Oct. 5, 1965 T. C. McCARTAN 3,209,630

ROTARY PUNCHING DEVICE

Filed Dec. 22, 1961 2 Sheets-Sheet 1

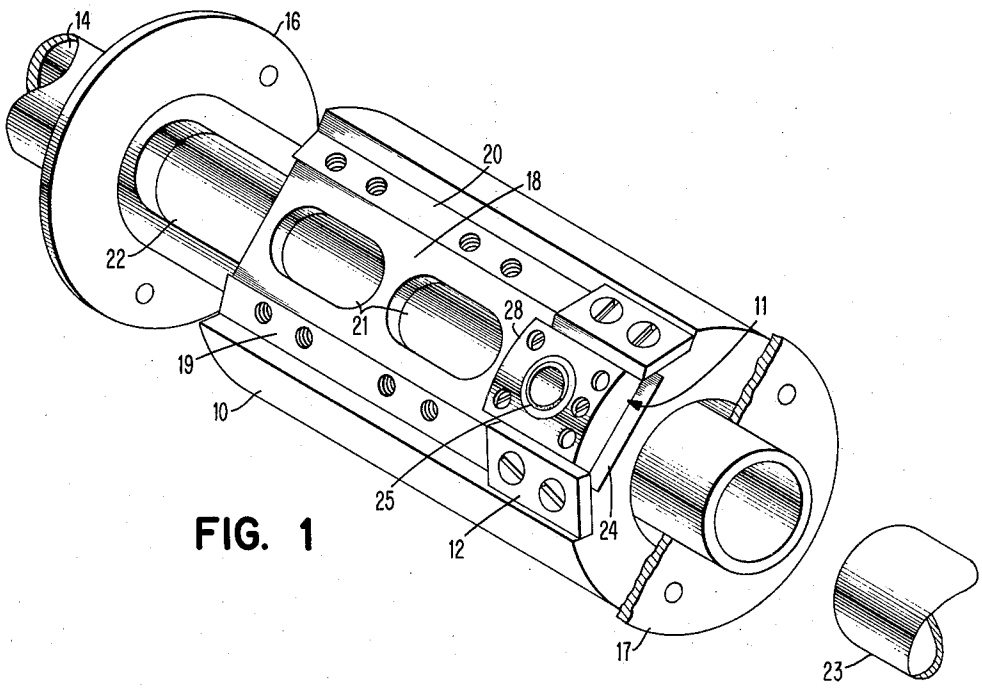


FIG. 1

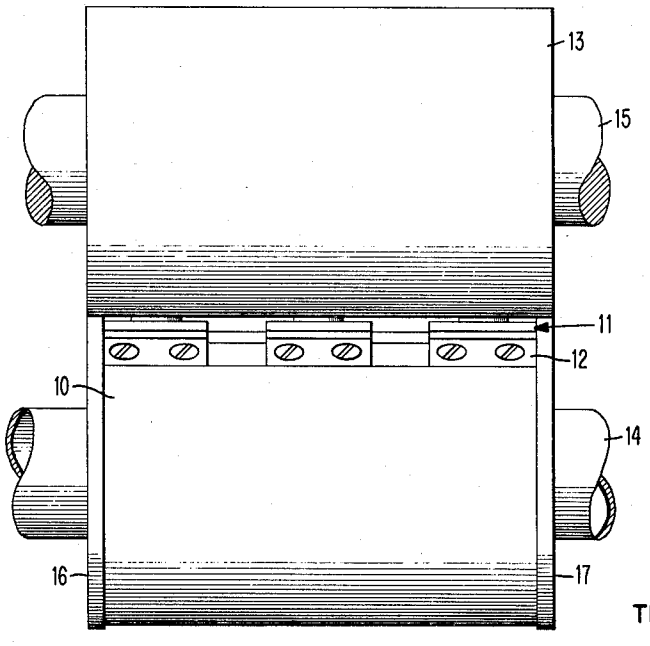


FIG. 2

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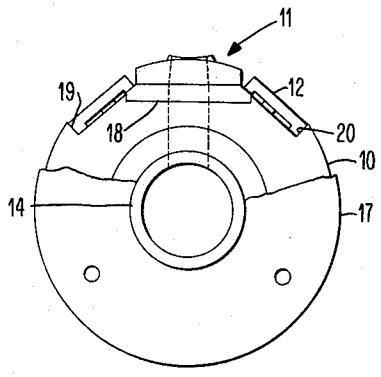


FIG. 3

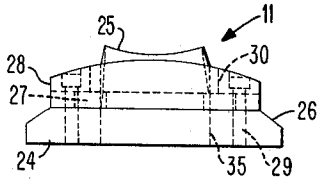


FIG. 4

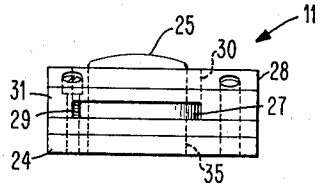


FIG. 5

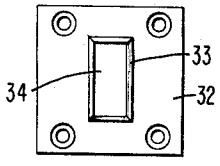


FIG. 6

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ROTARY PUNCHING DEVICE

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5 Claims. (Cl. 83—100)

This invention relates to a rotary punching device and more particularly to a rotary punching device having insertable punch elements and which is especially adapted for high speed operation.

