Dec. 18, 1962 J. HANDLEY 3,069,057

HIGH SPEED PERFORATORS

Filed Sept. 23, 1958 3 Sheets-Sheet 1

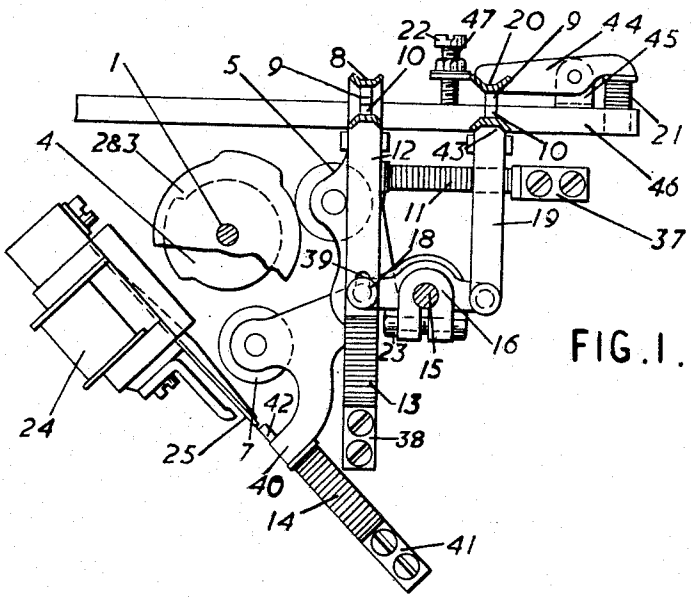



FIG. 1.

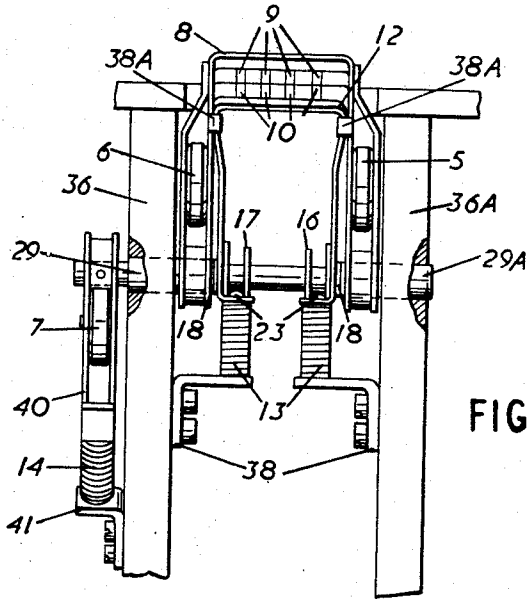



FIG. 2.

