United States Patent

[11] 3,536,256

[72] Inventor **Heinz-Dieter Purps**
Hamburg-Garstedt, Germany

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[73] Assignee **by mesne assignments, to**
U.S. Philips Corporation
New York, New York
a corporation of Delaware
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[33] **Germany**
[31] **P 41,585**

[54] **TAPE PUNCH DEVICE**
4 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **234/115**
[51] **Int. Cl.** **G06k 1/05**
[50] **Field of Search** 234/109, 110, 114, 115, 117, 119

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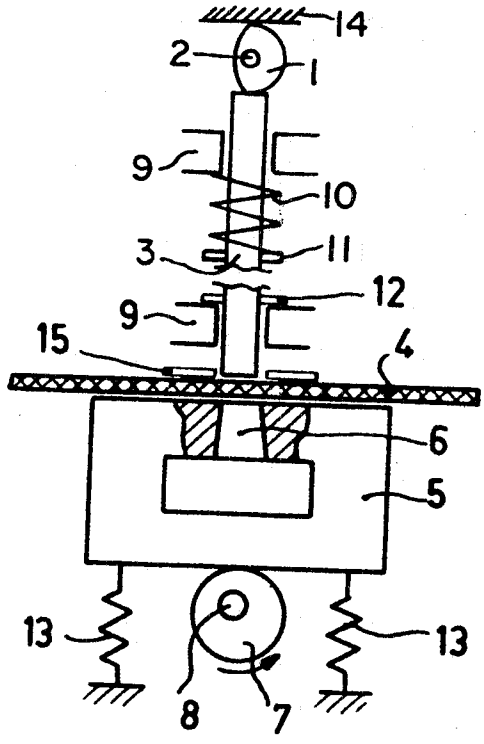
Primary Examiner—William S. Lawson
Attorney—Frank R. Trifari

ABSTRACT: A tape punch having an eccentric cam arrangement for cyclically moving a die toward and away from a punch tape; the tape is interposed between the die and one end of a punch. A second eccentric cam arrangement is programmed to either urge and lockingly engage the punch toward the tape thus removing a slug therefrom, or alternatively to permit movement of the die without a corresponding urging of the punch toward the tape, to achieve the desired pattern of punched holes.



