Jan. 22, 1952 W. W. CARPENTER 2,583,086

TAPE PERFORATING MACHINE

Filed April 14, 1945

FIG. 1

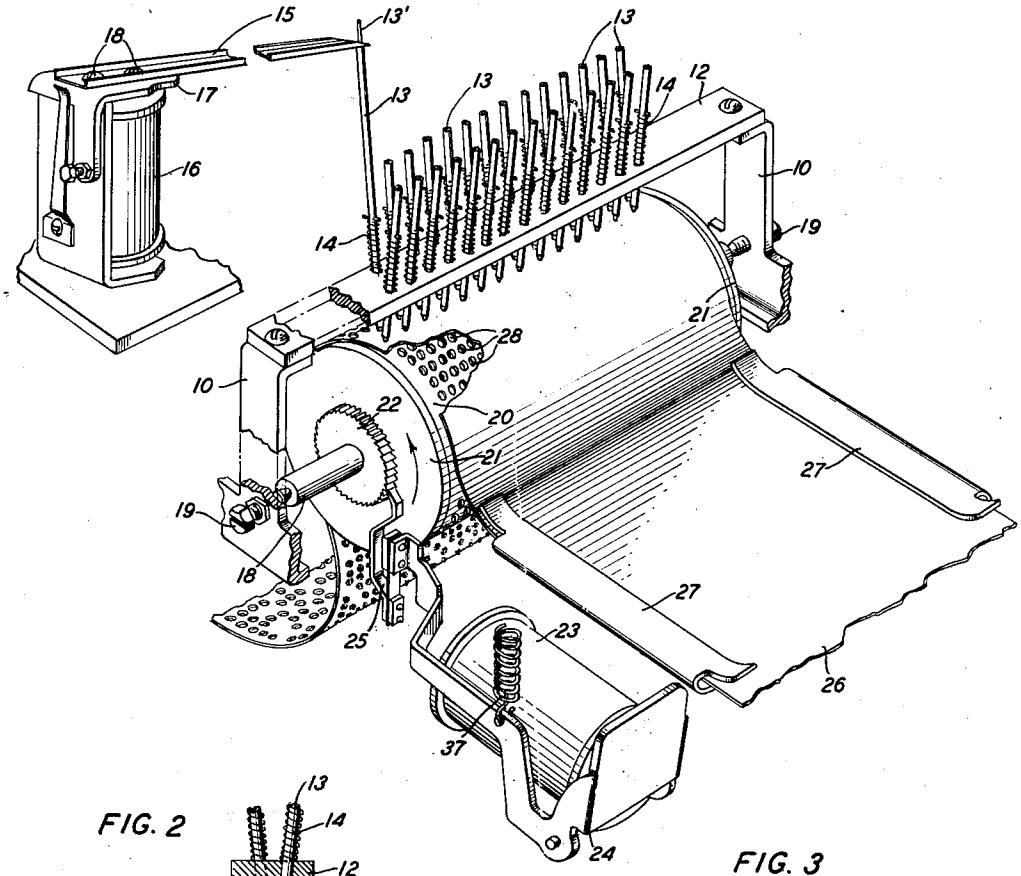


FIG. 2

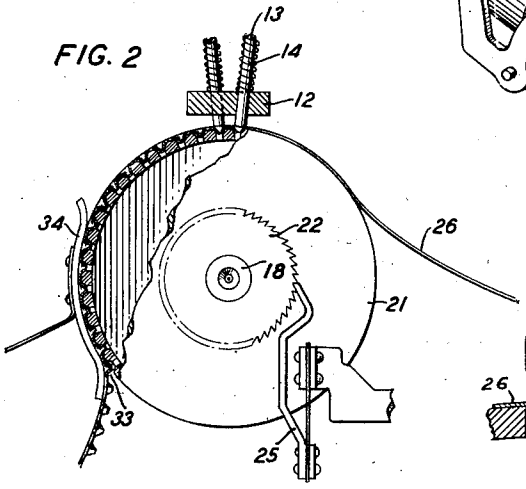


FIG. 3

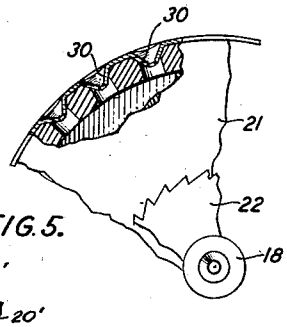


FIG. 5.

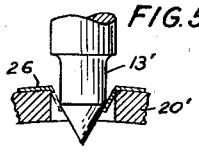
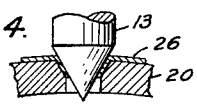


FIG. 4.



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TAPE PERFORATING MACHINE

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1 Claim. (Cl. 164—111)

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This invention relates to perforating, or punching and reading, or sensing machines of the type wherein code symbols are punched or otherwise impressed on a tape, or its equivalent, for subsequent use in a code translating device.

