

May 12, 1964

M. L. BOUDREAU ET AL

3,132,554

PAPER PUNCH

Filed Jan. 12, 1962

2 Sheets-Sheet 1

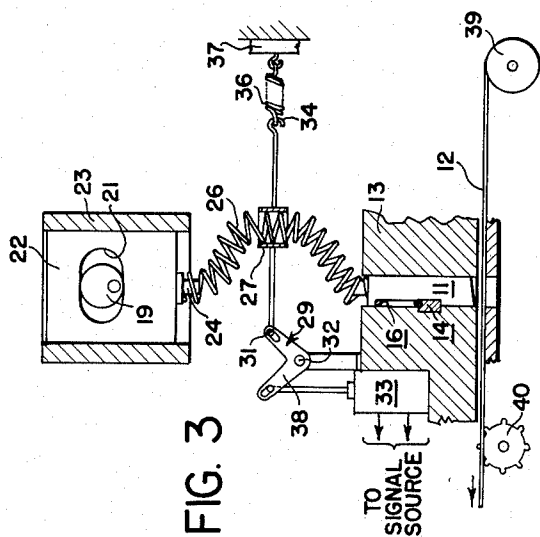


FIG. 3

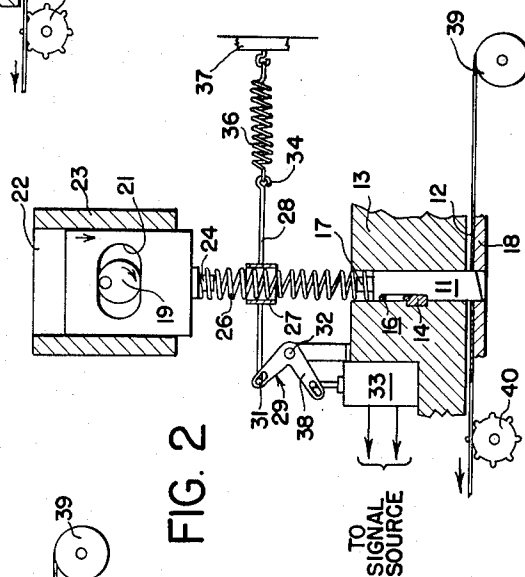


FIG. 2

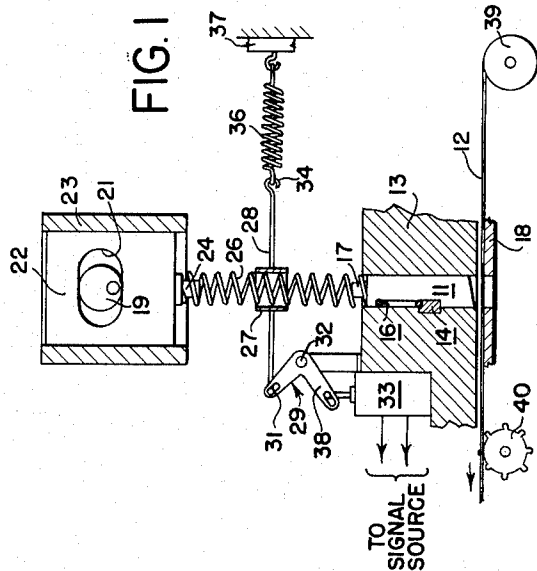


FIG. 1

INVENTORS
MAURICE L. BOUDREAU
JAMES R. COULT
BY *Harold D. Jastram*
ATTORNEY

May 12, 1964

M. L. BOUDREAU ET AL.
PAPER PUNCH

3,132,554

Filed Jan. 12, 1962

2 Sheets-Sheet 2

FIG. 4

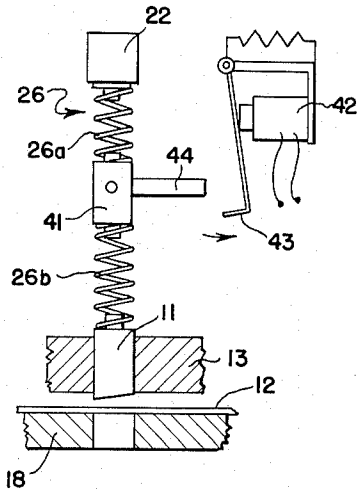


FIG. 5

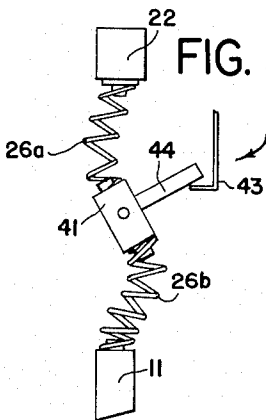
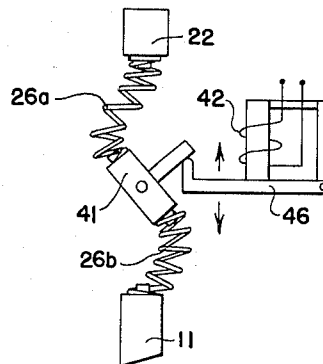


FIG. 6



INVENTORS
MAURICE L. BOUDREAU
JAMES R. COULT
BY *Harold D. Jastram*
ATTORNEY

1

2

3,132,554

PAPER PUNCH

Maurice L. Boudreau, Isanti, and James R. Coult, Minneapolis, Minn., assignors to General Mills, Inc., a corporation of Delaware

Filed Jan. 12, 1962, Ser. No. 165,809

10 Claims. (Cl. 83-572)

This invention relates to punching apparatus and more particularly to a device for entering data in the form of punched holes in a tape.

The usual paper tape punch or punching apparatus utilizes a number of rather complicated ratchets, dogs, escapements, toggles, and similar mechanisms which are extremely expensive to manufacture. Such mechanisms are expensive to produce since the mechanisms are movably interconnected and require precise fittings of joints and other sliding mechanical contacts. Sliding mechanical contacts introduce lubrication problems normally undesirable in high speed punching apparatus. Mechanisms containing rigid lengths such as ratchets, dogs, and escapements are often subjected to high mechanical impact during a punching operation which ultimately leads to breakdown of the punching apparatus.

It is therefore an object of the present invention to provide a new and improved punching apparatus.

Another object of the present invention is to provide a reliable punching apparatus requiring a minimum of precision parts.

A further object of the present invention is to provide a punching apparatus which utilizes the columnar characteristic of a coil spring.

Another object of the present invention is to provide a punching apparatus sensitive to the presence or absence of a signal such as a binary signal which is utilized in connection with computers, typewriters, or business machines.

