Nov. 25, 1941. J. F. HAWLEY 2,264,134

PUNCHING EQUIPMENT

Filed Sept. 30, 1940

Fig. 1.

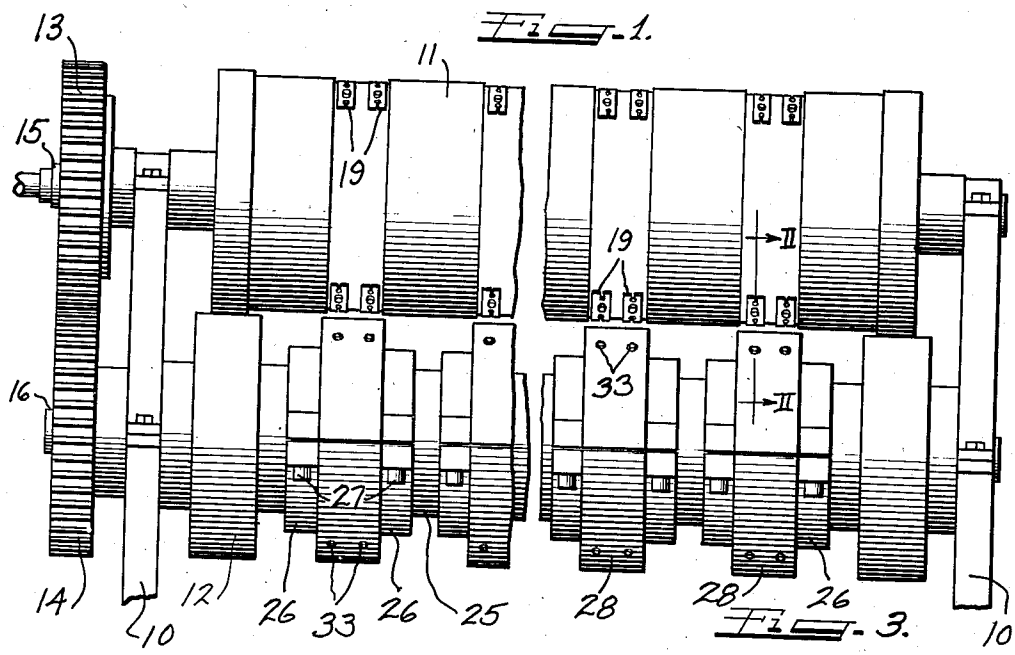


Fig. 3.

Fig. 2.

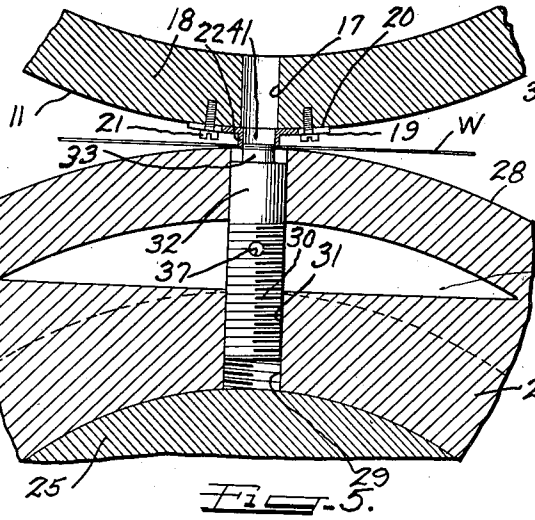


Fig. 5.

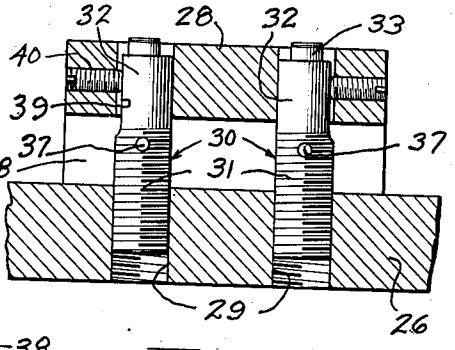
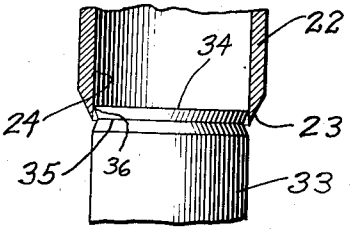


Fig. 4.



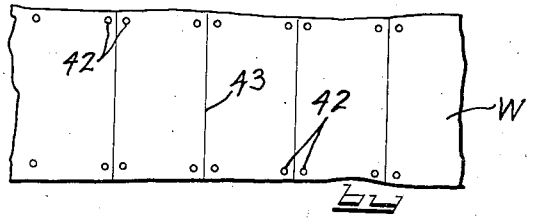


Fig. 6.

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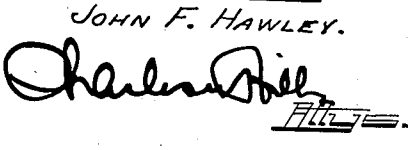

Attorney.

Patented Nov. 25, 1941 2,264,134

UNITED STATES PATENT OFFICE

2,264,134

PUNCHING EQUIPMENT

John F. Hawley, Riverside, Ill.

