Aug. 27, 1929. J. R. GAMMETER 1,726,219

PERFORATING DEVICE FOR RUBBER SHEETS

Filed Dec. 3, 1924 2 Sheets-Sheet 1

FIG. 1.

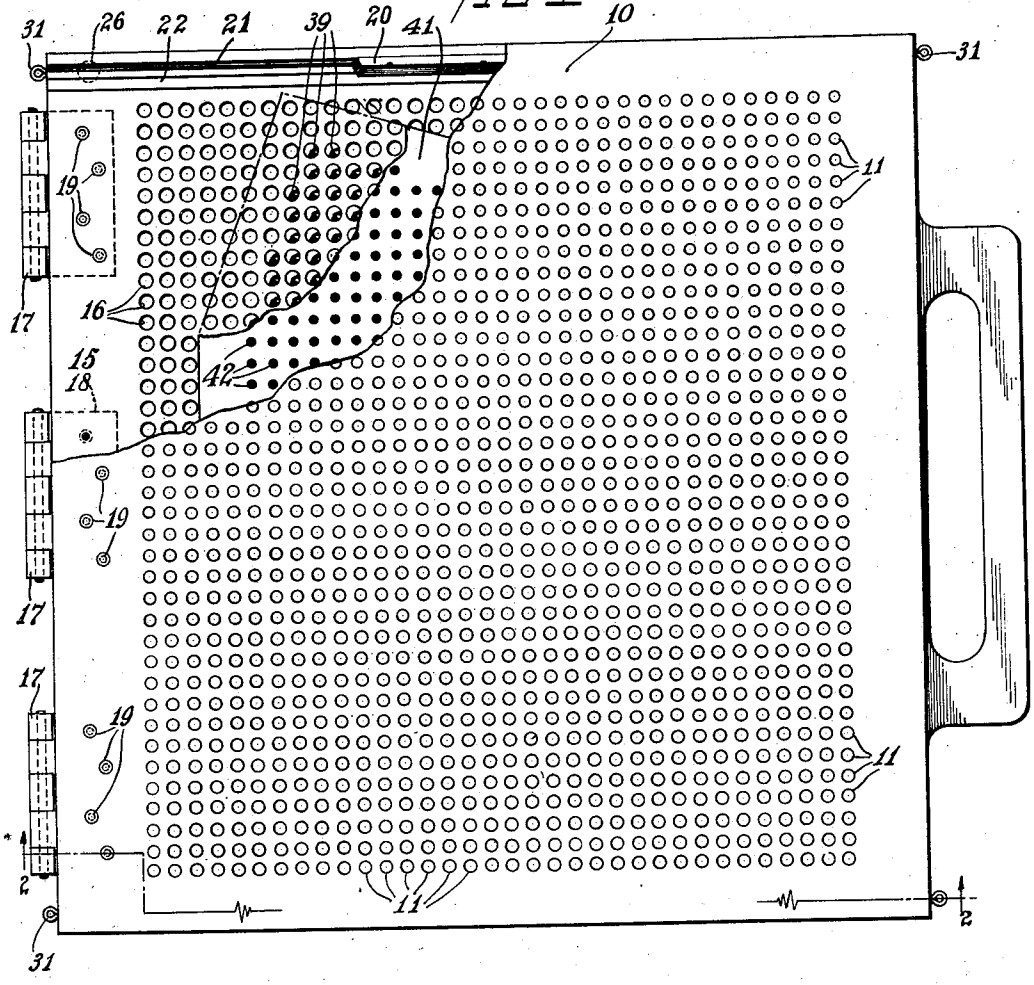
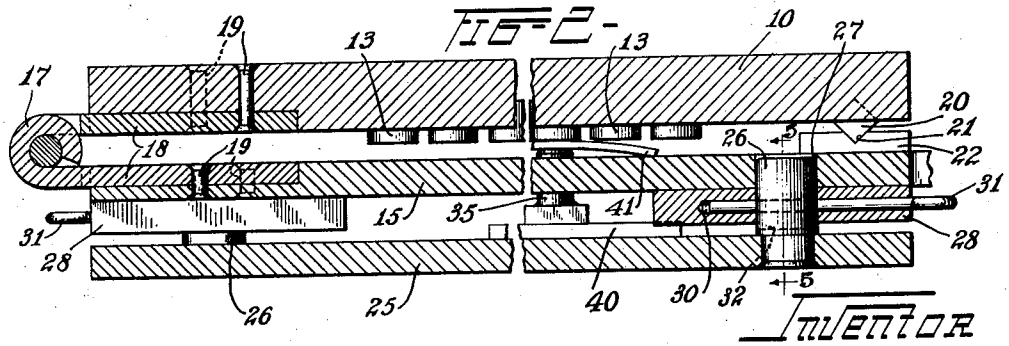


