and disk. This movement of the head imposes such compacting pressure on the paper material that the angle of the disk, where its flat surface 53 joins its cylindrical flange 54, is forced outward into the space between the plug ridge 49 and the can body 50; and because of the bevel of the ridge is actually thrust into the can body as at 66 (Fig. 6). The stock of the latter, thus squeezed by the disk angle entering it, is in turn forced into the crevices between the folds of the flange as at 68. If the pressure is carried far enough every bit of space in the chamber may become occupied by the paper. The ridge 49 on the plug, being between the edge of the plunger 20 and flange 54 of the disk, makes a sharp bend in the lip 50 of the can body which has been thrust over it, so that it is acutely deformed and its elasticity destroyed at the bend. Similarly at the other end of the joint, the inner edge of the can body is severely creased where the paper is compacted at the entrance of the clearance space between the inner edge of the die 62 and the cylindrical face of the plunger 29. This corner of the paper can easily be made abrupt, if the metallic angle between 62 and 29 be so; and also in fact a slight ridge or bead at this inner limit of the folded body lip 50 may be formed by the paper stock just entering the narrow space between the die and the plunger and forming a sort of bead as at 70 (Fig. 6). The inner face of the compacted mass made of the acutely bent lips 50 and 54 is cylindrical, being formed against the cylindrical surface of the plunger. The edge part of the disk portion 52 is sharply inclined inward in accordance with the inner slope of the circular ridge 49; and at its very edge is inclined reversely according to the outer slope on the said ridge, although this outer bevel is not so pronounced because at this point the angle of disk has been forced somewhat into the side 50 of the can, by the extrusion of a sort of bead.

When the paper material has been thus creased and compressed in the chamber or spaced between the plug, plunger and die until its compactness has reached a degree which resists further compression, the bar spring 42 yields, allowing the peak of the cam 45 to pass the rollers on the actuating lever 44. As the lever is returned by the cam 45 the spinning head is first withdrawn alone until the compressed spring 30 has been expanded. This enables the plunger 29 to hold the closure disk and tube against the plug 46 until the spinning head 26 and plunger 29 are in the positions relative to each other, shown in Figure 4, with the beveled portion 60 beside the crimped end of the can. Further withdrawal of the head brings with it the plunger 29 which slips out of the crimped end of the can, which occurs the more easily if there be a slight tapering of its end portion, as indicated at 31 in Fig. 5. The can may then be removed from the plug. It is advantageous to have a plurality of these plugs mounted on a rotating head stock, so that while the sealing operation is being performed on one plug a can body with end closure may be being placed on another plug

and the finished can may be being removed from the plug last previously in operation. The use of a head stock rotatable on an axis perpendicular to that of the operating parts permits of a plug being swung into alignment with the spinning head from a lateral position with precisely the proper positioning and without much withdrawal of the head in the axial direction, and altogether without axial withdrawal of the plug. Accordingly the travel of the spinning head is but little, and the speed of operation somewhat hastened.

I claim as my invention:

1. Apparatus for making paper cans and the like comprising a plug, for supporting a can body and its flanged closure blank, combined with a plunger, movable against the blank on the plug; and a crimping die surrounding the plunger, movable toward the plug independently of the plunger, and acting to compress the associated flange and body-end between itself, the plug and the plunger; the peripheral portion of the plug face, outside of the area overlain by the plunger, being in the same plane as the central portion of the plug face.

2. Apparatus for making paper cans and the like comprising a plug, for supporting a can body and its flanged closure blank, combined with a plunger, movable against the blank on the plug; and a spinning crimping die surrounding the plunger, movable toward the plug independently of the plunger, and acting to compress the associated flange and body-end between itself, the plug and the plunger; there being a flaring entrance to the clearance between die and plunger, and there being surface of the die having a spinning function adjacent to said clearance whereby the concentrated pressure is applied by the die to the material there progressively.

3. Apparatus for making paper cans and the like comprising a plug, for supporting a can body and its flanged closure blank, combined with a plunger, movable against the blank on the plug; and a crimping die surrounding the plunger, movable toward the plug independently of the plunger, and acting to compress the associated flange and body-end between itself, the plug and the plunger; the peripheral portion of the plug face, outside of the area overlain by the plunger, being in the same plane as the central portion of the plug face, and the said die having that portion of its crimping surface which terminates against the plunger, located at a substantial distance from the plug when at the end of crimping stroke, whereby a substantial extent of surface of the crimped materials then lies against the plunger's side wall; there being a small clearance space between plunger and die into the entrance of which small space a portion of the material of the body-end may enter and be creased when pressed by continued approach of the die to the plug.

4. Apparatus for making paper cans and the like comprising, in combination, a plug arranged to support a can body and a flanged closure disk in the body, with an end of the body and the flange of the closure projecting away from the plug; a spinnig head movable toward said plug and adapted to crimp and compress said projecting portions of the can and closure together; and means, for moving said head toward said plug, having a member adapted to yield when the crimping pressure is resisted to a predetermined degree by the crimped and compressed stock.

5. Apparatus for making paper cans and the like comprising, in combination, a plug arranged to support a can body and a flanged closure disk in the body with an end of the body and the flange of the closure projecting away from the plug; a spinning die adapted to engage said projecting portions of the can and closure and to crimp them into a tight seam; a sleeve carrying said die; a rod in said sleeve; a cylindrical plunger on said rod; means for rotating said sleeve and die; and means for moving said sleeve and rod axially toward said plug, comprising a yieldable connection between the sleeve and rod whereby the die may be moved toward said plug after said plunger has become seated on the closure.

6. Apparatus for making paper cans and the like comprising, in combination, a plug whose end for the most part is plane but which has an angular ridge extending around its edge; a plunger with plane end portion movable against said plane portion of the plug; and a crimping die surrounding said plunger and movable toward said plug independently of the plunger; said die being formed with crimping space between it, the plunger and the plug, with the side surface of the plunger serving as the inner wall, and the end of the plug serving as the bottom wall, of said crimping space; and said ridge on the plug being located adjacent to the outer wall of said crimping space, and being adapted to effect a swedging and creasing of material in said crimping space when said die compresses the mass.

Signed at Boston, Massachusetts, this fourth day of June, 1927.

RAYMOND A. BENNETT.