In punching machines of the type characterized above, it is customary to symbolize code signals by perforating a relatively wide tape at various points throughout its breadth in accordance with predetermined patterns. Such tapes are usually carried on a rotatable drum or roller, which functions, under automatic control, to advance the tape, step-by-step, under a multiplicity of selectively operable punch pins which are operated in various combinations to impress or perforate, on the tape, perforation patterns corresponding to the combination of punch pins operated. The particular perforation pattern symbolizes a particular group of code signals. Heretofore, the rotatable drum functioned to propel the tape through the media of pins projecting from the drum which cooperate with suitable perforations in the tape so that, by virtue of the cooperation of the drum-mounted pins with the tape perforations, the rotational movement of the drum was imparted to the tape.

It is the object of this invention to simplify and otherwise improve perforating, impressing, and code reading, or sensing machines, and particularly to insure a fixed relationship between a symbolized code tape and the rotatable drum, or tape carrying medium, of a code punching or sensing machine, and to effect the simultaneous movement of the tape and drum without relative slip or displacement.

This object is attained in accordance with a feature of the invention by symbolizing each of the code signals as a perforated tape embossment, or indenture, and utilizing the embossments or indentures to effect a gear coupling between the tape and a suitably apertured drum or tape supporting medium.

In accordance with this invention the operating or punching ends of the punch pins are structurally devised so as to present a substantially cone-shaped end to the tape, and the drum which carries the tape is provided with a multiplicity of apertures having inverted cone-shaped, or funnel-shaped mouths arranged in transverse rows so as to be in alignment with the punch pins. Thus, when a punch pin is actuated, its operating, or cutting end intrudes that portion of the tape which is interposed between the pin and a corresponding aperture in the drum, into the said aperture so as to effect a tape protrusion, or

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embossment, which assumes a configuration determined by the cone-shaped contours of the punch pin and its corresponding drum aperture. During the intruding of the tape portion into the drum aperture the tape is subjected to a stretching process which permits the cutting end of the punch pin to pierce the tape and to thereby effect a chadless perforation. When the pin is withdrawn in a manner to be described hereinafter, the tape embossment or protrusion, remains embedded in the drum aperture to effect a coupling, or driving connection between the tape and the drum. When the drum is rotated, the tape is carried along therewith, the movement of the drum being imparted to the tape through the cooperation of the drum aperture and its embedded tape protrusion, or embossment. Similarly, when the tape, subsequent to the combined embossing and punching operation, is fed onto the drum, or roller of a code sensing, or translating device, the tape protrusion, or embossment meshes with a corresponding aperture in the senser drum to effect a gear coupling between the senser drum and the tape. Thus when a series of code signals are embossed on the tape and mesh with corresponding apertures in the senser drum to effectively couple the tape and the drum, the code embossments are brought into accurate alignment with the sensing pins of the senser as the drum thereof is rotated.

The invention will be best understood from the following detailed description when read in connection with the accompanying drawing, in which:

Fig. 1 is a schematic perspective view of a code perforating or impressing machine embodying features of the invention and illustrating, particularly, the relative positions of the essential elements of the machine, and tape to be perforated thereby;

Fig. 2 is an enlarged end view of the feed roller, or rotatable drum, with a portion of the end plate thereof broken away to expose a fragmentary sectional view of the drum periphery; the tape protrusions, or embossments, in driving association with the drum apertures; a pair of punch pins, and a part of the ratchet mechanism which functions to drive the feed roll;

Fig. 3 is an enlarged fragmentary view of the feed roll, or drum and illustrates the meshing of the tape embossments with the drum apertures;

Fig. 4 is an enlarged view of the acting end of the punch pin employed in the structure shown in Fig. 1 and shows the pin in its operated position; and

Fig. 5 is an enlarged view of an alternative form of punch and die which serve to produce the same form of perforated embossment produced by the punch and die shown in Figs. 1, 2 and 4.

The spaced vertical brackets 10 support a bridge plate 12 which is provided with a plurality of cylindrical holes arranged in two transverse rows, the holes in one row being staggered with respect to the holes in the other row. Each of the holes in plate 12 accommodates a punch pin 13, each of which is held in the retracted position illustrated, by means of a coil spring 14 so that its upper end is held in constant communication with the arm 15 of a corresponding electromagnet 16. The upper end of each punch pin 13 is provided with an integral extension 13' of smaller diameter than that of the main body portion of the pin. This extension projects through a suitable opening in the outer end of the magnet arm 15, and the shoulder effected at the junction of the pin extension 13' with the main body portion of the pin abuts the under surface of the arm 15 due to the action of the coil spring 14. In practice, there are as many electromagnets 16 as there are punch pins 13, and the arm 15 of each electromagnet communicates with its corresponding pin in the manner described above. The arm 15 is, in fact, a channel-shaped member fixed to the electromagnet armature 17 by means of screws 18.

In Fig. 1 there are illustrated twenty-eight punch pins 13 so that there will be, in practice, twenty-eight electro-magnets 16 arranged in a circle, or in any other manner, which will permit the armature-extensions 15 thereof to communicate with their respective punch pins 13.

