

# United States Patent

Stoop

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[45] Aug. 1, 1972

[54] **ROTARY PUNCH DEVICE WITH PUSH-PULL CHIP REMOVAL**

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[52] U.S. Cl.....**83/98, 83/216**

[51] Int. Cl.....**B26d 7/06**

[58] Field of Search.....**83/98-100, 126**

[56] **References Cited**

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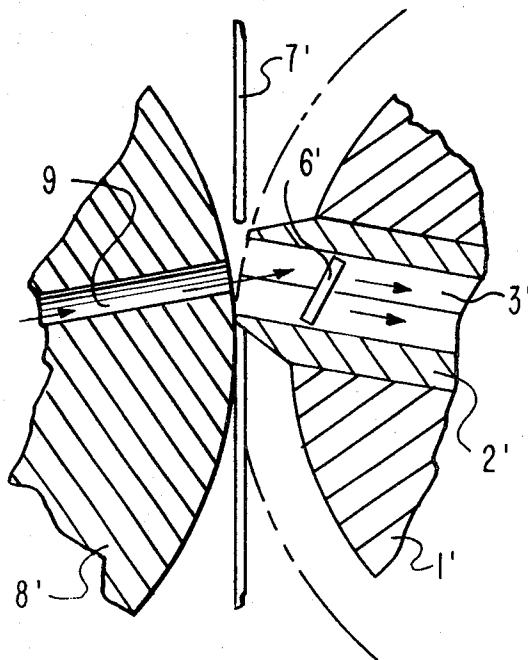
*Primary Examiner*—Donald G. Kelly

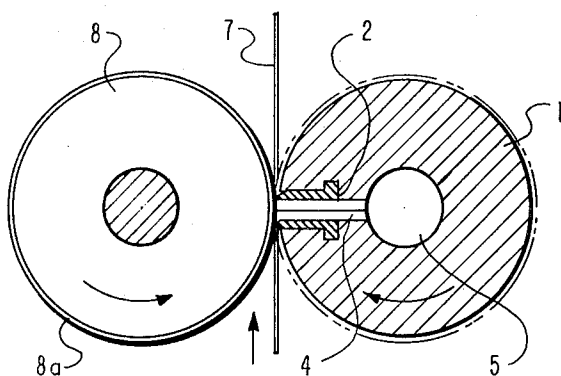
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[57] **ABSTRACT**

Small chips are removed from a paper web during high speed rotary punching by a push-pull action in which compressed air supplied via a radial port in a hollow back-up roll blows the cut chip into a hollow punch connected via a hollow shaft to a vacuum source for removing chips from the punch station.

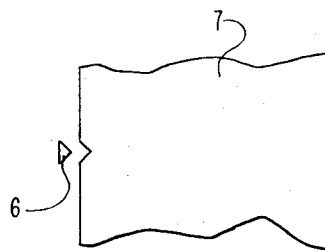
**6 Claims, 6 Drawing Figures**



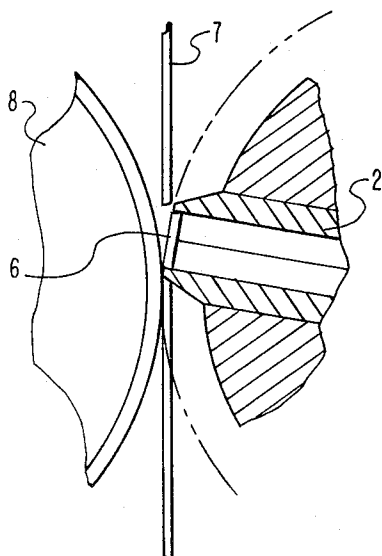


**FIG 1**

PRIOR ART

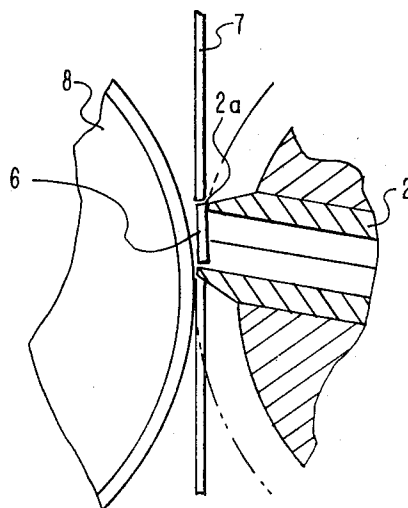


**FIG 2**



**FIG 3A**

PRIOR ART



**FIG 3B**

PRIOR ART

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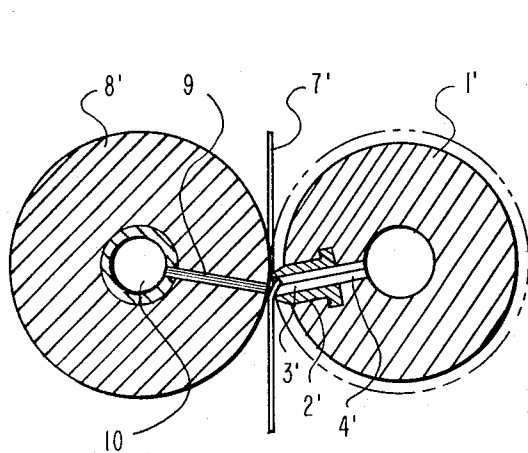