FIG. 2.



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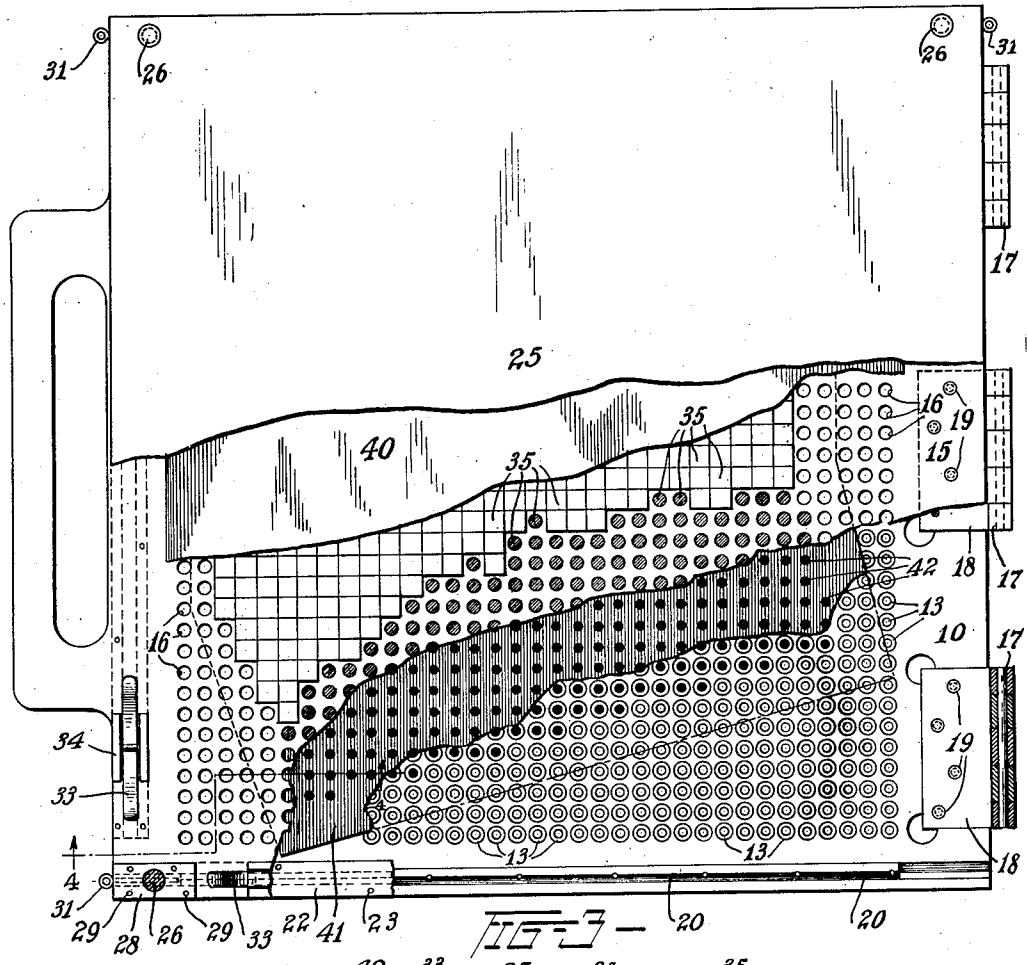


FIG. 3.