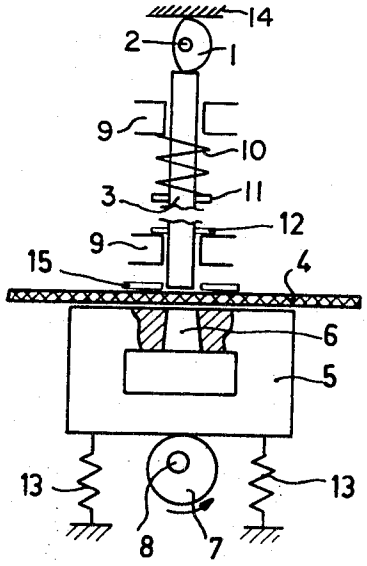


FIG.1

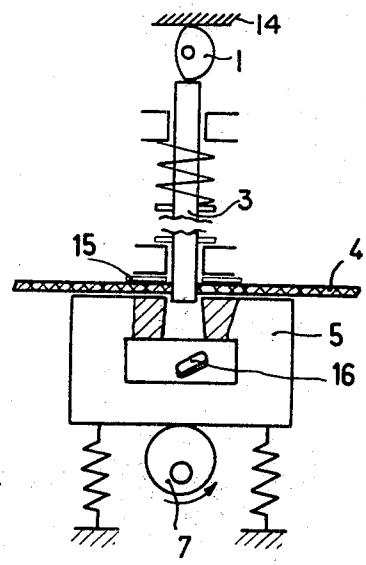


FIG.2

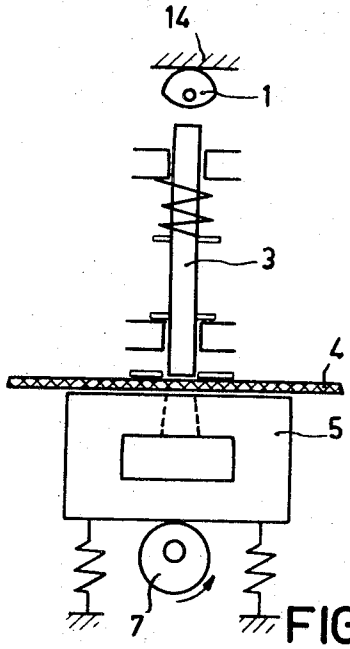


FIG.3

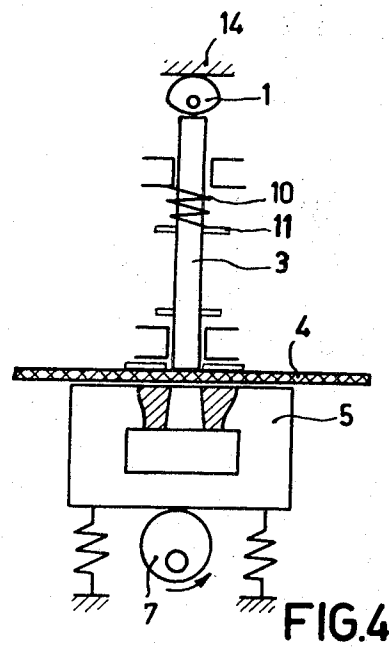


FIG.4

INVENTOR.
HEINZ-DIETER PURPS

BY Frank R. Trifari
AGENT

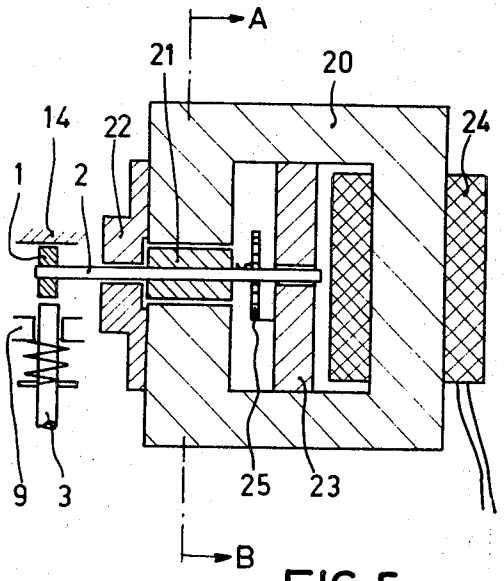


FIG.5

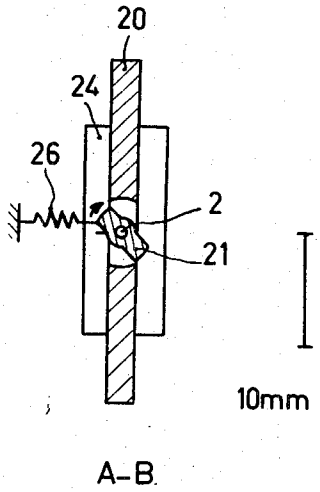


FIG.6

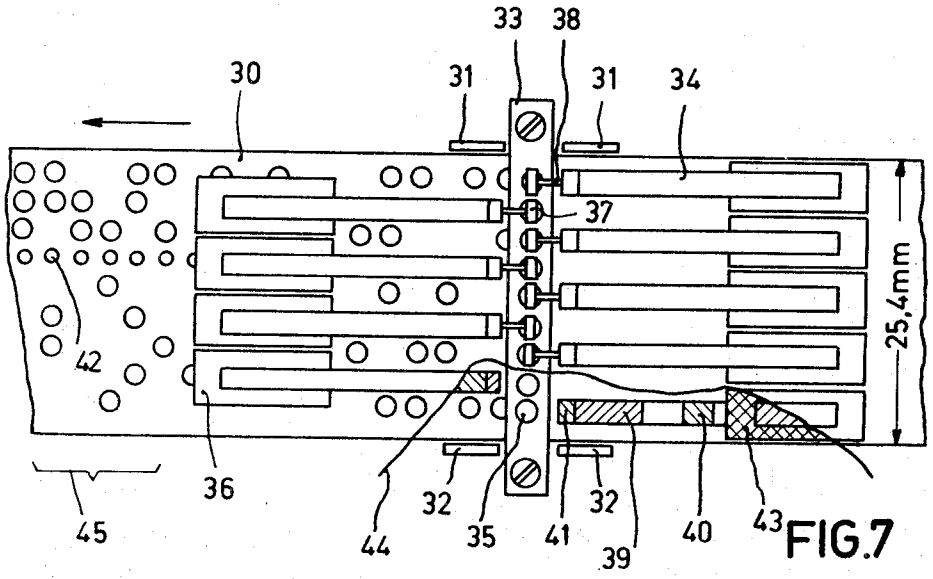


FIG.7

INVENTOR.
HEINZ-DIETER PURPS

BY
Frank R. Trifari
AGENT

TAPE PUNCH DEVICE

The invention relates to a device for locking the punches in fast tape or card punching unit, and in particular to a device which is actuated by electromagnetic means and has a low-inertia design for enabling setting times to be short and hence the punching frequency to be high.

Tape and card punching units are frequently used as output devices in electronic data processing. Their working speed determines the amount of information which can be processed per unit time; hence efforts are continuously being made to increase this working speed.