INVENTOR
JOHN HANDLEY

BY R. P. Morris

ATTORNEY

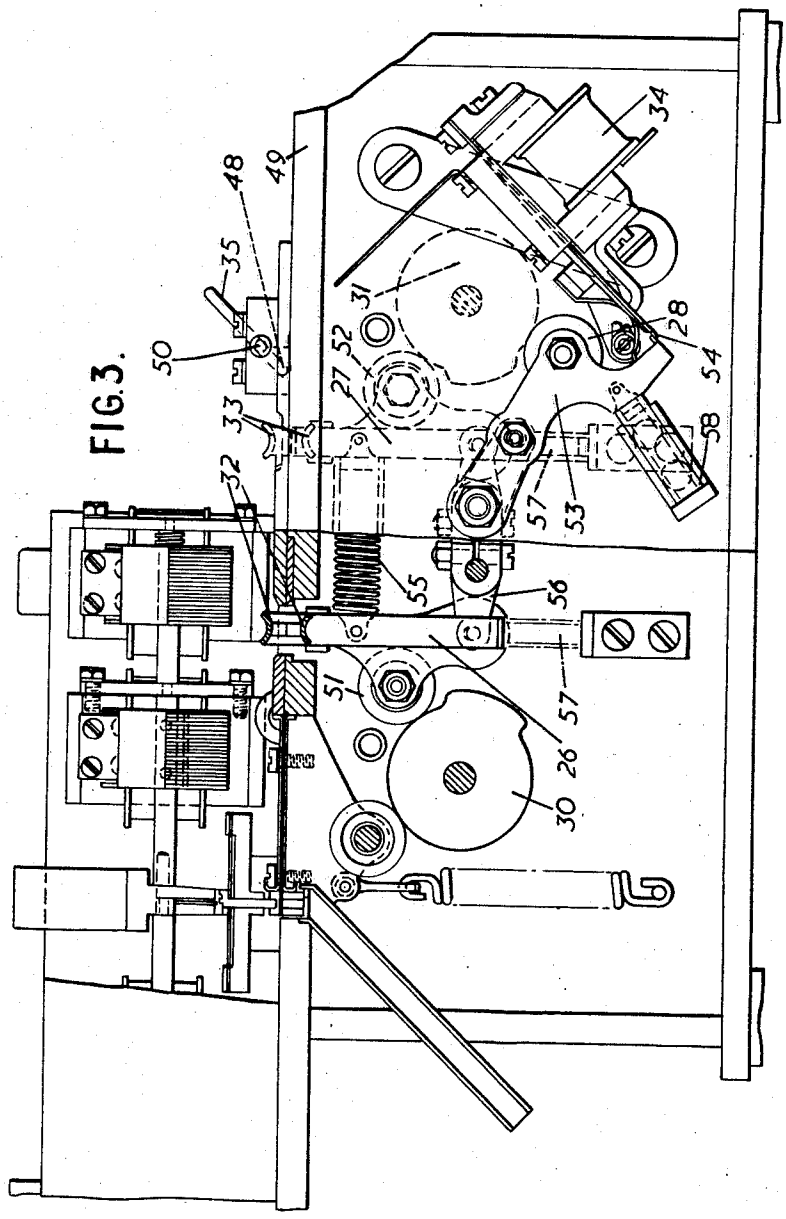
Dec. 18, 1962 J. HANDLEY 3,069,057

HIGH SPEED PERFORATORS

Filed Sept. 23, 1958

3 Sheets-Sheet 2

FIG.3.




INVENTOR
JOHN HANDLEY

BY R. P. Thomas

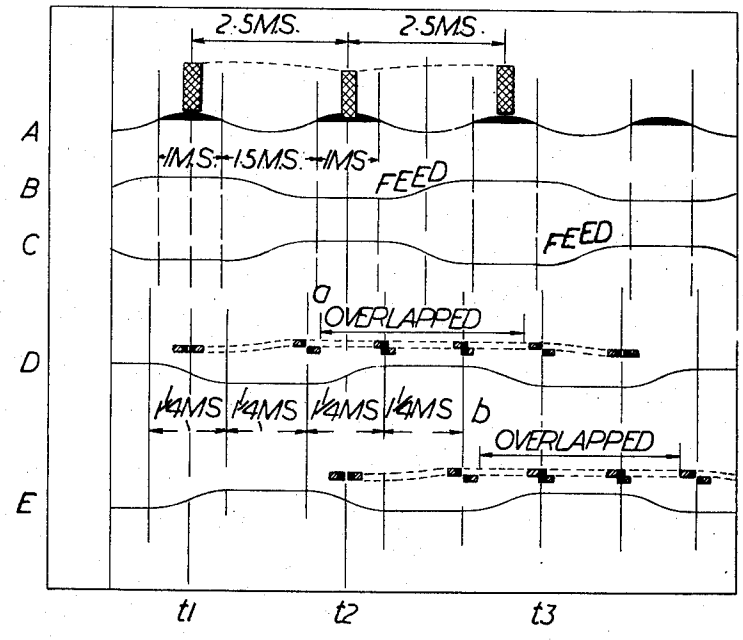
ATTORNEY

Dec. 18, 1962 J. HANDLEY 3,069,057

HIGH SPEED PERFORATORS

Filed Sept. 23, 1958 3 Sheets-Sheet 3

FIG.4.




*Inventor*

J. HANDLEY

*By* R. P. Morris

*Attorney*

United States Patent Office

3,069,057

Patented Dec. 18, 1962



3,069,057

# HIGH SPEED PERFORATORS

John Handley, Little Marland, Briar Hill, Purley, England

Filed Sept. 23, 1958, Ser. No. 762,828
Claims priority, application Great Britain Sept. 28, 1957
5 Claims. (Cl. 226—112)

This invention relates to mechanism for feeding tape in a step-by-step manner. Such mechanism is required in tape-printers, tape-perforators and machines for reading tape.

The object of the present invention is to feed the tape at high speeds. In my copending application Serial No. 582,718, filed May 4, 1956, now Patent No. 2,960,163, I described a mechanism for feeding tape in a step-by-step manner in which a toothed pawl was carried by a feed rocker and the teeth of said pawl were urged into contact with the tape at an obtuse angle to the direction in which the tape was to be fed. The feed rocker was cam-operated, first in the direction opposite to the tape feed and then to initial position to feed the tape.

I have found that such mechanism was not satisfactory when the speed of operation was increased beyond a certain amount, for the paper tape then overshot the desired position.

