

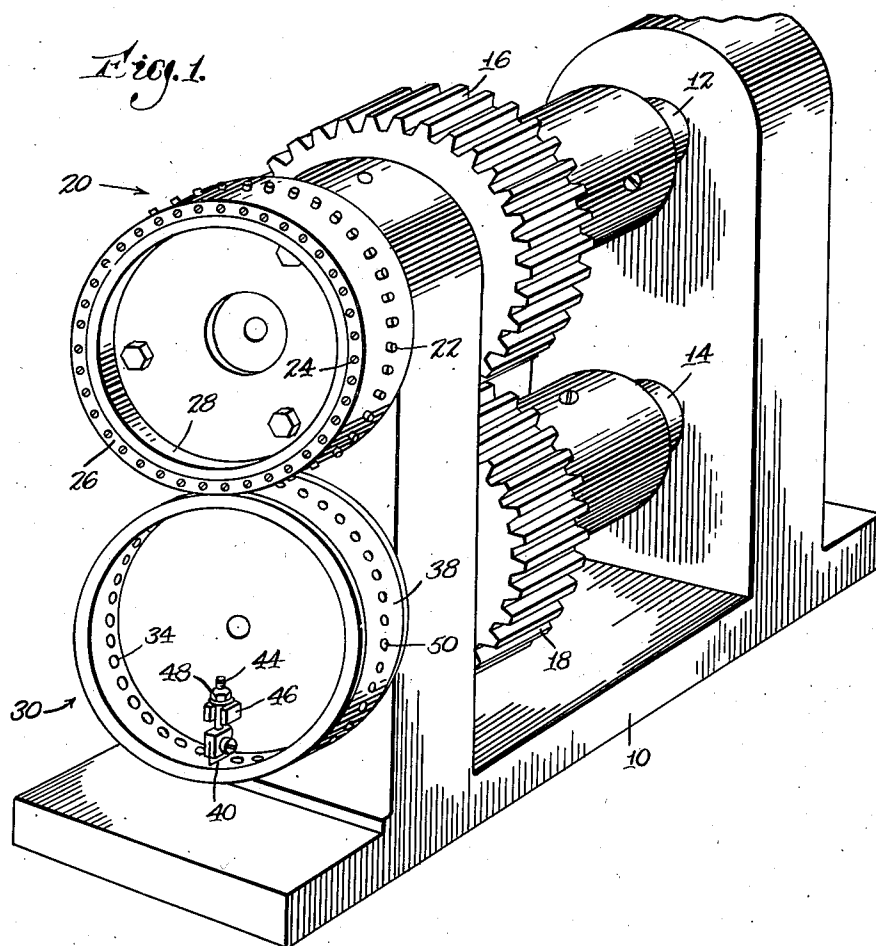
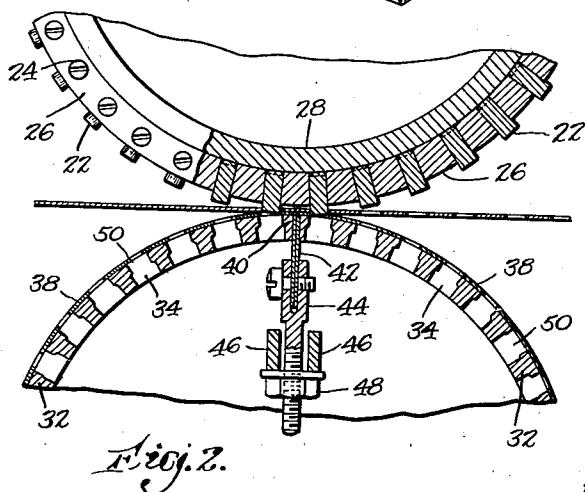
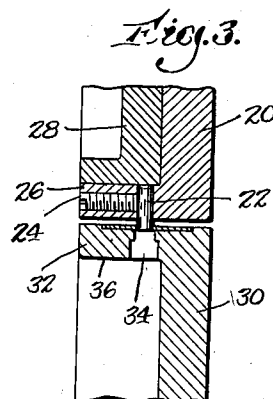
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METHOD OF MAKING DIE MEMBERS

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METHOD OF MAKING DIE MEMBERS

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1935, Serial No. 33,508

6 Claims. (Cl. 76-107)

This invention relates to an improved method of making the die members of punch and die couples for punching precisely spaced holes in sheet material. The invention of this applica-
5 tion is a division of the invention disclosed in my application for Punching machine Serial No. 738,068, filed August 2, 1934.

There are a great many needs for punching sheet material for a large variety of purposes and the perforations are not only circular but of
10 various other shapes, for example, flat oval, square, diamond, etc. The perforations may be in a relatively closely spaced continuous series or they may be in a succession of separated short
15 series, even in widely spaced pairs. An important requirement is that the punched holes must be clean, accurately spaced and so well cut that there will not be any tabs left hanging to the web being operated upon by unsevered
20 threads of the material. In many instances the web is 70 inches in width and the job may require a punching mechanism capable of punching twenty rows of perforations across the moving web. In rotary work the punch cylinders
25 range from 15 to 48 inches in circumference and for making perforations even a few inches apart the perforating unit or mechanism will require an enormous number of punch and die couples all of which must function perfectly in order
30 not to spoil the product which may be a costly printed web of wraps delivered from a multi-color printing press.