In the known punching units punching is effected either:

a. by vertical movement of the die with the aid of an eccentric, cam or crank drive, the punch being locked (punching) or released (no punching) in accordance with the information; or

b. by vertical movement of the punch holder with corresponding locking of the punches; or

c. by a direct mechanical or electromagnetic drive of the respective punches.

For controlling, *i.e.*, for locking or releasing the punches in units employing the methods described in a. and b. use is made of bulky mechanical intermediate members in the form of levers, toggle joints, pawls and the like, which in the case of electric control are actuated by associated solenoids and in the case of mechanical operation by further mechanical components. Although these intermediate members are designed so as to have little inertia, at high punching speeds they will, in spite of lubrication, give rise to wear due to impacts, shock loads and the like, and this materially reduces the useful life of the punching unit and requires frequent replacement.

According to this invention the disadvantages due to the said intermediate members are avoided by interposing a cam between the axially displaceable punch and a fixed member, the cam having the form of an eccentric disc which is adapted to be rotated into preferably two predetermined positions.

The cam may be rotated either by mechanical means or, according to a further feature of the invention, by a rotation magnet, through an angle of 90° or less so that in one of its two positions it serves as a direct driving connection between the punch and the supporting surface and in the other position permits a free stroke of the punch with no consequent punching.

In order that the invention may be readily be carried into effect, an embodiment thereof will now be described, by way of example, with reference to the accompanying diagrammatic drawings, in which:

FIG. 1 shows the setting device in readiness for punching (bottom dead point of the die);

FIG. 2 shows the setting device after punching (top dead point of the die);

FIG. 3 shows the setting device in readiness for allowing a free stroke of the punch (bottom dead point of the die);

FIG. 4 the setting device subsequent to a free stroke (top dead point of the die);

FIG. 5 is a side elevation of a rotation magnet for setting the cam;

FIG. 6 is the associated front elevation; and

FIG. 7 shows, by way of example, the arrangement of the rotation magnets for 8-track punched tape.

The operation of a crank punching unit provided with an eccentric, cam or crank drive may be assumed to be known and does not form a subject matter of the invention.

FIG. 1 is an elevation view of a device according to the invention. A punch 3 is supported for axial movement in guide members 9. By means, not shown, a tape or card 4 is intermittently fed forward over a die 5 which is adapted to be raised and lowered by the rotation movement of a shaft 8 carrying an eccentric 7. Draw springs 13 ensure a positive driving connection between the die 5 and the eccentric 7. In the bottom dead point of the eccentric 7 shown in FIG. 1 the tape 4 is just free to travel between the punch 3 and the die 5. By means of a plate 11 the punch 3 is pressed down toward the tape by a spring 10; a stop plate 12 limits the downward stroke by striking the lower guide member 9. According to the invention the upward stroke of the punch 3 is limited by the cam 1 which is rigidly secured to a shaft 2 mounted for rotation and, as is shown in FIG. 1, the part of the cam working surface remote from the punch 3 engages a fixed member 14. This member 14 is rigidly connected to the housing of the apparatus and in the punching process (FIGS. 1 and 2 show the setting of the cam 1 for "punching") absorbs the punching force transmitted from the die 5 through the tape 4, the punch 3 and the cam 1. When the shaft 8 is rotated in the direction shown, the die 5 is pressed out of its bottom dead point against the tape 4 until finally, as FIG. 2 shows, the punch 3 enters the die opening 6 and presses out a slug 16. Further rotation of the shaft 8 with the eccentric 7 results in the die 5 being lowered by the springs 13, the tape 4 is stripped from the punch 3 by a holddown member 15, and in the bottom dead point of the eccentric shaft 8 (cf. FIG. 1) the starting position is regained, *i.e.*, the tape 4 is moved one pitch and the cam 1 is set to "punching" or "no punching" (=free stroke of the punch 3) in accordance with the available information.

FIGS. 3 and 4 show the cycle for the setting "no punching". To this end, the cam 1 together with the shaft 2 is rotated, for example, through 90°, as is shown in FIG. 3. Angular movement may, however, be effected through a smaller angle; the required angle depends upon the required free stroke of the punch and upon the permissible flattening or eccentricity of the cam 1 at a given diameter. When the die 5 is raised from the position shown in FIG. 3 by the rotation of the eccentric 7, the punch 3 is axially displaced by the tape 4 because it is not locked by the member 14.

In the top dead point of the eccentric 7 the punch 3 is pushed back to its extreme upper position but still does not strike the cam 1 so that the tape 4 is not punched. Subsequently the die is lowered to the initial position (FIG. 3) by further rotation of the eccentric 7. In the free stroke shown in FIG. 4 the punch 3 is pressed upward against the action of the spring 10, which after the upward stroke pushes it down again. The spring 10 must be proportioned so that its force is smaller than the force required for punching so as to preclude any possibility of punching during the free stroke, but also so that with high-speed punching it presses the punch 3 with its support plate 12 against the lower guide member 9 at a speed such as to enable the cam 1 to be set to its new position without having to do any frictional or stroke work for the punch 3.