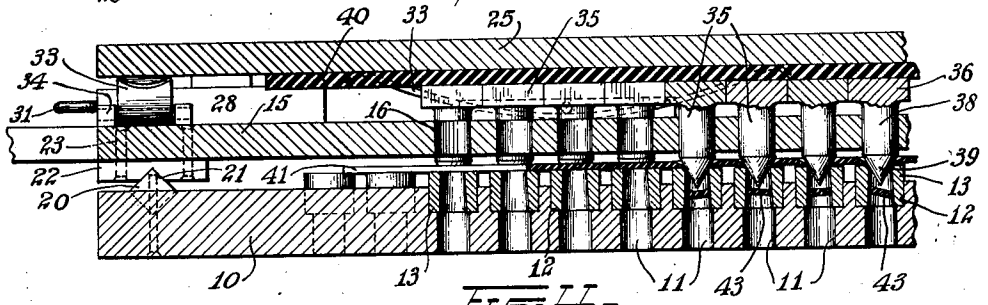
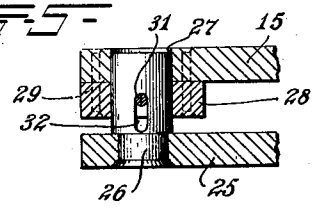


FIG. 4.

FIG. 5.



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UNITED STATES PATENT OFFICE.

JOHN R. GAMMETER, OF AKRON, OHIO, ASSIGNOR TO THE B. F. GOODRICH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PERFORATING DEVICE FOR RUBBER SHEETS.

Application filed December 3, 1924. Serial No. 753,638.

This invention relates to machines for perforating sheets of rubber and similar elastic material, and has for an object to provide for performing operations of this character a device adapted to accommodate sheets of various shapes and sizes, to leave imperforate margins of desired widths on the sheets irrespective of the size or shape of the sheet, and to form therein with the perforations designs of varied character. A further object is to provide an apparatus which will accurately, quickly and economically perforate a thin elastic, soft-rubber sheet.

Of the accompanying drawings, Fig. 1 is a plan view of a preferred embodiment of my perforating device, parts being broken away to show the rubber sheet and punch plate; Fig. 2 is a section on an enlarged scale, on line 2—2 of Fig. 1; Fig. 3 is a reverse plan view of the device of Fig. 1, parts being broken away; Fig. 4 is an enlarged sectional view on line 4—4 of Fig. 3; and Fig. 5 is a detailed sectional view on line 5—5 of Fig. 2.

In the drawings, 10 is a die-plate of steel, or other suitable material, having aligned rows of apertures 11 regularly spaced and substantially coextensive with the plate, the marginal portions only being imperforate. The apertures 11 as shown, are in quadrangularly disposed rows, but it is obvious that the perforations may be placed in equilateral triangular relation to each other, or in other relative positions. Each of the apertures 11 has an enlarged portion 12 on the inner side of the plate 10 in which a hollow, cylindrical die member 13 of hardened steel is disposed.

Hinged to die plate 10 is a punch plate 15, coextensive in size with the die plate 10, and having apertures 16 axially aligned with the die apertures 11. As shown, the plates 10 and 15 are connected by hinges 17 which have their leaves 18 inset into the inner surfaces of the plates 10 and 15 and secured thereto by rivets 19. Accurate spacing of the plates 10 and 15, and alignment of the apertures 11 and 16, when the plates are in closed position, are attained by means of the square dowel strips 20 diagonally disposed and mounted along the marginal edges of the plate 10, which strips fit into notches 21 in spacer blocks 22 secured to the plates 15, as by bolts 23.