Those skilled in the art will recognize the impossibility of constructing all of the male and
35 female members of so complicated a punch and die mechanism from hardened steel, the most satisfactory form, so that all of the punches and dies will exactly mate and match with the accuracy and precision required for clean holes.
40 Due to this difficulty a soft steel punch has been used with a hardened die in which case a mismatched punch will wear itself into its die opening but these punches will fail to completely sever the tab from the web. Another source of mis-
45 mating lies in inaccuracy in cutting the driving gears for the rotary unit since one or more teeth slightly off or slightly oversize will disturb the position between the dies and punches opposite
50 those teeth.

While the inaccuracies developed in these and other ways are slight their effect on the product requires correction, usually by a replacement of the disturbing factor of the perforating
55 mechanism. This runs to considerable expense

in dollars when the time the machine is out of commission is considered.

The object of this invention is to provide a method of making a hardened die member for a punch and die couple having die openings that
5 will exactly mate or register with the punches thereof, all at a cost of a few cents because the machine operation, when employing this method for replacement, needs to be stopped only for a
10 few minutes as compared to possibly half a day when the old methods are used. A like saving flows from the initial manufacture of the punch and die couples.

In order fully to understand the new method of making hardened die-members for punch and
15 die couples the invention will be explained in connection with a description of one such couple, it being understood that the accompanying drawing is used for purposes of explanation only and in no way confines the use of the invention
20 to the simple rotary punch and die couple there shown since it is useful with other types of perforating mechanism for example where the web is fed intermittently.

In the accompanying drawing:

Figure 1 is a view, in perspective, of a stand
25 supporting co-acting punch and die wheels as herein improved, that may be employed in rotary punching machines for perforating either sheets or strips in rolls;

Fig. 2 is a view, mostly in section, of portions
30 of the punch and die wheels in operation on a strip of material; and

Fig. 3 is a view, in fragmentary section, showing
35 a punch in the act of forming its co-acting die at the final stage of the manufacture of the die band used on the die wheel.

The accompanying drawing illustrates a rotary punching machine in its simplest form sufficient
40 for the disclosure of this invention, it being understood that in commercial use feeding or reeling devices for sheets or strips, gages, guides, clearers, starting and stopping mechanism and all other desirable or required adjuncts may be applied from previously known machines in the art.
45

As illustrated in the drawing a stand 10 provides journals for upper and lower shafts 12
and 14 having intermeshing gears 16 and 18 respectively. A belt pulley (not shown) or any other convenient power device will rotate one
50 shaft and, the two gears each having the same number of teeth, the other shaft will be driven at the same rate of speed as the driving shaft.

The upper shaft 12 is provided at one end with a punch wheel 20 secured to the shaft in any suit-
55

able manner to be rotated therewith. The punch wheel may consist of a flanged disk having a circumferential series of shear punches 22 said punches being set singly in a series of equally spaced holes in the flange 26 and held at the desired limit of projection from the flange by a series of set screws 24. A second flanged disk 28, dimensioned to fit within the flange of the punch wheel, is bolted in place as shown and forms a backing for the punches. As a punch wears its radial position on the punch wheel may be adjusted after removing the backer and loosening its set screw. The construction of the punch wheel all may be the same as the present practice.

The lower shaft 14 is provided with a die wheel 30 secured to the shaft in any suitable manner. The die wheel may also desirably be a flanged disk, its flange 32 most conveniently being of the same width as the flange 26 on the punch wheel and immediately underlying said flange 26.

Various methods have heretofore been employed for forming a circular series of dies in the die wheel flange 32 with which the punches 22 will exactly register and of such size that each punch will shear through the material to be operated upon without burring or leaving a ragged edge. It is obvious that in operating the machine the gears will wear and thus destroy the registry of the punches and dies. The fitting of a new gear that is slightly irregular or of a new keyway would have the same effect. This means the production and fitting of a new die wheel having die openings with which the punches on the punch wheel of the unit will match and mate under the new conditions. One prior method was to roll the punch wheel, without its punches, on the rim of a new die wheel and endeavor to obtain exact registry under the new conditions by using the punch openings as guides for successively drilling the new die openings and even then perfection of registry was not insured. This is a long and expensive proceeding the difficulty increasing with the size and number and odd shapes of the die openings to be re-cut.

By practising the method of manufacturing die members according to this invention a correction of any error of registry can be effected within a few minutes and at a cost of a few cents as will be understood from the following description.