FIG 4

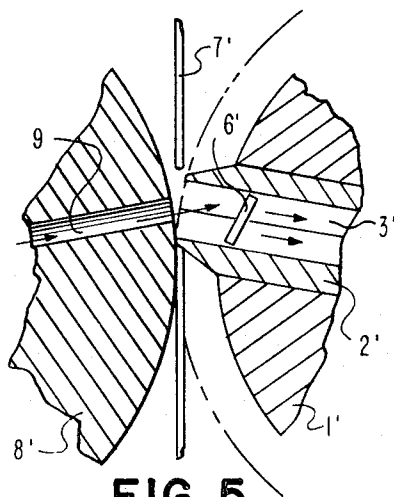


FIG 5

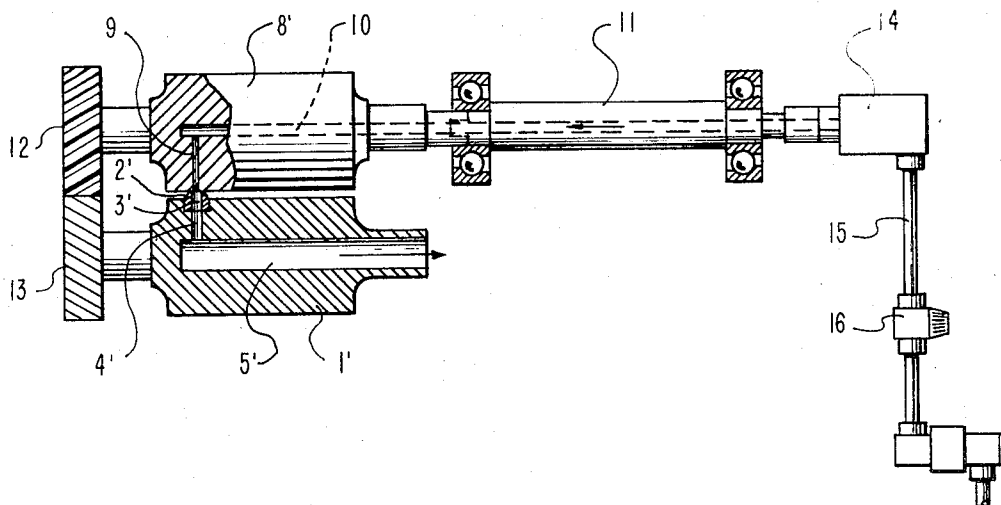


FIG 6

## ROTARY PUNCH DEVICE WITH PUSH-PULL CHIP REMOVAL

This invention relates to a device for punching patterns from a web of paper or the like, and relates more specifically to a rotary punch device wherein a punch roll, provided with a hollow punch, cooperates with a back-up roll on the other side of the web.

### BACKGROUND OF THE INVENTION

It is common to provide a punch roll having a hollow punch and ducts communicating therewith so that parts or chips punched from a moving web may be withdrawn from the punch station by means of vacuum through a hollow shaft or by mechanical removing means, such as a conveyor screw. However, when very minute chips are punched from a rather rigid material, particularly along the edges of the web, and the punch and web are operated at fairly high speed, the chips cut out tend to fly off instead of being removed by way of the aperture in the hollow punch. This can be very troublesome, especially if near the punch station other operations are also carried out on the web, such as printing or applying glue.

### SUMMARY OF THE INVENTION

Applicant has discovered that this problem can be eliminated by providing an improved rotary punch device wherein the back-up roll has apertures alignable with the apertures in the hollow punch of the punch roll, and the apertures in the back-up roll are connected to a source of compressed air. Thus, while the chips are only partially cut out, their severed parts are deflected into the punch aperture; and hence as soon as the chips have been completely cut from the web, they are quickly removed through the aperture in the punch, preferably by a push-pull action in which suction is applied via the hollow punch shaft to assist in chip disposal.

Other objects and advantages will become apparent from the following more detailed description of the invention and from the accompanying drawings, wherein:

FIG. 1 is an end view, partly in section and partly in outline, of a conventional punching device, wherein the chips cut out are removed through the hollow shaft of the punch roll by means of vacuum;

FIG. 2 is a plan view of a web with a detached triangular chip cut from the web to provide beveled edges on cards later to be cut from this web;

FIGS. 3A and 3B are enlarged fragmentary views, basically like FIG. 1, respectively depicting the type of chip motion desired and the type of chip motion that actually occurs when a conventional punching device of the type shown in FIG. 1 is used to cut small chips like those in FIG. 2 from the edge of a web;

FIG. 4 is an end view, comparable to FIG. 1, but of the improved rotary punch device embodying the invention and showing the motion of a partially cut chip during the initial phase of a punching operation;

FIG. 5 is a fragmentary view of a portion of FIG. 4 showing motion of the chip during the final phase of the punching operation; and

FIG. 6 is a side elevational view of the improved rotary punch device including the means for conveying compressed air and vacuum to the respective rolls.

