

[54] **PERFORATING MACHINE**
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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 673,391, Oct. 6, 1967, abandoned.
 [52] U.S. Cl.72/129, 72/177, 72/186, 72/325
 [51] Int. Cl.B21d 13/04, B21d 28/36
 [58] Field of Search.....72/129, 176, 177, 186, 187, 72/325; 29/6.1, 163.5; 113/116 A

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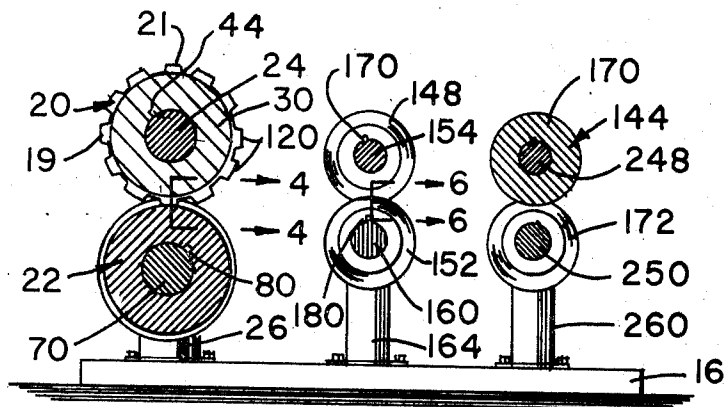
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[57] **ABSTRACT**

A machine for manufacturing corrugated perforated material having successive sets of corrugation forming roll means preceded or succeeded by rotating punch and die roll means cooperatively correlated with the corrugated roll means in a manner for forming openings in material in positions such that the openings will have side flanges extending outwardly from the crests of the finished corrugated material, the punch roll being formed of discs separated by spacers, each disc having a special shape for the sharpening of punches projecting therefrom.

5 Claims, 6 Drawing Figures



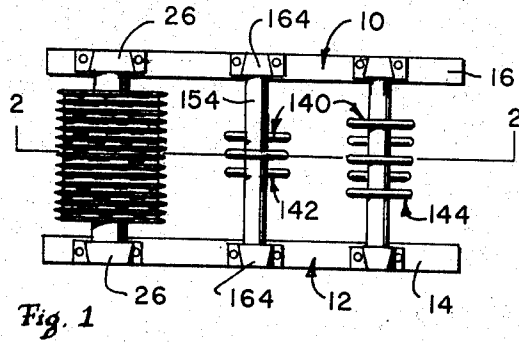


Fig. 1

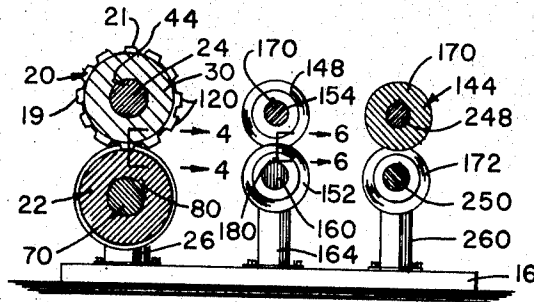


Fig. 2

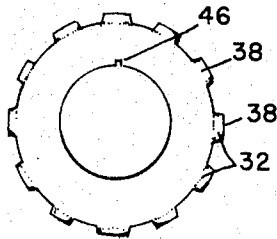


Fig. 3

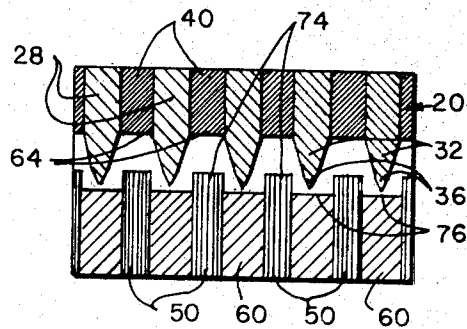


Fig. 4

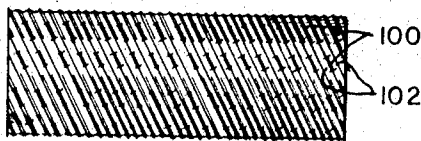


Fig. 5

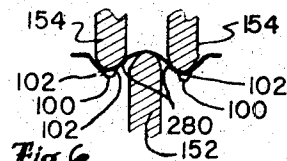


Fig. 6

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PERFORATING MACHINE

This application is a continuation-in-part of the applicant's copending patent application Ser. No. 673,391, filed Oct. 6, 1967, and titled PERFORATING MACHINE, now abandoned.