In the manufacture of merchandise tags, shipping tags, special tickets, and the like, which have to be provided with a string hole, at least at one end, it is particularly desirable to have not only a simple and accurate performing device but also a performing device which is capable of extremely high speed operation since each individual order for such tags generally requires that several million tags be perforated. In addition, since there are demands for such a large variety in size and format of individual tags or tickets and the holes that are to be perforated therein, it is extremely advantageous to provide a high speed punching device having individual punch elements which can be easily inserted and removed to selectively provide the desired punching format. For example, an order may call for the tag to be of conventional record card size, which is generally 3¼" by 7⅜", and it may call for one, two or more special holes positioned on the tag and each hole may vary in diameter, for example, from 1/16" to ½". Of course, configurations other than circular holes may be called for or it may be desired to place a special notch in one or more edges of the tag. At any rate, a substantial problem exists when multitdues of orders are received for special tags with each order requiring the printing and perforating of several million tags and, in addition, with each order requiring a different format and size of special perforations.

Heretofore, such tags have been printed and perforated on conventional flat-bed machines but due to the inherent slowness of the flat-bed machine the tags could be perforated at a rate of only around 200 per minute. Conventional rotary type punch and die devices have also been used in order to increase punching speed but these proved unsatisfactory due to the requirement for extreme precision in the gearing, etc., in order to obtain the required punching accuracy and also the need for substantial set-up time when changing jobs to run different orders.

To overcome the above problems and satisfactorily meet the increased output that present day business demands, the present invention provides an improved and vastly superior rotary gang punching device which is not only adapted for extremely high speed operation but which also employs an arrangement of insertable punching elements which may be easily and quickly interchanged to produce the required different punching formats. The preferred form of the rotary gang punching device comprises a solid steel die or bed roll and a cooperating hollow steel punch roll. A slot or recess extends axially along a portion of the periphery of the punch roll which is adapted to receive a row of individual punch support blocks and the punch blocks are held by individual retaining plates suitably mounted in grooves which extend along each side of the recess. Each punch support block is adapted to removably support an individual punch element or insert which coacts directly against the tag and the surface of the steel bed roll to produce the perforations. The foregoing arrangement is extremely advantageous from the standpoint of flexibility and ease of set-up since each support block and punch insert assembly

may be interchanged or the support blocks may be left alone and only the punch inserts changed.

The arrangement of having the punch inserts coact directly against the tag and solid steel bed roll without the use of mating die holes in the bed roll eliminates the need for any undue or extreme precision in the drive gearing and allows the gang punch to operate with an extremely high rate of speed. In fact, the present device has successfully produced accurate perforations in tags or record cards feeding at a rate of 1350 to 1400 cards per minute. This is seven times faster than the heretofore normal punching rate and represents a substantial advance in the punching art.

Another feature of the present invention is the provision of an improved vacuum arrangement for removing the punched out chips during the high rate of speed of operation. Each of the individual punch elements or inserts is hollow and communicates with a port in the bottom of the punch support block and a port in the recessed portion of the punch roll. The ports in the recessed portion of the punch roll in turn communicates with a large port in a hollow shaft which supports the punch roll. The hollow support shaft is suitably connected to a source of vacuum such that the punched out chips are sucked back through the individual punch inserts and punch roll and into the hollow support shaft to be discarded. The hollow portion of each punch insert is tapered to facilitate the passage of the chips therethrough.

Accordingly, a principal object of the present invenis to provide an improved high speed rotary gang punching device.

A further object of the present invention is to provide an improved high speed rotary gang punching device which requires no undue precision in drive gearing and which therefore is capable of extremely high speeds of operation.

A still further object of the present invention is to provide a rotary gang punching device having insertable punches and including a vacuum arrangement for discharging punched out chips back through the insertable punches.

A still further object of the present invention is to provide a rotary gang punching device having insertable punches for punching against a solid bed roll and including means for preventing the punches from digging into the bed roll during punching.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a perspective view showing the punching cylinder of the present invention with one of the punching inserts assembled in place.