Application September 30, 1940, Serial No. 358,980

7 Claims. (Cl. 164—86)

This invention relates to punching equipment for use in perforating paper and other web material.

The present invention constitutes an improvement over the punching equipment disclosed in my patent entitled "Method of producing perforated paper," Patent No. 1,965,893, dated July 10, 1934. In that patent, an annular die cooperated directly with a wood surfaced backing roll to cut discs from a paper web fed therebetween. Such an arrangement has the disadvantage that ultimately the wood surface becomes scored and must be shifted relative to the punching dies to present a new, unscored surface for cooperation therewith.

In accordance with my present invention, I provide an annular cutting die similar to that disclosed in my previous patent, but for cooperation therewith I provide a punch having an end of softer metal than that of the cutting edge of the die, whereby the cutting edge can itself shear the punch end, if initially oversize, to the proper size to fit within the opening defined by the cutting edge. By making the punch end of softer metal than the cutting edge, and also by providing an annular undercut beneath said end surface, I find that it is a simple matter to renew the efficiency of the punch, when worn. This can be done by merely hitting the end surface of the punch with a ball hammer, or peening it slightly, and then allowing the cutting edge of the die to shear the punch end to proper size and form again. The punching equipment of my invention, thus, has an almost unlimited life of usefulness and may easily be kept in such condition as to give a clean cut perforation in the web that is being perforated.

It is therefore an important object of my invention to provide punching equipment of novel construction, the efficiency of which can be readily maintained to give the equipment a long life of usefulness.

It is a further important object of this invention to provide cooperating die and punch members wherein the punch is formed of relatively softer material than the cutting edge of the die in order that the die may be capable of shearing the punch end, if initially oversize or intentionally made so, to bring said punch end into close cutting fit therewith.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawing.

This invention (in a preferred form) is illustrated in the drawing and hereinafter more fully described.

On the drawing:

Figure 1 is a fragmentary top plan view of punching equipment embodying the principles of my invention.

Figure 2 is an enlarged fragmentary sectional view taken substantially on the line II—II of Fig. 1.

Figure 3 is an enlarged fragmentary detail view of the punches.

Figure 4 is a further enlarged, fragmentary, detail view of the cooperating ends of a die and punch.

Figure 5 is a top plan view of a perforated web of paper that has been perforated by means of my punching equipment.

As shown on the drawing:

The reference numeral 10 indicates generally the side frame of punching equipment embodying the principles of my invention. Said punching equipment comprises a die carrying roll 11 and a punch carrying roll 12, both of which are suitably journaled at their ends in the frame members 10. Gears 13 and 14 are secured on the ends of the shafts 15 and 16 of said rolls 11 and 12, respectively. The shaft 15 may be extended for connection to a source of power (not shown). Since the gears 13 and 14 are in mesh, the rolls 11 and 12 will be driven at the same surface speed.

The die carrying roll 11 is hollow and provided with a plurality of radially extending bores 17 extending through its outer shell 18 (Fig. 2). Dies 19 are secured to the periphery of said roll 11 in alignment with the bores 17. The arrangement of said dies 19 may, of course, be varied to suit the requirements of the job, but, as shown, the dies 19 are arranged in pairs spaced peripherally about the roll 11 and with each of the dies in a pair in longitudinal alignment.

Each of the dies 19 comprises a plate 20 curved to conform with the periphery of the roll 11 and having openings therein through which screws or bolts 21 are inserted and threaded into the shell 18 to hold the die in place. An annular cutting flange 22 projects outwardly from the plate 20 and terminates in a beveled cutting edge 23. Said cutting edge 23 defines an opening 24 which may be the same diameter as the bore 17, or of a slightly smaller diameter. Although the opening 24 has been shown as circular in cross section, it will be understood that it may be elliptical or any other desired shape, depending upon the shape of the perforations

that it is to make. The material from which the annular flange 22 and cutting edge 23 are formed may be any hardened metal or alloy capable of retaining its cutting edge. A hardened steel is entirely satisfactory.

The roll 12 is of a built-up construction, comprising a cylindrical shell 25, to which are secured a plurality of sectional collars 26 clamped thereon by means of bolts 27. Mounted upon said collars 26, or formed integrally therewith, are cylindrical members 28 of larger diameter, in which are formed radially extending bores 29, arranged in pairs and spaced peripherally about said cylindrical members 28 so as to be brought successively into alignment with the corresponding bores 17 in the die carrying roll 11.

A threaded punch member 30 is adapted to be positioned in each of the bores 29. Said punch members 30 comprise threaded shanks 31, outer cylindrical ends 32 and cylindrical punch ends 33 of reduced diameter extending therefrom. The punch ends 33 are of substantially the same diameter as the internal diameter of the annular flanges 22 of the dies 19, so that they may project slightly into said die openings 24 during the punching operation. As best shown in Fig. 4, each of said punch ends 33, in its preferred form, is provided with an undercut head or end 34, formed by cutting an annular groove 35 just below said head or end 34. The annular groove 35 may suitably be V-shaped, as shown, to provide a comparatively sharp peripheral edge 36 about the head or end 34. The purpose of providing each of the punches with an undercut head will later appear.