FIELD OF THE INVENTION

This invention is in the field of machines for producing corrugated and perforated material for such uses as well casings.

DESCRIPTION OF THE PRIOR ART

In the prior art, the first method of placing holes in corrugated pipe which had its corrugations extending spirally was to gang-drill the pipe after the pipe was formed. Such gang drills had great cost and the operation was slow.

The second method used in the prior art was to provide punch and die sets in positions such that as material moving through the machine in a strip passed between a punch and die set, the material was temporarily stopped with respect to the punch and die set by providing a large slack area or loop in the strip on each side of the punch and die set. This has also been slow and costly, and even a temporary shifting of the punch and die set in the general direction of the movement of the sheet of material after the sheet has been clamped to the die has not speeded up the operation sufficiently for good economy. A means for stopping the sheet and clamping it temporarily and also the means for causing a punch and die set to shift both have great costs and are slow.

My discovery that it is possible to effectively punch attractive holes with continuously rotating punch and die rolls and to precisely position the holes so that their side flanges extend outwardly from the crests of the finished material has provided great speed advantages.

This new method has also provided great economy in the manufacturing of the machine for these purposes since it is no longer necessary to use means for stopping and clamping the sheet nor mechanism for causing punch and die set to shift.

The disadvantage of some of the punching machines used in the prior art for other types of products, in which rolls having projecting punches are employed, has been that they have been expensive to manufacture because the punch roll had to have special costly construction for supporting removable punches in order that the punches could be each separately removed from the roll.

Other prior art machines which have had the punches permanently attached to an entire punching roll have had the disadvantage that the punching roll is bulky and hard to handle during the sharpening of the punches.

Still another disadvantage of the prior art punching roll machines of the type which have the entire set of punches and the entire roll of one piece, has been cost of manufacture and the difficulty of manufacturing such a roll, especially out of quality steel as is required for the long life of the punches.

SUMMARY OF THE INVENTION

A machine for manufacturing corrugated perforated material comprising: rotating and cooperating punch and die roll means, the punching roll means having groups of punches thereon with the punches of a group arranged in substantially a same plane, the punches each having a wedge-shape, punching openings of a type having bent-out side walls, a plurality of sets of oppositely disposed corrugating roll means rotatably mounted on the frame members and spaced apart along a bed of the machine and defining corrugation forming stages of the machine, the corrugating roll means of a set having axially spaced annular protrusions meshing alongside each other, the corrugating roll means sets being cooperatively correlated within themselves and with each other to corrugate material moving continuously through the stages of the machine, the alignment of the corrugating roll sets and the punch planes of the punch roll means being such as to cause the punches each to be in alignment as seen looking lengthwise of the elongated bed with annular protrusions of the corrugating rolls so as to cause the bent-out sidewalls of the perforations to be positioned at the crests of the corrugations made in the material and facing away from the annular protrusions of the corrugating rolls.

The combination described in which the punch and die rolls means forms a first stage of the machine and in which each set of the corrugating roll means has an empty area extending therethrough as seen looking lengthwise of the elongated bed for the reception of the punched-out sidewalls of the openings so that their shape is preserved.

The machine described in which the punch roll means is formed of a plurality of punch roll discs, the punch roll discs each having a group of the punches on and protruding from the exterior thereof, the punch roll means having an axle extending through each disc at a right angle to the plane of its punches, means holding the discs apart along the axle, and means interlocking the punch roll discs and the punch roll axle for preventing rotation of the punch roll discs with respect to the punch roll axle.

The discs each being formed of a single piece of material for economy of manufacture, the discs being shaped for ease of sharpening by having the converging sides of wedge-shaped punches continuous at their inner ends with planar sides of the respective disc.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a top plan view of the corrugation and perforation machine of this invention.

FIG. 1A is a sectional view taken along the line 1A—1A of FIG. 1 and showing the vertical adjustability of the punch and die rolls with respect to each other.

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1.

FIG. 3 is a detail of a punching roll.

FIG. 4 is a detail taken along the line 4—4 of FIG. 2.

FIG. 5 is a view showing a side view of a corrugated perforated pipe, convolutions of which are formed into arcuate shape by means not shown in the machine of FIG. 1, but the parts of which are corrugated and perforated by the machine of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The corrugating and perforating machine of this invention is generally indicated at 10 in FIG. 1 and comprises an elongated bed or frame 12 with roll-carrying frame members 14 and 16.