According to a first aspect of the invention there is provided a mechanism for feeding tape in a step-by-step manner. This mechanism includes a first cam and a cooperating first spring which reciprocates a feed clamp to feed the tape in the noted step-by-step manner. There is also provided a second cam and a cooperating second spring for closing and opening the feed clamp to grip and release the tape so that it is fed in one direction only. An electromagnet is provided which when in one position holds the feed clamp open and when in the other position allows the feed clamp to close and grip the tape for movement in the feed direction.

According to a second aspect of the invention there is provided a mechanism of the above character which further includes a spring-operated retention pawl arranged to prevent the tape from moving in a direction reverse to the feed direction.

Preferably I provide relay means to control the feed mechanism so that in one condition of the relay the feed mechanism is prevented from operation.

The invention will be better understood from the following description taken in conjunction with the accompanying drawing.

FIGS. 1 and 2 are a sectionalized side elevation and end elevation respectively of a mechanism according to the invention.

FIG. 3 is a side elevation in part section of a perforator incorporating two tape feed mechanisms according to the invention, and FIG. 4 is a timing diagram of the operation of the perforator of FIG. 3.

Referring to the drawings and first to FIGS. 1 and 2, shaft **1** is driven by a motor through suitable gearing and carries cams **2**, **3** and **4**.

The feed clamp for the tape is constituted by a feed rocker **8** and an inner frame **12**. The feed rocker **8** is in the form of an inverted U and the vertical side members thereof are pivotally mounted at their lower extremities on shafts **29** and **29A** which are rigidly affixed in axial alignment in side members **36** and **36A** respectively of the mechanism frame, thus the upper end of the feed rocker **8** which is constituted by a cross member, and which carries anvils **9** on its under side, may be moved to the left or right about the axes of the shafts **29** and **29A**. Rollers **5** and **6** are rotatably carried between side members of the feed rocker **8** and arranged to peripherally engage profiles of the cams **2** and **3** which



are mounted on the shaft **1**, only cam **2** may be seen in FIG. 1 since cams **2** and **3** are of the same profile and in alignment. Compression springs such as **11** are disposed between the side members of the feed rocker **8** and anchor members such as **37** affixed to part of the mechanism frame (not shown) so as to urge the feed rocker toward the left about the axes of shafts **29** and **29A** and so that the peripheries of the rollers **5** and **6** are always in engagement with the profiles of cams **2** and **3** respectively.

The inner frame **12**, also in the form of an inverted U, is located so that side members thereof are between side members of the feed rocker **8** and maintained in alignment therewith by clips **38A**. The upper end of the inner frame **12**, constituted by a cross member, carries anvils **10** on its upper side and which are disposed in alignment with the anvils **9** on the underside of the cross member of the feed rocker **8**. The lower extremity of each side member of the inner frame **12** is engaged by one end of a compression spring **13**, the other end of which is supported by an anchor member **38** affixed to a part of the mechanism frame (not shown), so that the anvils **10** thereon are, when permitted, urged toward the anvils **9** on the feed rocker **8**. The inner frame **12** is carried on extending portions of rocker arms **16** and **17** by means of pins **18** on the ends of these extending portions, the pins extending through elongated slots such as **39** through the side members of the inner frame and in close proximity to their extremities. Both the rocker arms **16** and **17** are rigidly affixed to a shaft **15** rotatably mounted in portions of the mechanism frame (not shown). A rocking arm **40** is rigidly affixed to one end of the shaft **15** and carries thereon a freely rotatable roller **7** which is urged into peripheral engagement with the profile of the cam **4** under the influence of a compression spring **14** which, at one of its ends, engages an extending portion of the rocking arm **40** and at its other end with an anchor member **41** rigidly mounted on a part of the mechanism frame (not shown). A relay **24** is rigidly mounted on part of the mechanism frame (not shown) and with a movable armature **25** constituting an interposer arranged to engage a pin **42** on the rocking arm **40** when the relay is de-energised, and arranged to clear the pin **42** when the relay is energised. A tape holding clamp is constituted by member **19**, in the shape of an inverted U and a retainer **20**, both of which are shown in the sectioned side elevation of FIG. 1. The inverted U shaped member **19** is pivotally affixed at the lower extremities of its side members to ends of extending portions of the rocker arms **16** and **17**, these portions being disposed on the other side of the shaft **15** opposite the previously mentioned extending portions. The upper end of the inverted U shaped member **19** is constituted by a cross member **43** which carries anvils **10** similar to those carried by the inner frame **12**. The retainer **20**, in the form of a bar which is disposed to lie parallel with the cross-member **43** of the inverted U shaped member **19**, has anvils **9** disposed on its under side in line with the anvils **10** on the member **19**. A member **44** is affixed at one of its ends to an end of the retainer **20** and is pivotally mounted in a bracket **45** affixed to part of the mechanism frame **46**. The other end of the member **44** is engaged by one end of a compression spring **21** the other end of which is anchored to the part of the mechanism frame **46**.