A further object of the present invention is to provide a punching apparatus utilizing a coil spring as a connecting link between a drive mechanism and a punch, which spring is deflected in accordance with the presence or absence of a signal to actuate or prevent actuation of the punch.

An apparatus forming a specific embodiment of the invention may include a coil spring interconnecting an eccentric driven actuator and a paper tape punch. A lock rod is connected to the central portion of the spring and is operated laterally of the spring by a solenoid actuated rocker arm against the restraining force of a trip spring. A signal energizes the solenoid and the rocker arm so that the lock rod positions the interconnecting coil spring so that motion of the eccentric is transmitted by the columnar coil spring to force the punch through a paper tape. The absence of a signal permits the trip spring to draw the interconnecting spring out of its columnar condition so that actuation of the eccentric does not force the punch to engage the paper tape.

A complete understanding of the invention may be obtained from the following detailed description of an apparatus forming a more specific embodiment when read in conjunction with the drawings in which:

FIGURE 1 illustrates a punching device according to the invention where a signal is energizing a solenoid to align the coil spring for a punching operation;

FIG. 2 is a view similar to FIGURE 1 except that an eccentric has compressed the aligned coil spring and has forced the punch through a paper tape;

FIG. 3 illustrates the situation when no signal appears at the solenoid and the coil spring is deflected so that the punch cannot be forced through the paper tape by the eccentric;

FIG. 4 illustrates an alternate embodiment of the

punching device having two coil springs interconnecting the follower and punch;

FIG. 5 illustrates the embodiment shown in FIG. 4 with the coil spring sections deflected and

FIG. 6 illustrates a modification of the punching device shown in FIG. 4 having a modified deflecting armature and coil.

