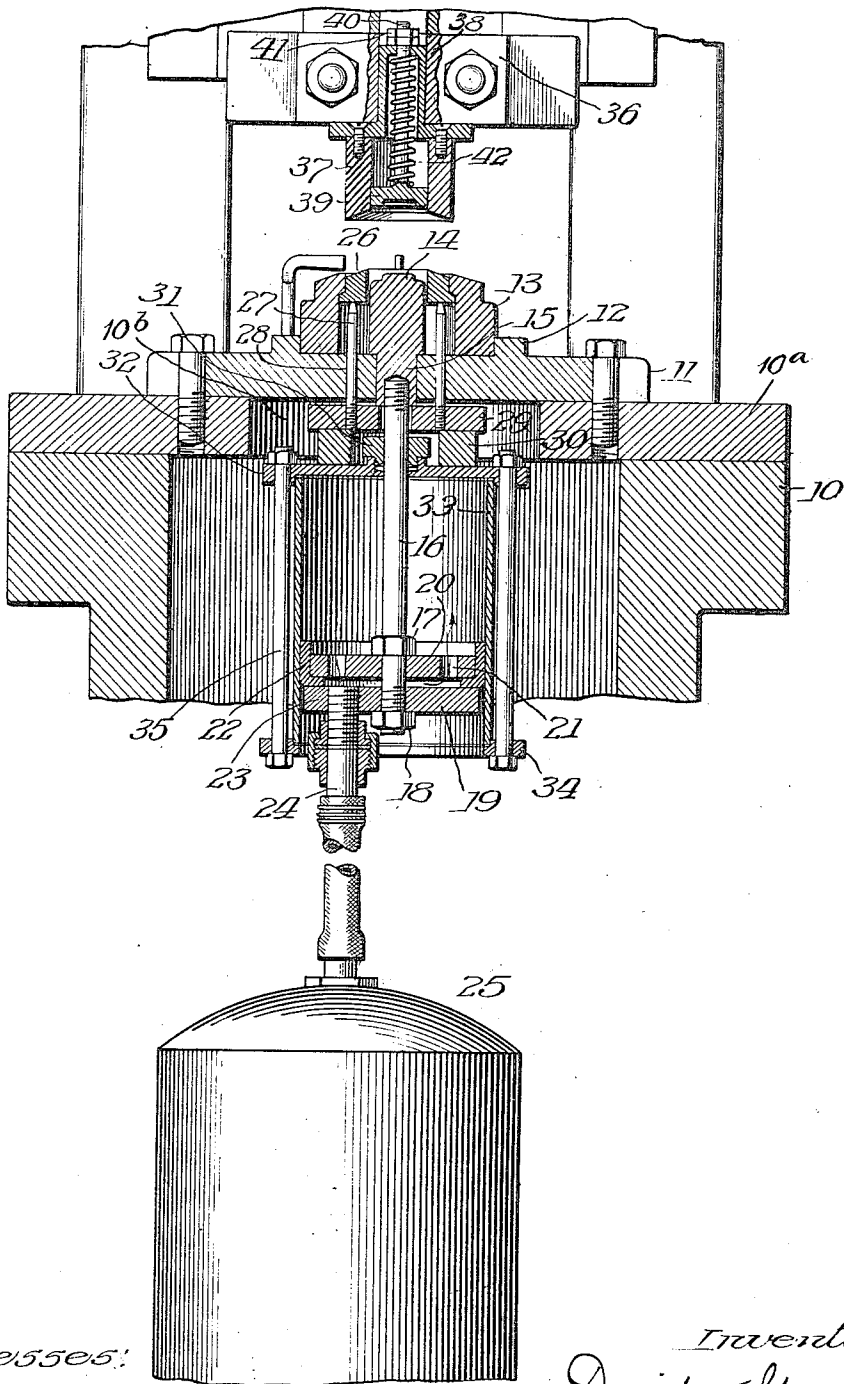


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DIE CUSHION.