FIG. 2 is an elevation view showing the punching cylinder with punch inserts and the cooperating solid bed roll.

FIG. 3 is an end view of the punching cylinder with its end plate partially broken away.

FIG. 4 is a side elevation view of a punch insert and holding block assembly for punching a hole.

FIG. 5 is an end elevation view of the punch insert and holding block assembly shown in FIG. 4.

FIG. 6 is a plan view of another type punch insert for punching rectangular holes.

Referring now in particular to FIG. 2, the rotary gang punching device is shown in general as comprising a punch roll or cylinder **10** having a series of insertable punch unit assemblies **11** and associated retainer plates **12** disposed along the surface of the cylinder. The punch unit assemblies **11** coact with the surface of a solid steel die or bed roll **13**. The device is particularly adapted

for high speed punching of tags or record cards and the like and it may be easily adapted to existing high speed machines which are currently in use in connection with the manufacture of such cards or tags. For example, the present device has been added as a punching station to the tabulating card printing machine of the type shown and described in U.S. Patent 2,181,935, which issued on December 5, 1939. Reference may be had to said patent for the details of operation of the printing machine and it will suffice to say here that the present device is preferably attached to the machine just ahead of the print station and the punch roll shaft **14** and bed roll shaft **15** may be driven by suitable gearing from any of the continuously running feed rolls on the printing machine.

Referring now in particular to FIGURES 1 and 3, the hollow punch cylinder **10** is mounted on the hollow shaft **14** and pinned to a pair of end plates or discs **16** and **17** which are press-fitted fast on the shaft. Disposed axially along the surface of the cylinder is a rectangular groove or channel **18** and extending along adjacent to the sides of this channel are the V-shaped grooves **19** and **20**. The individual punch unit assemblies **11** are slideably positioned along the channel **18** and each one is held in place by an associated pair of the insertable retainer plates **12** which are screw fastened to the base of the grooves **19** and **20**. The slideable arrangement of the individual punch unit assemblies and the retaining plates in their respective channels greatly facilitates the ease with which they may be removed or interchanged.

Cut in the base of the channel **18** are a series of elongated ports **21** which communicate with a common port **22** in the hollow shaft **14**. Each one of the ports **21** communicates with the hollow interior of the punch unit assembly **11** positioned thereover and one end of the hollow shaft **14** is left open and is positioned adjacent to or is suitably connected with a source of vacuum, such as vacuum pump **23**. As will be further described, this arrangement allows for the vacuum removal of the punched out chips back through the punch unit assemblies **11**, the punch cylinder **10** and the hollow shaft **14**.

Referring to FIGURES 4 and 5, the insertable punch unit assemblies **11** each comprise a base block **24** for supporting a cutting or punching element **25** which has a configuration corresponding to the type of perforation desired. The punching element shown in FIGURES 4 and 5 has a configuration for punching a circular hole and the cutting edge is made both concave and convex for proper cutting action against the solid bed roll **13**. A pair of parallel edges of the base block is provided with a bevelled surface **26** which the insertable retainer plates **12** bear against to anchor the punch unit assemblies **11** in place along channel **18**. The punch element **25** has a flanged base portion **27** which is held fast in position on the base block **24** by means of a holder block **28** and the set screws **29**. The holder block **28** is provided with a thru-hole **30** so that it may be inserted over the positioned punch element and the underside of the holder block is slotted across to provide a pair of shoulders **31** which extend alongside the flanged base portion **27** of the punching element to firmly lock the element in position.

A feature of the present invention is the ease and flexibility with which the punching format of the device may be changed with a minimum of set-up time required. As was previously pointed out, by simply loosening the retainer plates **12**, the individual punch unit assemblies may be interchanged or replaced in channel **18**. Or, if desired, the assemblies may be left secure in the channel and only the holder blocks **28** removed and new punch elements inserted. If it is desired not to use all of the possible punching positions along channel **18**, selected punch unit assemblies may be simply removed and, although it is not necessary, blank plates may be inserted in place of the removed units to seal the vacuum ports **21** not being used. Punching elements which fit in the unit assemblies may be stocked to cover a wide range