Referring first to FIGURE 1 there is illustrated a punching apparatus according to the present invention with a punch 11 disengaged from a paper tape 12. A punch block 13 serves as a guide for punch 11 and has a stop pin 14 embedded in the wall for limiting the vertical movement of punch 11. A preload spring 16, which may be a loop spring, coil spring, or some other device, is designed to withdraw punch 11 from tape 12 when only a limited or no downward force is exerted on the punch 11 at its base 17. Spring 16 is also a preloading device which is used to prevent vertical downward movement of punch 11 unless a predetermined force is applied at base 17. A die block 18 is provided to co-operate with punch 11 to perforate tape 12 when punch 11 is actuated.

Rotary motion from any suitable motive means, which is not shown, is transformed to reciprocal motion by a drive cam 19 which rides in a cam slot 21 to reciprocate cam follower 22 within cam follower guide 23.

Between extension 24 of cam follower 22 and the base 17 of punch 11 is a resilient member such as coil spring 26 which displays favorable columnar characteristics to transfer linear motion along its longitudinal axes when it is compressed but which fails to transfer motion when its longitudinal axes is deflected from a straight line. Spring 26 is compressed when cam follower 22 is moved vertically downward, as illustrated in FIGURE 1, by drive cam 19. Coil spring 26 transmits forces from cam follower 22 along its longitudinal axis to the base 17 of punch 11 provided the longitudinal axis of spring 26 is a straight line as illustrated in FIGURE 1. The force thus transmitted overcomes the preload tension developed by preload spring 16 and forces punch 11 into engagement with tape 12 to sever the tape or punch a hole therein. (See FIGURE 2.)

The longitudinal axis of spring 26 is maintained in a straight line between follower extension 24 and punch base 17 by a spring column lock 27 and a lock rod 28. Spring lock 27 may encircle the outer surface of spring 26 or it may be placed within the spring column. Either arrangement may work satisfactorily and many other arrangements such as attachment of the lock 28 directly to the spring coils may be used. The essential feature is that lock 27 is located somewhere between the ends of the spring so that it can control the deflection of spring 26. Spring 26 remains slightly compressed or tensioned in the withdrawn position illustrated in FIGURE 1. Tensioning of spring 26 permits columnar alignment of spring 26 in spite of the deflecting force exerted by trip spring 36 and additionally, the tensioning reduces the distance that solenoid 33 must move in order to align or "lock" spring 26.

Lock rod 28 is pivotally connected to a rocker arm 29 by a shaft 31. Rocker arm 29 is pivoted about shaft 32 in response to a solenoid 33. The opposite end of lock rod 28 contains a hook 34 which engages a tension biased trip spring 36 which in turn is fastened to a stationary member 37.

When an electrical signal energizes solenoid 33, the solenoid pivots extensions 38 of rocker arm 29 in the counterclockwise direction, as viewed in the figures, so that lock arm 28 and spring lock 27 are moved to the left in the figures to align spring 26 as illustrated in FIGURES 1 and 2. Solenoid 33 moves rocker arm 29, rod 28, and spring lock 27 against the opposing tension of trip spring 36. Thus it can be seen that when a signal ener-

gizes, solenoid 33 rod 28 and spring lock 27 align spring 26 so that as follower 22 moves vertically downward compressing spring 26, punch 11 engages tape 12 which is driven by sprocket 40. This energizing signal could be one portion of a binary signal designed to change binary intelligence from the electrical signal to perforation printed forms on a paper tape such as tape 12.

In the event that no signal energises solenoid 33, the solenoid releases rocker arm extension 38 and the lock rod 28, the central portion of spring 26, and the spring lock 27 moves to the right as viewed in the figures under the influence of tensioned trip spring 36. (See FIGURE 3.) The columnar characteristics of the spring 26 are thus destroyed so that no linear force is transmitted from solenoid 22 along the longitudinal axes of spring 26 to punch 11. Follower 22 may move downward as viewed in the figures, however, this downward movement is merely dissipated in the deflected spring 26 and no force component is transferred to the base 17 of punch 11 which is great enough to overcome preload spring 16 and force the punch 11 into engagement with tape 12. This no signal condition which leaves solenoid 33 deenergized may be the second portion of intelligence in the ordinary binary system of intelligence transmission or recordation. The movement of tape 12 from supply 39 is timed at a constant rate with respect to a cyclic operation of follower 22 and the intelligence recordation on tape 12 may be accomplished by merely aligning or deflecting spring 26 to actuate punch 11 to perforate tape 12 in accordance with the signal which arrives at solenoid 33.