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DIE-CUSHION.

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To all whom it may concern:

Be it known that I, DAVID STRAND, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Die-Cushions, of which the following is a specification.

In the drawing and pressing of sheet-metal by means of dies and working it up into various forms suitable for commercial use, it is necessary, during the shaping operation, to hold the marginal portion of the blank, or that portion adjacent to the forming block, between two moving members suitably pressed together, otherwise, the metal will not be adequately drawn or stretched, or the border of the blank will be wrinkled or in folds, such two cooperating members forcing the metal down over the forming block. Heretofore, for this purpose, it has been customary to back up the pressure-ring constituting one of such clamping members, either with a coil spring or a block of rubber of substantial size. Neither of these styles of cushion has been satisfactory because in each instance as the pressure-ring descends, the pressure exerted on it by such cushion increases, causing the margin of the blank to be gripped so securely and unyieldingly that the metal being drawn tears and breaks, ruining the article in the process of manufacture. If, on the other hand, it is attempted to use a lesser pressure, then the border of the blank is not held securely enough and the metal becomes drawn in folds or wrinkles, thus seriously damaging the article and rendering it unfit for use. Furthermore, such rubber cushions, which, by the way, have been found to be superior to springs, last but a short time and are expensive to renew.

The present invention aims to not only overcome these difficulties by providing means which will exert a substantially-constant pressure on the holding ring throughout its entire stroke or travel but to also provide an improved fluid pressure cushion, which is detachably or removably secured to the machine to act upon the gripping means, and which fluid pressure cushion is adapted

to be readily applied to any of the types of machines of this character already on the market. In the preferred embodiment of the invention, compressed air is used for this purpose, and a tank is employed of sufficient capacity, whereby movement of the pressure-ring will not modify the air-pressure used. Experience has shown that this means works entirely satisfactorily and overcomes all of the defects of the prior devices.

In the accompanying drawing which forms a part of this specification, I have illustrated a preferred embodiment of the invention, and reference should be had to this illustration for a full understanding of the structural and functional features of the device.

In this appliance, the machine-frame or table has supported thereon a bolster plate ^a10 having the usually centrally disposed opening ^b10 therethrough, and supported upon the bolster plate is a holding-plate 11 equipped with an upstanding rim 12, which maintains in position a stationary cutting die 13 of ring form, as shown, and this holding plate 11 constitutes a portion of the die, the shape thereof is determined by the shape of the work to be performed as usual in dies of this character. Centrally disposed within this die is a stationary center or forming block 14 of the required conformation to produce the desired pressed or drawn metal article. The reduced lower end 15 of this block fits in an aperture of the plate 11 and is provided with a threaded recess into which one end of a depending rod 16 is removably threaded to the lower end of which rod and between two nuts 17 and 18 there is fastened a plunger or piston composed of a lower plate 19, an upper plate provided with apertures 21, and a leather or similar cup washer 22, a portion of which encircles the member 20, another portion or inwardly-turned flange being clamped between the parts 19 and 20. Plate 19 preferably has a threaded aperture 23 there-through accommodating the upper end of a tube or pipe 24 associated with a compressed-air tank 25 of substantial capacity, which may be supplied with compressed-air

from any suitable form of pumping apparatus. The tube 24 forms an unvalved connection between the tank 25 and the fluid pressure cushion, so that any increase in pressure in the cushion due to the operation of the machine, will be rendered negligible by the fluid being allowed to flow freely back into the tank 25.

Between the cutting-die 13 and the forming or shaping-block 14, a pressure-ring 26 of suitable shape rests upon the upper ends of a plurality of rods 27 adapted to slide through apertures 28 in plate 11, the lower ends of these rods having threaded engagement with a plate 29 centrally apertured to receive the stem 16, and beneath such plate there is a ring 30 encircling a stuffing-box 31, which maintains a fluid-tight association with the stem 16 and forms a part of the upper end-wall 32 of a casing or cylinder composed of a shell 33, a lower end ring 34, and a plurality of bolts 35 securely fastening together the parts 32 and 34, all as is clearly illustrated. The cup-washer 22 of the stationary plunger or piston maintains an air-tight connection with the inner cylindrical surface of the casing or shell in the usual and well-known manner.