of punching configurations. In FIGURE 6, there is shown a different insertable punch element **32** having a cutting edge configuration **33** for punching a rectangular hole. This particular element would not require a holder block **28** but would be screw fastened directly to the base member **24**. Also a feature of the invention resides in the fact that the punch elements operate directly against the solid die or bed roll which eliminates the need for undue precision in the drive gearing and allows the present device to be easily adapted to a high speed machine of the type shown in the previously mentioned U.S. Patent 2,181,935, whereby unusually high punching speeds of up to 1400 record cards per minute are attained. In this connection, it should be pointed out that the end plates **16** and **17** fastened at the ends of the punch cylinder play an important part. These end plates are intended to rotate against the surface of the die or bed roll, as shown in FIG. 2, and the peripheral surface of each plate extends out radially from the punch shaft **14** the same distance as the cutting edges of the inserted punch elements. As a result, the end plates function to protect the punch elements and to prevent the cutting edges from digging into the surface of the bed roll during punching. In addition, they tend to balance the forces acting against the punch cylinder during high speed operation to smooth out the punching action. They also afford a means for determining when the punch and die cylinders have been adjusted relative to each other into the correct punching position.

Each of the punching elements has a thru-hole or passageway, as indicated at **34** on FIG. 6, which has the same configuration as the cutting edges of the element and which communicates with a thru-hole or passageway **35** in its base block **24**. The passageways in the base blocks are in registry with the ports **21** in channel **18** and hence the punched chips are under the influence of the vacuum pump **23**. The inside walls of each punch element are tapered slightly, the passageway which the walls form having a narrower cross-section at the top which is the same as the cross-section of the chip to be punched out, to allow for better removal of the chips by the vacuum. The passageway in each punching element will hold from 3 to 4 chips after which the next chip punched will mechanically cause the bottom chip to eject down into the underlying port **21** where it may be easily carried away by the vacuum in the hollow shaft **14**.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A high speed rotary punching device of the class described comprising in combination, a rotatable punching roller, means on said roller for slideably supporting along the longitudinal axis thereof a plurality of insertable base members, said base members being individually slideable to selected positions along said axis, means for selectively securing and removing alone individual base members positioned along said axis, holding means associated with each base member for securing thereto and removing therefrom a selected insertable punching element with said base members secured to said punching roller, and a rotatable solid bed roller against which said punching elements rotate to carry out a selective punching operation.

2. A high speed rotary punching device as defined in claim **1** and including a rotatable hollow shaft for supporting said punching roller, ports in said punching roller communicating with the hollow portion of said shaft, thru-passageways in said base members and punching elements communicating with said ports in the punching roller, and vacuum chip removal means communicating with the hollow portion of said shaft.

3. A high speed rotary gang punching device of the

class described comprising in combination, a rotatable punching roller, a channel disposed axially along the surface of said roller, a plurality of insertable base members each of which is adapted to be slid into said channel for selective positioning along said channel, a plurality of retainer members disposed along opposite sides of said channel and in overlapping relationship with portions of said base members, means for securing said retainer members to the punching roller to lock said base members against movement in said channel, each of said retainer members being removable individually to allow the removal alone of a selected base member from the punching roller while the other base members remain locked, a plurality of insertable punching elements, a holder member associated with each base member for securing an inserted punching element to the base member or removing an inserted punching element therefrom while said base members are locked in said channel, and a rotatable solid bed roller against which said punching elements rotate to carry out a gang punching operation.

4. A high speed rotary gang punching device of the class described comprising in combination, a rotatable punching roller, a channel disposed axially along the surface of said roller, a plurality of insertable base members each of which is adapted to be slid into said channel for selective positioning along said channel, each said base member having a pair of parallel bevelled shoulders projecting therefrom, a pair of grooves on said punching roller which extend parallel and adjacent to the sides of said channel, a plurality of retainer members disposed in said grooves and in overlapping relationship with the shoulders on said base members, detachable fastening means for securing said retainer members to the punching roller to lock said base members against movement in said channel, each of said retainer members being removable individually to allow the removal alone of a selected base member from the punching roller while the other base members remain locked, a plurality of insertable punching elements, a holder member detachably fastened with each base member for securing an inserted punching element to the base member or removing an inserted punching element therefrom while said base members are locked in said channel, and a rotatable solid bed roller against which said punching elements rotate to carry out a gang punching operation.

5. A high speed rotary gang punching device of the class described comprising in combination, a rotatable punching roller, a channel disposed axially along the surface of said roller, a plurality of insertable base members each of which is adapted to be slid into said channel for selective positioning along said channel, a plurality of retainer members disposed along opposite sides of said channel and in overlapping relationship with portions of said base members, means for securing said retainer members to the punching roller to lock said base members against movement in said channel, each of said retainer members being removable individually to allow the removal alone of a selected base member from the punching roller while the other base members remain locked a plurality of insertable punching elements, detachable fastening means for securing selected inserted punching elements to said base members or removing selected inserted punching elements therefrom while said base members are locked in said channel, and a rotatable solid bed roller against which said punching elements rotate to carry out a gang punching operation.

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