The thickness of the tapes most commonly used at present is about 0.1 mm.; thus, a punching stroke of between 0.2 and 0.3 mm. is sufficient. In order to ensure freedom of travel for the tape with the die at bottom dead point and to compensate for any tolerances an overall stroke of the die of between 0.3 and 0.4 mm. will be sufficient. The radius of the cam 1 on the freestroke side must be smaller than the radius of the working surface engaging the member 14 by at least the same amount.

In FIGS. 5 and 6 a small rotation magnet is shown enlarged and simplified as an example of a possible construction of a member for setting the cam 1. As described hereinbefore, the shaft 2 carries the cam 1 and it is also rigidly connected to a rotation armature 21. By means of bearings 22 and 23 of non-magnetic material the shaft 2 is mounted in a bore of a flat magnetic yoke 20 of soft magnetic material in a manner such that the armature and the shaft are readily rotatable in this bore with a minimum air gap. In the inoperative position (=free stroke for the punch 3) the armature 21 is rotated by a spring 26 (FIG. 6) out of the magnetic yoke, for example through an angle of 45°, as is shown in FIG. 6; this spring 26 may also have the form of a spiral spring 25 (FIG. 5).

When the magnet coil 24 passes a current by which in the magnetic circuit comprising the yoke 20, the armature 21 and twice the air gap between the yoke and the armature, a sufficiently large magnetic induction flux is produced, the armature 21 is rotated into the yoke 20 by the magnetic force; as a result the armature rotates the cam 1 through a predetermined

angle and locks the punch **3** for the punching stroke. When the electric current through the magnetic coil **24** is switched off, the spring **25** or **26** pulls the armature **21** into the inoperative position again. The pole pieces of the yoke may suitably be designed so as to produce optimum distribution of the magnetic flux for the flat armature **21**, which in turn ensures an advantageous variation for the force during the rotation movement of the armature **21**. These factors are essential for the operation of the device described at high punching speeds.

The usual tapes contain **5**, **6**, **7** or **8** information tracks arranged side by side and in addition a timing sprocket track. For an 8-track tape according to DIN (German standard) 66016 the tape width is 25.4 mm. This means that the control magnets for actuating the cams **1** must be arranged closely side by side. Hence an extremely narrow design is proposed for the rotation magnet of FIGS. **5** and **6**. According to a further feature of the invention these magnets are arranged in the form of two interleaving combs one on each side of the plane of the punches so that in spite of the narrow construction the required number of control magnets can be accomodated across the width of the tape, as is shown in FIG. **7**. This Figure is a top plan view of the proposed arrangement, the member **14** shown in FIGS. **1** to **5** being omitted for the sake of clarity.

The tape **30** is laterally guided by strips **31** and **32**, the travelling direction being indicated by an arrow. A bridge **33** contains the guides for the punches **35**; rotation magnets **34** of the kind shown in FIGS. **5** and **6** are arranged on both sides of the bridge **34** in a manner such that enough space is available for coils **36**, and also cams **37** secured in the manner described to shafts **38** of the rotary armatures become located above the punches **35** so as to be able to lock them.

A line **44** bounds a partial sectional view of two rotation magnets below the armature plane; a magnet yoke **39**, bearings **40** and **41** for an armature and a magnet coil **43** are shown. Further constructional details have been omitted since they are of slight importance to the invention. Behind the bridge **33**—viewed in the travelling direction of the tape —punched information holes **45** and a continuous track of timing sprocket holes **42** are visible.

I claim:

1. A device for punching holes in a tape or card punching unit comprising a die, spring biased punch means positioned for coaction with the die, first cam means for cyclically moving the die toward and away from said punch means, and second cam means including a shaft attached to the second cam means for selectively rotating same to block the punch so as to cause it to assume an operative position relative to said moving die.

2. A device as claimed in claim **1** wherein the second cam means further comprises an eccentric disc-shaped cam member, an armature affixed to the shaft, magnetic drive means for coaction with the armature and coil means for energizing the magnetic drive means to rotate the cam member into punch blocking position.

3. A device as claimed in claim **2** further comprising a spring member for rotating the cam member to an inoperative position when the magnetic drive means are deenergized.

4. A device as claimed in claim **3** further comprising a bridge member placed transversely across the punch unit and defining therein a plurality of punch guides, a plurality of punches set in the guides, and a plurality of corresponding second cam means for activating each of the punches, said second cam means being alternately placed on opposite sides of the bridge member.