## DESCRIPTION

For punching chips from a web of paper or the like, a device may be used of the type diagrammatically illustrated in FIG. 1 which comprises a punch roll 1, having removably fitted therein a cutting punch 2. Cutting punch 2 is a type of recessed hollow punch in which the cut-out chips are conveyed via a central aperture 3 in the punch and a radial duct 4 to a hollow shaft 5. The cut chips 6 (FIG. 2) are moved through hollow shaft 5 to a receptacle (not shown) by suitable means, such as vacuum, supplied from a source (not shown).

To cut the chips 6 from web 7, punch 2 in punch roll 1 cooperates with a back-up roll 8, comprising a steel cylinder which may, if desired, be surrounded with a thin copper layer 8a. Cutting out is effected by pinching off the material between punch 2 and back-up roll 8. Copper layer 8a makes it possible for punch 2 to penetrate somewhat into back-up roll 8, better to cut off the fibrous material.

Although punch 2 is made as sharp as possible, a definite minimum wall-thickness is required. In consequence the cut chip 6 is fractionally larger than aperture 3 in punch 2. If the cut chips are very minute and the material from which they are cut is fairly rigid, the situation illustrated in FIG. 3B was found to occur (rather than the desired situation illustrated in FIG. 3A). That is, as punch 2 left web 7, chip 6 had not yet sufficiently penetrated into aperture 3; and despite the vacuum applied through the aperture, the chip hung up at 2a (see FIG. 3B) and rebounded and was flung away, especially when the punch device rotated at high speed. This problem was resolved by use of the improved device now to be described.

In the improved punch device embodying the invention and shown in FIGS. 4-6, like reference numerals except primed are used to denote structure which is similar to that shown on the conventional device illustrated in FIG. 1. According to the invention, back-up roll 8' is provided with a radial duct or port 9, connected to a source (not shown) of compressed air via a small diameter bore 10 in roll 8', a hollow drive shaft 11, a rotary seal unit 14 and a compressed air line 15 that is connected to said source via a valve 16. Shaft 11 drives back-up roll 8' which, in turn, is directly coupled to punch roll 1' by means of a pair of identical gears 12 and 13 so that the rolls rotate in perfect synchronism. Bore 9 is located so that it accurately faces and registers with aperture 3' in punch 2'.

As the chip 6 is partially cut out (see FIG. 4), compressed air supplied via port 9 will start to deflect it into the punch aperture 3. As soon as the chip is completely cut out, it will rapidly be driven into aperture 3' by a combination push-pull action (see FIG. 5). It has been found in practice that jamming or hang-up of the chips is now prevented and they are neatly withdrawn and removed from the punch station.

It will be apparent that various changes may be made without departing from the spirit, scope and teaching of the present invention. Accordingly, the device herein disclosed is to be considered merely as illustrative, and the scope of the invention is to be limited only as specified in the claims.

What is claimed is:

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1. A rotary punching device of the type comprising a punch roll with a protruding hollow punch that cooperates with a back-up roll to punch chips from a web of sheet material that is advanced through the nip of said rolls, characterized in that

both said rolls are provided with ducts that open through their respective peripheries and are registerable during a punching operation, one of said ducts including the aperture in the hollow punch, and

means including respective openings in said rolls communicating with said ducts for conveying fluid under pressure to one of said openings and applying a vacuum to the other of said openings, such that the chip punched out from the web is directed into one of said rolls and removed by a push-pull operation.

2. A device according to claim 1, further characterized in that

the pressure fluid is conveyed via the opening in the back-up roll and the vacuum is applied via the opening in the punch roll so the chip will be removed by withdrawal through the aperture in the hollow punch.

3. A device according to claim 2, further characterized in that

the pressure fluid and vacuum cooperate to deflect the initially pierced leading portion of each chip into said aperture prior to complete severance of the chip from the web.

4. A rotary punching device for punching out chips from a web of paper or the like, said device comprising a punch roll comprising a hollow punch element pro-

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jecting radially from the outer periphery thereof and having an aperture communicating with an internal opening,

a back-up roll having a port that opens through the outer periphery thereof and is intermittently registerable with the aperture during a punching operation,

positive drive means for rotating said rolls in synchronism for causing such intermittent registration of the aperture and port as the web is advanced between said rolls,

means for conveying fluid under pressure to the port in said back-up roll, and

means for applying vacuum to the aperture via the opening in the punch roll,

the port and aperture being so configured that as the chip is severed from the web, it will be successively deflected into and then conveyed away from the punch station via said aperture and opening.

A device according to claim 4 further characterized in that

said punch element is so disposed in relation to the web as to cause chips to be cut from one side edge of the web.

6. A device according to claim 4, wherein said means for conveying fluid under pressure includes

a hollow drive shaft constantly communicating with an aligned bore provided in the back-up roll and connected to said port, and

a rotary seal unit interposed between the drive shaft and fluid supply line.

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