The die wheel flange 32 is provided with a number of radial holes 34 equal in number to the punches 22 but having a larger diameter. A shallow groove 36 is cut in the rim of the die wheel. A steel strip 38, that may be any hard or semi-hard steel, for example Swedish and somewhat longer than the circular length of the floor of the groove, is laid in the groove and its ends, having first been annealed or otherwise treated to permit of bending, are turned inward through a slot 40 (Fig. 1) cut through the flange 32 as far as the outer edge of the groove 36. The groove and strip are so dimensioned that the latter fills the former leaving a smooth rim on the die wheel after the strip has been drawn taut and locked in position. A groove prevents displacement of the endless die band formed by the tautly drawn strip.

To retain the band on the die wheel a draw-pin lock may be used. The inturned ends 42 of the band are securely held in a slot at the inner end of a draw-pin 44 which lies between fixed posts 46 rising from the inner face of the die wheel. A nut 48 is threaded on the outer end of the draw-pin and bears against the posts 46.

Turning up the nut tensions the band and draws it snugly into its groove.

Having applied the band 38, the die wheel is mounted on its shaft beneath the punch wheel and the machine is turned over thus causing the shear punches 22 to punch their own series of die openings 50 in the steel band (see Fig. 3) having exact registry with the series of punches. The machine thus equipped with a hardened die and a hardened punch is now ready for perforating any material which it is designed to handle.

Those skilled in the art will recognize the ease with which replacement of a hardened die member may be made should this become necessary. All that is required is to loosen the band 38 from its locking device, remove and replace it with a new imperforate band and then cause the punches to punch their own die holes in this band as above described. The clearance provided by the excessive diameter of the rim holes 34 gives a tolerance that provides for any angular shift of the die holes relatively thereto that may occur in effecting corrections. These holes also provide for discharge of the punchings from the machine.

It will be seen from the foregoing description that in its broader aspects the invention resides in a simple and inexpensive provision for a hardened die as well as a hardened punch in a perforating machine. This is highly important in perforating for certain uses where it is essential that the perforations be punched clean, for example the punched paper used in connection with precision instruments such as recorders. The burring of the die, which cannot be avoided with the use of soft metal, prevents the use of soft dies for such work and the production of accurate work has heretofore been both difficult and expensive. This invention makes readily available a hardened die for such precision work adaptable to any type of shear punch perforating machine.

It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation and it is not intended to limit the invention beyond the terms of the several claims hereto appended as considered in view of the prior art and the requirements thereof.

Having thus described the novel method of making registering punching couples having both a hardened die and a hardened punch, the essence of which resides in the use of the punches to form their own die openings in the die member, yet recognizing that some modifications and changes may be made without departing from the spirit and scope of the invention, what is claimed as new, is:—

1. The method of making die members for hardened punch and hardened die couples which includes preparing a multiple shear punch member, partially preparing a die member by forming holes in a die support for receiving the punches of the punch member and adapted to discharge waste, then mounting a relatively thin imperforate sheet of hardened metal over said holes, and finally, said punch and die members being at that time assembled in workable relation, completing the die member by operating said couple and causing the punches thereof to punch their own hardened die openings through said sheet of metal.

2. The method of making die members for rotary punch and die couples which includes preparing a punch wheel having one or more hardened shear punches at its circumferential face,

partially preparing a rotary die wheel by forming holes in its circumferential face for receiving the punches and adapted to discharge waste, covering said holes in the die wheel with an imperforate flexible hardened metal band and setting
5 said band taut on the circumferential face of said die wheel, and finally, said punch and die wheels being assembled in workable relation, completing the die member by rotating the couple and
10 causing the punches thereof successively to punch their own hardened die openings through said band.

3. The method of making hardened dies for punching machines which consists in covering
15 the waste discharge passages formed in the die member with an imperforate piece of hardened steel, sufficiently thin to be punched by the hardened shear punches of the machine, and then operating said machine to cause its punches to
20 punch through said hardened steel forming die-openings therein at each of said discharge passages exactly matching and mating with the punches.

4. The method of making hardened dies for rotary punching machines which consists in applying
25 a flexible band of hardened steel to the circumference of the die wheel having had waste discharge passages formed therein, and drawing

said band taut over said passages, and then rotating the punch wheel on the die wheel causing the hardened punches thereof successively to pass into said discharge passages each punching
5 its own hardened die opening through said steel band.

5. The method of making hardened die openings for hardened punches of gear driven rotary shear punching machines which consists in covering the waste discharge passages in the die
10 member with a tautly drawn flexible hardened metal band, and utilizing the punches of the punch wheel to transfer to the die wheel any inaccuracy or error of precision in the machine by punching their own hardened die-openings
15 through said band.

6. The method of making an accurately tracking rotary punch and die couple having both hardened punches and hardened dies which consists in partially preparing a die wheel with waste
20 discharge passages equal in number and spacing to the punches of the punch wheel and slightly larger in size but without regard to tracking accuracy, covering said passages with a flexible metallic band, and obtaining tracking accuracy by
25 causing said punches to make their own die-openings in said band.

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