As previously stated, each of the punches 30 is threaded into a bore 29. For ease of adjustment, the threaded shank 31 of each punch member is provided with a bore 37 extending transversely therethrough for receiving a key (not shown). Each of the collars 28 is provided with an opening 38 that extends completely through the cylindrical member 28 to provide access to the shanks 31 of the punch members for the insertion of the key and its operation. Each punch member is also provided with a flat longitudinally extending face 39 along its smooth cylindrical portion 32. A set screw 40 is threaded laterally through a cylindrical member 28 for engagement against a flat face 39 of the adjacent punch member. In order to adjust the position of the punch member within a bore 29, therefore, it is merely necessary to insert a key in the bore 37, turn the threaded punch member to its adjusted position, and then tighten up a set screw 40 against a flat face 39.

In its working position, the end or head 34 of each punch member projects slightly above the periphery of the cylindrical member 28, as shown in Fig. 2, and is received within the die opening 24 of a cooperating die member 19. Accordingly, when a web of paper W is passed between the die roll 11 and punch roll 12, it is perforated by the threading action of the cooperating dies and punch members. The disc 41 cut out of the web W by each of the cooperating die and punch members is drawn, as by suction, through the corresponding bore 17 into the interior of the shell 18, from whence it is removed in any suitable manner. With the usual arrangement of die and punch members, the web W is provided with aligned pairs of perforations 42, between which the paper is subsequently severed, as along the line 43, to form individual wrappers.

Each of the reduced cylindrical ends 33, constituting the punch proper, of the punch member 30, is formed of a relatively soft metal, such as a soft steel or iron. Since the cutting edge 23 of each of the die members 19, however, is formed of a hardened metal or alloy, this makes it possible for the cutting edge 23 to shear the peripheral edge 36 of a punch end or head 34 if the latter is oversize. Consequently, when a punch end or head 34 becomes worn, so that in cooperation with its mating die member, it is no longer capable of making a clean, well defined cut in a web W, all that is necessary is to enlarge the punch end or head 34 by tapping it with a ball hammer, or other tool, to peen over the edge 35 to expand its diameter. Then, when the expanded punch end or head 34 next comes into cooperative relationship with its die member, the cutting edge 23 of the die member shears off the excess of the punch head or end 34 to bring it again to the exact size of the die opening 24. This operation can be repeated as many times as necessary during the use of the equipment to restore the punching efficiency of the cooperating punches and die members.

The provision of the groove 35 beneath each punch end or head 34 facilitates the operation of restoring the punch end or head 34 to a close fitting relationship with its die member, since with the head undercut, its edge 36 is relatively thin and easily displaced outwardly by a light tap of a ball hammer or the like. Also, when the cutting edge 23 of the die member is called upon to shear off excess portions of a punch end or head 34, the thinness of the peripheral edge 36 makes the shearing operation an easy one.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. Punching equipment comprising a pair of rotatable members, a die carried by one of said members provided with an annular hardened cutting edge and a punch carried by the other of said members, said punch being of relatively softer metal having an end of the same size as the opening in said die to cooperate with said cutting edge to punch a disc out of web material fed therebetween.

2. In punching equipment, a die having an annular hardened cutting edge defining the die opening and a punch cooperating therewith having an end adapted to be received in said die opening and formed of sufficiently softer metal than said cutting edge to be sheared thereby to fit within said opening if initially oversize.

3. In punching equipment, a die having an annular hardened cutting edge defining the die opening and a punch cooperating therewith having an undercut end adapted to be received in said die opening and formed of sufficiently softer metal than said cutting edge to be sheared thereby to fit within said opening if initially oversize.

4. Punching equipment comprising a pair of rolls, a die carried by one of said rolls provided with an annular cutting edge defining an opening, said other roll being provided with a radially extending threaded bore and a threaded punch adjustably secured therein, said punch

having an end of such size as to be received in said die opening and cooperate with said cutting edge to punch out web material fed between said rolls.

5. Punching equipment comprising a air of rolls, a die carried by one of said rolls provided with an annular hardened cutting edge defining an opening, said other roll being provided with a radially extending threaded bore and a threaded punch adjustably secured therein, said punch having an end of softer metal for cooperation with said cutting edge to punch out web material fed between said rolls.

6. In punching equipment, a die having an annular hardened cutting edge defining the die opening and a punch having an annular head of soft workable metal adapted for peening into size for proper cooperation with said die and also adapted for shearing by said die if initially oversize.

7. Punching equipment comprising a pair of rolls, a die projecting radially from one of said rolls and provided with a bevelled annular cutting edge clear of said roll, and a punch extending radially from the other roll and having an undercut end of such size as to be received into said annular die for shearing cooperation therewith to punch out web material fed between said rolls, said punch being formed of sufficiently softer metal than said cutting edge to be sheared thereby to fit the die if initially oversize, said equipment further comprising means for removably securing said die and said punch to said rolls.

JOHN F. HAWLEY.