The lower or cutting end of the pin 13 is substantially cone-shaped so as to provide a sharp piercing point.

A shaft 18 is supported between the brackets 10 by means of bearing bolts 19 or in any other suitable manner. This shaft fixedly supports a drum, or feed roll 20, between two circular end plates 21, and carries at its left end a ratchet wheel 22. The end plates 21, drum 20, ratchet wheel 22 and shaft 18 rotate as a unit on the bearing bolts 19 under the action of a stepping magnet 23, the armature 24 of which has fixed thereto, as illustrated, a ratchet pawl 25. A spring 37 associated with the armature 24 functions in the usual manner to lift the ratchet 25 upon deenergization of the magnet 23.

A paper tape 26 is guided in its travel to the drum, or roller 20, by means of a shelf-like member whose longitudinal edges are bent over to provide guide integral pieces 27. The spaces between the floor of the shelf-like member and the under surface of the guide pieces 27 constitute longitudinal guide slots in which the tape moves freely in its travel to the drum. The ends of the guide pieces 27 are slightly curved upwards to facilitate the entrance and exit of the tape to and from the guide slots.

The feed roll, or drum 20, is provided with a multiplicity of transverse rows of small truncated conical apertures 28 whose outer dimension exceeds the root, or inner dimension thereof so as to give to each aperture a substantially funnel-shaped mouth. When the roller 20 has assumed a perforating position, two adjacent rows of apertures 28 will be in transverse alignment with the cutting ends of the two rows of punch pins 13 and when, with the tape 26 interposed between the pin ends and the roller 20, any of such punch pins is operated by its associated

punch magnet 16, those portions of the tape which lie immediately below the pins will be intruded or forced into corresponding truncated conical apertures 28 in the drum 20 to effect protrusions or embossments, such as are identified by the numeral 30 in Fig. 3. By virtue of the cone-shaped end of the punch pin and the correspondingly shaped mouth of the aperture 28, the tape protrusion or embossment which results from the penetration of the pin into the aperture will have a substantially cone-shaped configuration. During the operation of the punch pin, the tape protrusion, or embossment 30 is pierced at its apex in such a manner as to preclude the formation of chads.

When, upon the release of punch magnet 16, the associated punch pin is withdrawn under the action of its spring 14 after the combined embossing and perforating operation, the embossed or protruding portion of the tape remains embedded in its corresponding aperture in the drum 20 so that a driving connection between the drum and tape at the point of embossment is effected.

In practice, a plurality of electromagnets 16 are operated simultaneously in accordance with a particular code, so that a corresponding number of punch pins 13 will function simultaneously to provide a plurality of tape protrusions or embossments which extend across the breadth of the tape to define a pattern corresponding to the combination of punch pins operated. Thus, a plurality of tape embossments are embedded in a corresponding number of drum apertures throughout the breadth of the drum, and an effective union between the tape and drum is thus effected. When, subsequently to the deenergization of the code punch magnets 16 and the consequent withdrawal of the operated punch pins 13, the stepping magnet 23 functions through the ratchet drive 25, 22 to advance the drum 20, the tape 26 will be connected to the drum by virtue of the embedded embossments in corresponding drum apertures, and will rotate with the drum.

By virtue of the driving connection between the tape 26 and drum 20 effected by the tape embossments, the tape 26 will cling to the drum during the rotation of the latter and until it reaches a point 33 at which it will separate from and leave the drum. A guide piece 34 serves to insure the association of the tape with the drum until the point 33 is reached.

It is apparent from the foregoing description that the tape protrusions or embossments, when embedded in the drum apertures, function to provide an effective driving connection in the nature of a gear coupling between the tape and drum so that the rotation of the drum is imparted to the tape without the use of extraneous means such as drum-mounted driving pins. It is also apparent that applicant's invention precludes the necessity for providing the tape with perforations which accommodate such drum-carried driving pins so that a completely blank tape may be employed, which after the perforating operation has been performed thereon, bears only those perforations which identify the code signals.

It is equally apparent that, when a tape has impressed thereon code signals of the character described and is fed onto an apertured drum, or feed roller, of a reader, or code translating device, the tape embossments will mesh with corresponding apertures in the drum to effectively couple the tape and the drum so that the tape will

be moved by, and simultaneously with the drum. It is also apparent that, by virtue of this physical coupling, relative movement of the tape and drum in any direction except upwardly is precluded.

Fig. 5 illustrates an alternative form of punch pin and die combination which produces substantially the same form of perforated embossment as is produced by the punch and die combination of Figs. 1, 2 and 4. In this case the perforating element 13' is a cylinder with a conical point and the die 20' is cylindrical instead of conical. Furthermore, in this case it is not necessary for the punch to bottom, that is, to press the paper firmly against the die as is the case with the punch and die combination shown in the other figures of the drawing.

What is claimed is:

The combination of a rotatable apertured drum

and a tape, means for connecting said tape to said drum consisting of embossments in said tape symbolizing code signals and meshing with the apertures in said drum, said embossments and drum constituting the sole means for driving the tape.

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