A backing plate 25 is detachably secured to the plate 15 in parallel spaced relation thereto, the securing means being such as to permit relative limited movements therebetween in a direction axially of the apertures 16 in the plate 15. As shown, the plate 25 has swaged therein at its four corners up-standing studs 26 which project into aligned apertures 27 formed in the plate 15 and spacer blocks 28, the latter being secured to the corners of the plate 15 as by rivets 29. (See Figs. 2 and 5.) Each spacer block 28 is provided with an elongated bore 30, disposed to pass centrally through the apertures 27 therein, and which is adapted to receive a cotter or tie pin 31. The studs 26 are provided with longitudinal slots 32 registering with the bores 30 of the blocks 28, the slots being of sufficient length to permit the desired relative movement of the plates 15 and 25 when the cotter pins 31 are in place. Normally, the plates 15 and 25 should be in their extreme spaced apart position. Arcuate springs 33 seated in suitable saddles 34, the latter secured to the plate 15, bear against the plate 25 and hold the plate 25 in maximum spaced relation to the punch plate 15, the pins 31 in the slots 32 limiting the distance between said plates.

The punch plate 15 carries in the apertures 16 interchangeable punch pins 35. These pins, as shown, have a square head 36, a cylindrical body 38 and a pointed tip 39. The body portions 38 of the pins 35 are somewhat greater in diameter than the inner diameters of the hollow dies 13, and have a relatively close, free-moving fit in the apertures 16. The square heads 36 are of such size as to abut each other on all sides and thus present a substantially unbroken surface to a cushion 40 of slab-rubber, which is normally interposed between the heads 36 and the backing plate 25. It is to be understood, however, that square-headed punch pins are not essential to my invention, since they serve merely to give a longer life to the cushion 40. Hexagonal and round headed pins may be employed with equally satisfactory results.

The apparatus above described may be employed in the following manner. The backing plate 25 and the cushion slab 40 having been removed from the punch plate 15, the pins 35 are inserted in the apertures 16 in such number and disposition as to

form a design of required size and shape. The cushion 40 and backing plate 25 are then secured to the punch plate 15 by insertion of the cotter pins 31 into the aligned bores 30 in the spacer blocks 28 and slots 32 in the studs 26. The plates 10 and 15 are then opened up by swinging back the upper plate on the hinges 17, and a sheet of rubber 41, or other like material to be perforated, is placed over the lower plate in correct position to receive, in proper relation to its margin, perforations of the design set up in the punch plate 15. The sheet 41 preferably is wet to facilitate the punching operation.

The upper plate is now closed upon the lower plate, the interlocking of the dowel strips 20 and the notches 21 of the blocks 22 ensuring that the punch pins 35 and dies 13 are brought into accurate axial alignment. (See Fig. 2.) The perforating device is now placed in a suitable press and the backing plate 25 and die plate 10 are forced relatively toward each other against the compression of the springs 33, the tie pins 31 moving in the slots 32 of the studs 26. The punch pins 35 are thus moved into the central openings of the dies 13, the points of the punch pins 35 first penetrating the rubber sheet 41, then stretching it locally over the conical walls of the tips and finally bringing the conically deformed portions of the sheet into contact with the inner edges of the dies 13. The cutting of all perforations is thus concurrently affected by a direct pressure action, rather than a shearing action, which produces clean-cut perforations 42. The cushion 40 serves to equalize the cutting pressure exerted by each of the punch pins 35 and to compensate for any slight inequalities in their lengths. The severed disks 43 pass into the apertures 11 of the die plate whence they are subsequently readily removed. The device is then taken from the press, the plates opened up and the perforated sheet removed. The device is then ready for a succeeding operation.

A particular advantage of the above described device and method of procedure lies in the facility with which the backing plate 25 and the cushion 40 may be removed from the punch plate 15, and the design or arrangement of the punch members 35 in the apertures 16 changed either in size or configuration to accommodate articles of various sizes and shapes. Further, the employment of interchangeable and separately operable punch members permits the ready replacement of defective punch members.

Alternative to the above procedure, where a wide variety of designs or sizes of sheets are to be perforated, in order to eliminate the labor of resetting the design in the punch plate 15, I may fill all the apertures 16 in the punch plate 15 with punch pins 35 and insert between the backing-plate 25 and punch pins 35 a cushion slab 40 of the shape and size it is desired that the perforated portion of the sheet 41 shall have. Upon the application of pressure in the press, the punch pins 35 which do not engage the cushion are not forced into the dies 13 and hence effect no cutting action upon the sheet. The result is that perforations are made in a portion of the sheet having the shape and size of the cushion 40. Thus, the marginal and any other desired portions of the sheet may be retained imperforate while certain other portions are perforated with the desired design.