The machine has rotating and cooperating punch and die roll means generally indicated at 19 and carried by the frame members 14 and 16 and disposed opposite each other and forming a first stage of the machine. The punching roll means 20 has groups of punches 21 on its circumference, the punches of a group being in substantially a same plane normal to the axis of rotation of the punch roll means 20, such axis being the axis of an axle 24 of the punch roll 20.

The axle 24 is mounted in bearings 26 in the respective frames 14 and 16.

On the axle 24 are a plurality of discs 28 each having a circumference of approximately a circular shape except for outwardly protruding punching wedges 32 having sharp tips 36 terminating in linear cutting edges, best seen in FIG. 3.

The discs 28 are held in spaced relation by spacers 40, which latter are arranged on the axle 24 as also are the punching discs 28, both being keyed to the axle by a key 44, best seen in FIG. 2, received in a key slot 46, as seen in FIG. 3.

The die roll or female roll 22 also has a plurality of discs 50 held apart by spacers 60, and the discs and spacers are also mounted on an axle, the axle 70, which latter is journaled in bearing posts 26 secured to the frames 14 and 16.

The discs 50 and spacers 60 are held by a key 80 to the axle.

The discs 50 each preferably have cylindrical outer surfaces 74, as best seen in FIG. 4, and the surfaces 74 lap the punching wedges 32 sufficiently so that when a flat sheet is passed between the punch and die rolls 20 and 22, the sheet becomes perforated with lines of perforations disposed in parallelism, each perforation and line being spaced apart. Such perforations are shown in FIG. 5 at 100.

Each perforation 100 is elongated and has side flange means 102 along each of its sides which are bent outwardly by the action of the wedge-shaped punches 21, the perforations 100 being best seen in a piece of pipe shown in side elevation in FIG. 5, the pipe of FIG. 5 being a product partly of the machine of FIG. 1 and partly also a product of a machine following the machine of FIG. 1 in a production line, the latter machine being adapted to take strips of corrugated metal and form them into spiral arrangement and interlocked relation to form a cylindrical pipe.

The punches 21 which follow one another in substantially a same plane normal to the axle 24 are herein called the punches of a group 120, the punches of a disc 28 each forming a group 120. The planes in which each group of punches 120 is arranged are spaced along the punch roll axis by the spacers 40.

The corrugating means will now be described and it is generally indicated at 140.

The corrugating means comprises a plurality of sets 142 and 144 of corrugating roll means and each set has a first group of corrugating rolls 148 disposed opposite

and staggered or spaced along an axle 154 with respect to the corrugating rolls 152 of a second set, which latter are disposed preferably beneath and opposite the rolls 148 and are arranged on an axle 160. The axles 154 and 160 are carried in bearing posts 164 and the rolls 148 and 152 are keyed to the axles 154 and 160 as at 170 and 180.

The following set of corrugating rolls 144 form a third stage of the machine, and it will be seen that the upper rolls 170 of the set 144 are disposed opposite and likewise staggered with respect to the rolls 172 on the bottom of the stage 144. The third stage 144 has more rolls in it than the first set or stage 142, and it will be seen that certain of the corrugating roll 170 and 172 are in alignment with rolls in the second stage of the machine 142, as seen in top elevation. That is to say, the roll on the upper side of the first set 142 will be in alignment with the roll on the upper side of the second set 144, and rolls on the lower side in the set 142 will be in alignment with rolls in the lower side of the set 144.

The number of corrugating roll sets or stages can be varied in accordance with the width of material to be handled.

The corrugating roll means of the sets 142 or 144 have axially spaced protrusions meshing alongside each other, these protrusions 200 being the outer edges of the rolls 152 and 154, 170, 172.

The successive sets of rolls 142 and 144 are cooperatively correlated within themselves and each other as above described, to corrugate material moving continuously and horizontally through the stages 142 and 144.

The alignment of the corrugating roll sets 140 and the plane of the punches 21 are such as to cause the punches 21 each to be in alignment with the circumference of those corrugating rolls which will be pushing at the material being corrugated from side of the material opposite to the side on which the sides 102 of the perforations 100 are outwardly protruding. This causes the perforations 100 to be positioned at the crests of the corrugations described.

Each set of corrugating roll means 142 or 144 has an empty area extending therethrough for the reception of the punched-out side walls 102 of the openings 100 so that the shape of the openings 100 is preserved.