There are a number of alternative arrangements which may satisfactorily be used in an apparatus such as the one described. For instance lock rod 28, rocker arm 29 and solenoid 33 could be replaced by a first solenoid directly connected to coil spring 26 and a second solenoid which then takes the place of spring 36 could be used to oppose the first solenoid. Proper programming of signals would then result in alignment and deflection of spring 26 as desired. The drive mechanism including cam follower 22 and drive cam 19 could be replaced by any drive mechanism which produces cyclic linear motion such as an electrical vibrator. Spring 26 could be two springs terminating at the lock 27 which could be a block designed to deflect the ends of the pair of springs. Conceivably one end of spring 26 could be displaced from engagement with extension 24 or base 17.

FIGURES 4 and 5 illustrate an alternate embodiment where spring 26 is divided into sections 26a and 26b with a centerbody 41. When solenoid 42 is energized, armature 43 is pulled out of the vertical path of trip arm 44 so that the sections 26a and 26b retain a columnar characteristic and are compressed by follower 22 to force punch 11 into engagement with tape 12. If the solenoid 42 is not energized, trip arm 44 strikes the armature 43 (see FIGURE 5) and pivots centerbody 41 which in turn destroys the columnar characteristic of spring sections 26a and 26b to prevent actuation of the punch 11.

A modification of the embodiment illustrated in FIGURES 4 and 5 is illustrated in FIGURE 6 where armature 46 is moved vertically to engage trip arm 44 to destroy the columnar characteristic of the spring sections 26a and 26b.

It is to be understood that the above described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will employ the principles of the invention and fall within the spirit and scope thereof.

What is claimed:

1. A punching apparatus for selectively perforating a tape which comprises a punch, means for driving said

punch, resilient means interconnecting said punch and said driving means for transferring punch actuating movement from said driving means to said punch, and means responsive to a signal for displacing said transferring means to prevent actuation of said punch.

2. A punching apparatus for selectively perforating a tape which comprises a punch, reciprocal means for driving said punch, a resiliently deflectable means connected to said punch for transferring motion from said driving means to reciprocate said punch, and means connected to said transferring means for deflecting said transferring means in response to a signal to prevent actuation of said punch.

3. An apparatus according to claim 2 in which said means for deflecting includes a solenoid responsive to an electrical signal.

4. An apparatus according to claim 2 in which said means for transferring is a coil spring which is laterally deflectable by said means for deflecting.

5. A punching apparatus for selectively perforating a tape which comprises a punch, means for driving said punch, resiliently deflectable means interconnecting said punch and driving means for forcing said punch into engagement with said tape, means associated with said punch for resisting said deflectable means and for disengaging said punch and tape after said tape is perforated, and means connected to said deflectable means for displacing said deflectable means in response to a signal to prevent said punch from perforating said tape.

6. An apparatus according to claim 5 in which said means for resisting is a preload spring associated with said punch and said deflectable means is a coil spring which transfers motion from said driving means to said punch to overcome said preload spring when said coil spring is undeflected.

7. Apparatus according to claim 5 in which said means for deflecting includes a lock mechanism connected to said deflectable means and a solenoid responsive to an electrical signal which actuates said lock mechanism to displace said deflectable means.

8. A punching apparatus for selectively perforating a tape which comprises a punch, means for reciprocally driving said punch, resiliently deflectable means interconnecting said punch and said driving means for transferring movement from said driving means to said punch, a first means for deflecting said deflectable means to impede engagement of said punch with said tape in the absence of a signal and a second means responsive to the presence of a signal for opposing said first means to align said deflectable means to force said punch to engage said tape in response to said driving means.

9. An apparatus according to claim 8 in which said first means includes a tensioned spring and in which said second means includes an electrical solenoid.

10. A punching apparatus for selectively perforating a tape which comprises a punch, means for driving said punch, compressible and deflectable means interconnecting said punch and driving means for forcing said punch into engagement with said tape, means associated with said punch for resisting said compressible and deflectable means and for disengaging said punch and tape after said tape is perforated, and signal responsive means connected to said compressible and deflectable means for displacing said compressible and deflectable means to prevent said punch from perforating said tape.

References Cited in the file of this patent

UNITED STATES PATENTS

599,560	Hodgeland	Feb. 22, 1898
2,831,355	Zimmerman	Apr. 22, 1958