Modifications may be resorted to within the scope of this invention, and I therefore do not wholly limit my claims to the specific procedure or apparatus herein described.

I claim:

1. A device for perforating a sheet of rubber or like material comprising means securing a plurality of hollow dies in spaced relation, means adapted to support a plurality of independently reciprocative punch pins adapted to be arranged in interchangeable designs of varying sizes and shapes in alignment with said dies, and means movable relatively to said supporting means for forcing said dies and punch pins into simultaneous cutting engagement with a resilient pressure.

2. A device for perforating a sheet of rubber or like material comprising means securing a plurality of hollow dies in spaced relation, means for presenting a plurality of independently movable punch pins in alignment with certain of said dies, independently movable means for simultaneously bringing said aligned dies and punch pins into cutting engagement, including means for distributing the pressure with substantial equality among the cooperating dies and punch pins.

3. A device for perforating a sheet of rubber or like material comprising means securing a plurality of hollow dies in regularly spaced relation, means embodying a plurality of apertures disposed in the same spaced relation as the hollow dies, punch pins adapted to be inserted in said apertures in free-moving relation thereto, means for securing an alignment of the punch pins with the dies, and resilient means movable relatively to said apertured means to bring said dies and punch pins simultaneously into cutting engagement.

4. In a perforating device, in combination, a plate having a plurality of regularly spaced apertures, punch pins removably inserted in at least some of the said apertures, a cushion adapted to engage the heads of said punch pins, a backing plate supporting said cushion and so attached to said apertured plate as to permit a limited move-

ment of said plates toward and from one another, and a die-plate containing a plurality of hollow cylindrical dies in the same regular arrangement as the apertures and aligned to coact with said punch pins, the internal diameter of the dies being less than the diameter of the punch pins.

5. In a perforating device, in combination, an apertured plate in which a plurality of headed punch members are adapted to be inserted to form designs of varying sizes and shapes, means movable relatively to said apertured plate and adapted to coact with said heads for simultaneously advancing the punch members in the said apertures, said means being removable to permit a change in design of said punch members, and a die-plate containing a plurality of hollow cylindrical dies in the same regular arrangement as the apertures and aligned to coact with said punch pins, the internal diameter of the dies being less than the diameter of the punch pins.

6. In a perforating device, in combination, an apertured plate in which a plurality of headed punch members are adapted to be inserted to form designs of varying sizes and shapes, a backing plate coacting with said heads for simultaneously advancing the punch members in said apertures, and means detachably securing said backing plate to said apertured plate and permitting a limited movement of said plates toward and from one another.

7. In a perforating device, in combination, an apertured plate in which a plurality of headed punch members are adapted to be inserted to form designs of varying sizes and shapes, a backing plate coacting with said heads for simultaneously advancing the punch members in said apertures, means detachably securing said backing plate to said apertured plate and permitting a limited movement of said plates toward and from one another, and resilient means normally holding said plates in maximum spaced-apart relation.

8. In a perforating device, in combination, an apertured plate in which a plurality of headed punch members are adapted to be inserted to form designs of varying sizes and shapes, a backing plate coacting with said heads for simultaneously advancing the punch members in said apertures, and means detachably securing said backing plate to said apertured plate and permitting a limited movement of said plates toward and from one another, said means including posts fixedly secured in one plate and attached to the other plate with a lost-motion connection.

9. In a perforating device, in combination, an apertured plate in which a plurality of headed punch members are adapted to be inserted to form designs of varying sizes and shapes, a backing plate coacting with said heads for simultaneously advancing the punch members in said apertures, means detachably securing said backing plate to said apertured plate and permitting a limited movement of said plates toward one another, said means including posts fixedly secured in one plate and attached to the other plate with a lost-motion connection, and springs normally holding said plates in maximum spaced relation.

In witness whereof I have hereunto set my hand this 1st day of December, 1924.

JOHN R. GAMMETER.