The upper portion of the appliance comprises a reciprocatory member 36 on which is mounted a hollow combined punch and cutting die 37 secured to a sleeve 38. Within the part 37 a knock-out plunger 39 is mounted on a stem 40, the latter extending through an aperture in the top end of the sleeve 38 and provided above such sleeve with a plurality of nuts 41. A downwardly-pressing spring 42 abuts at its lower end against the plunger and at its upper end against the end of the sleeve, the spring encircling the stem 40 being accommodated within the parts 37 and 38, as is shown.

The operation of this appliance is substantially as follows:

Assuming that a metal sheet has been placed on the part 13, the member 36 and its associated elements descend, the cooperating cutting dies 37 and 13 acting to cut out a blank of the proper size and shape, the die 37 entering the die 13, as will be readily understood. As it does so, the marginal portion of the blank is gripped or clamped between the pressure-ring 26 and the lower face of the punch or cutting die 37. During the continued descent of the part 37 the pressure-ring 26 which is forced down by it is pressed upwardly securely clamping the sheet-metal blank by reason of the action of the compressed air in the cylinder 33 acting against the end-plate 32, it being understood that the air in such chamber is in direct and unobstructed communication with the interior of the reservoir

or compressed-air compartment 25, through the apertures 21 and pipe or tube 24. Downward movement of the ring 26, of course, causes a relative movement of the cylinder 33 and piston 22, one with relation to the other, and a portion of the air within the cylinder 33 is expelled into the chamber 25 by reason of such relative movement of the housing or casing and piston, but the capacity of the tank 25 is such that the pressure acting upwardly on the pressure-ring 26, nevertheless, remains substantially constant. The pressure around the ring, that is, around the forming block, is also substantially uniform. In thus pressing the sheet downwardly, it is formed or drawn to shape around the fixed center forming block 14, the co-acting descending parts 26 and 37 during this operation clamping the edge of the blank sufficiently to prevent its wrinkling or folding, but not sufficiently, however, to cause the article being formed to tear or become severed.

Upon the up-stroke of the part 36 and its associated elements, the knock-out plunger 39 which during the forming operation was caused to recede in the part 37, now, under the action of its spring 42 discharges the shaped or formed shell. Of course, as the member 36 rises, the ring 26 and its cooperating parts also rise under the action of the compressed air, being limited in their upward travel by any suitable means. This pressure being uniform around the ring, there is no tendency to cant the finished article in the discharging operation and hence such article is stripped off of the form without injury to itself.

It will be manifest that all of the operative connections between the cushion and the respective parts of the die, are made through the opening 10^b, and which opening is present in all ordinary machines of this type, so that the present invention is universal in its use, in that it may be readily and quickly transferred from one machine to another, or attached to a machine without the slightest alteration in either the machine or the cushion.

It will also be observed, therefore, that the portion of the sheet-metal blank around the forming block during the shaping operation is held between two traveling members pressed together under a substantially-uniform pressure, and this is one feature in which the invention principally resides, although the removal of the shaped article from the form by the pneumatic cushion, without injury, constitutes another advantage of the invention.

To those skilled in this art, it will be clear that many minor mechanical changes may be made in the structure illustrated and described without departure from the sub-

stance of the invention and without the sacrifice of any of its substantial benefits and advantages.

I claim:

5 1. The combination of a sheet metal shaping member, means cooperating with said member for shaping the material, and embodying gripping means for the material, a freely detachable and self contained fluid
10 pressure means for maintaining a substantially unvarying pressure on the gripping means during the operation of shaping the material, said fluid pressure means embodying a piston and a cylinder, said piston
15 carrying a rod extending beyond the end of the cylinder and detachably secured to the said shaping member.