The corrugating rolls 170 and 172 of the second set 144 are mounted in all ways similarly to the rolls 148 and 152 of the first set 142 and are carried on axles 248 and 250 suitably and rotatably carried in bearing posts 260 mounted on the frames 14 and 16.

Referring to FIG. 6, the empty area 280 can be seen between corrugating rolls 154 and 152. FIG. 6 is specifically drawn in a certain alignment below FIG. 4 so that the two views can be looked at cooperatively in which it will be seen that the corrugating rolls 154 which are disposed opposite the out-turned sides 102 of perforations 100 are disposed in alignment with the punches 21 of FIG. 4, and so this forms a way of indicating the arrangement.

Referring now to FIG. 1, it will be seen that stages 142 and 144 can be reversed when it is desired to send the material through the machine from the right-hand side in order to corrugate it first and, in such a case, the punch and die rolls would be the last stage of the machine forming the openings in the crests of the cor-

rugations such that the flanges of the openings protrude outwardly from the convex crests of the material.

Referring to FIG. 1A, one of the bearings 26 is there shown mounted on a frame member 16 and a bearing 300 rotatably receiving the axle 70 of the die roll is shown slidably mounted in a housing 302. The housing 302 is attached to the frame member 16 and the bearing 300 is vertically adjustable in the housing 30 so that it can be set in a position closer or farther from the axle 24 by adjustment of a bolt 310, which latter is threadedly mounted through the housing 302 and engages the underside of the bearing 300.

A similar housing 302, bearing 300, and adjustment bolt 310 is disposed at the opposite end of the axle 70 so that by means of adjustment, the depth of the punchings can be regulated for making practical the use of punching discs 28 which are of one-piece economical construction with the punches 32.

I claim:

1. A machine for manufacturing corrugated perforated material comprising: an elongated bed with roll-carrying frame members, rotating and cooperating punch and die roll means in and carried by said frame members and disposed opposite each other and forming a stage of the machine, said punching roll means having groups of punches thereon, the punches of a group being in substantially a same plane normal to the axis of said punch roll means for punching openings in material, said punches each having a wedge-shape and punching openings of a type having bent-out sidewalls, the said planes of said groups of punches being spaced along said punch roll axis, a plurality of sets of oppositely disposed corrugating roll means rotatably mounted on said frame members and spaced apart along said bed with respect to each other and with respect to said punch and die roll means and defining corrugation forming stages of the machine, the said corrugating roll means of a set having axially spaced annular protrusions meshing alongside each other, said corrugating roll means sets being cooperatively correlated within themselves and with each other to corrugate material moving continuously through the said stages of the machine, the alignment of said corrugating roll sets and said punch planes of said punch roll

means being such as to cause said punches each to be in alignment as seen looking lengthwise of said elongated bed with annular protrusions of said corrugating rolls so as to cause the bent-out sidewalls of said perforations to be positioned at the crests of the corrugations made in said material and facing away from said annular protrusions of said corrugating rolls, said punch roll means being formed of a plurality of punch roll discs, said punch roll discs each having a group of said punches on and integral therewith and protruding from the exterior thereof, said punch roll means having an axle extending through each disc at a right angle to the plane of its punches, means holding said punch roll discs apart along said axle, and means interlocking said punch roll discs and said punch roll axle for preventing rotation of said punch roll discs with respect to said punch roll axle, said punch roll discs each having a pair of substantially planar parallel sides parallel to the plane of its punches, said punches having converging sides which converge to and join at a point at the outer ends of each punch.

2. The combination of claim 1 in which the inner ends of said converging sides of a punch are of not substantially greater spacing than the sides of the respective punch roll disc in those portions of the respective punch roll disc which are adjacent to the respective punch for providing a punch roll disc having ease of sharpening.

3. The combination of claim 2 in which the inner ends of each of said converging sides of a punch is substantially continuous with and joining the planar sides of the respective punch roll disc.

4. The combination of claim 1 in which said die roll means has continuous grooves extending circumferentially around its surface substantially in planes at a right angle to its axis and receiving said punches.

5. The combination of claim 4 in which said die roll is formed of die roll discs of circular periphery as seen along the axis of said die roll, said die discs having parallel sides with spacing means between them, the periphery of each of said spacing means being spaced inwardly toward the axis of said die roll means from the circumference of the discs of said die roll means for forming said circumferential grooves.

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