2. The combination of a sheet metal shaping member, means cooperating with said
20 member for shaping the material, and carrying gripping means for the material, a freely detachable and self contained fluid pressure means for maintaining a substantially unvarying pressure on the grip-
25 ping means during the operation of shaping the material, the said fluid pressure means embodying a cylinder and piston relatively movable, said piston carrying a rod extend-
30 ing beyond the end of the cylinder and detachably connected with the said shaping member, and also operating to support the cylinder.

3. The combination of a sheet metal shaping member, a support therefor, said sup-
35 port having an opening therethrough in alinement with the said member, means cooperating with the said member for shaping the material and embodying gripping means for the material, and a self-contained fluid
40 pressure cushion operating upon the gripping means whereby a substantially unvarying pressure will be maintained on the gripping means during the operation of the
45 shaping of the material, the said cushion embodying a cylinder and a piston movable relatively one with relation to the other, one
50 of the parts of said cushion being connected with the said shaping member, through the said opening and being freely detachable therefrom, and an operative connection be-
tween the other part of said cushion and the said gripping means but being detached therefrom.

4. The combination of a sheet metal shaping member, a support therefor, the said
55 support having an opening therethrough in alinement with the said member, means cooperating with the said member for shaping the material and embodying gripping means
60 for the material, and a self-contained fluid pressure cushion operating upon the gripping means whereby a substantially unvarying pressure will be maintained on the grip-
ping means during the operation of the

shaping of the material, the said cushion
65 embodying a cylinder and a piston movable relatively one with relation to the other, one of the parts of said cushion being connected with the said shaping member, through the
70 said opening and being freely detachable therefrom, and means where the gripping means will be responsive in its operation to the operation of the other part of the cushion.

5. The combination of a sheet metal shaping member, a support therefor, said sup-
75 port having an opening therethrough in alinement with the said member, means cooperating with the said member for shaping the material and embodying gripping means
80 for the material, and a self-contained fluid pressure cushion operating upon the gripping means whereby a substantially unvarying pressure will be maintained on the grip-
85 ping means during the operation of the shaping of the material, the said cushion embodying a cylinder and a piston movable relatively one with relation to the other, one
90 of the parts of said cushion being connected with the said shaping member, through the said opening and being freely detachable therefrom, and an operative connection be-
95 tween the other part of said cushion and the said gripping means but being detached therefrom, the shaping member and the said gripping means being both connected with
the respective parts of the cushion through the said single opening in the support.

6. The combination of a sheet metal shaping member, a support therefor, said sup-
100 port having an opening therethrough in alinement with the said member, means cooperating with the said member for shaping the material and embodying gripping means for the material, and a self-contained fluid
105 pressure cushion operating upon the gripping means whereby a substantially unvarying pressure will be maintained on the gripping means during the operation of the
110 shaping of the material, the said cushion embodying a cylinder and a piston movable relatively one with relation to the other, one
115 of the parts of said cushion being connected with the said shaping member, through the said opening and being freely detachable therefrom, and an operative connection be-
tween the other part of said cushion and the said gripping means but being detached therefrom, the connection between the said
120 shaping member and one of the elements of the cushion constituting the sole support for the cushion.

7. The combination of a sheet metal shaping member, a support therefor, said sup-
125 port having an opening therethrough in alinement with the said member, means cooperating with the said member for shaping the material and embodying gripping

means for the material, a self-contained fluid pressure cushion operating upon the gripping means whereby a substantially unvarying pressure will be maintained on the gripping means during the operation of the shaping of the material, the said cushion embodying a cylinder and a piston movable relatively one with relation to the other, one of the parts of said cushion being connected with the said shaping member, through the said opening and being freely detachable therefrom, and an operative connection between the other part of said cushion and the said gripping means but being detached therefrom, and a compressed fluid tank having free communication with the cylinder, whereby the pressure in the cylinder and tank are always maintained substantially the same.

DAVID STRAND.