In operation, the shaft **1** and cams **2**, **3**, and **4** thereon are driven by the aforementioned motor. The profiles of cams **2** and **3** engage rollers **5** and **6** which are constantly urged there-against by springs **11** and cause both the feeder rocker **8** and the inner frame **12** to pivot together about the axes of the shafts **29** and **29A**, and pins **18** in rockers **16** and **17** respectively so that the upper

end of the feed clamp which they constitute is moved in the feed direction to the left and a direction reverse to the feed direction to the right alternately to carry the anvils 9 and 10 in the same directions. If the relay 24 is de-energised, then the interposer 25 thereof rests in the position shown and maintains the periphery of the roller 7 on rocking arm 40 out of contact with the profile of the cam 4 by way of the pin 42.

As a result of this, the rocking arm 40 is prevented from oscillating shaft 15 which carries rocker arms 16 and 17, and in consequence the inner frame 12 of the feed clamp, which is supported by the elongated slots such as 39 therein on pins 18 on extending portions of the rocker arms, is prevented from being oscillated upward and downward with respect to the feed rocker 8 so that the anvils on the feed rocker 8 and the inner frame 12 remain apart and the tape is maintained released. During this period of de-energisation of the relay the inverted U shape member 19 of the holding clamp is maintained stationary with the tape gripped between the anvils 9 and 10 on the retainer 20 and the member 19 respectively. As soon as a signal is received indicative of a requirement to feed the tape, which signal is applied to the relay 24, the relay is energised and causes the interposer 25 to move away from the pin 42 on the rocking arm 40, and in consequence the roller 7 on the rocking arm 40 is allowed to follow the periphery of the cam under the influence of compression spring 14 as well as compression springs such as 13. As a result, shaft 15 is caused to oscillate, as are the rocker arms 16 and 17 thereon, so that the inner frame 12 of the feed clamp and the member 19 of the holding clamp move upward and downward alternately so that they grip and release the tape alternately. The cams 2, 3 and 4 are so arranged on the shaft 1, one with respect to the other, that whilst the feed clamp is being moved to the right in a direction reverse to the feed direction, the anvils 9 and 10 thereon are maintained apart and the anvils 9 and 10 of the holding clamp are maintained together to grip the tape; and during movement of the feed clamp to the left in a feed direction the anvils 9 and 10 of the feed clamp are maintained together to grip the tape and feed it whilst the anvils 9 and 10 of the holding clamp are maintained apart so as to allow for free passage of tape therebetween.

By virtue of the fact that there is free play of the pins 18 in the elongated slots such as 39 in the side members of the inner frame 12, the rocker arms 16 and 17 have a small amount of free movement before they move the inner frame 12 downward with respect to the feed rocker to release the tape at the end of the feed movement of the feed clamp. The adjusting screw 22 which engages a nut 47 affixed to the end engaged by the compression spring 21, allows the retainer 20 to be raised or lowered with respect to the member 19. This adjustment in conjunction with the free play of the pins 18 in the elongated slots 39 in the side members of the inner frame 12 permits the holding clamp to grip the tape at the end of the feed movement just before the feed clamp is released from the tape. Similarly the holding clamp is permitted to release the tape just before the feed clamp grips it at the commencement of the feed movement.

As soon as relay 24 is de-energised the interposer 25 is moved so that its end obstructs the pin 42, and roller 7 on rocking arm 40 is no longer able to follow the periphery of the cam 4. In consequence anvils 9 and 10 of the feed clamp are maintained apart and thus there is no feeding of the tape which is gripped between anvils 9 and 10 of the holding clamp. It will readily be understood that the holding clamp could be dispensed with providing means were available to prevent the tape moving in the direction reverse to the feed direction when the feed clamp is moving in that direction. To this end a spring-loaded pawl such as 35 (shown in the embodiment in FIG. 3) could be provided to engage the tape with its lower end 48 by a pivoting action about the pin 50 so that the tape is gripped between the lower end of the pawl 35 and part of the mechanism frame 49 over which it passes in its passage in the feed direction.

Referring now to FIGS. 3 and 4, FIG. 3 shows a perforator mechanism—designed for punching 400 characters per second. The punching mechanism per se forms no part of the present invention.

In this particular embodiment two feed clamps 26 and 27 are provided, movement of the feed clamps in the feed direction to the left and the direction reverse to the feed direction to the right is accomplished by cam means co-operating with spring means as described for the first embodiment. A cam such as 30, via rollers such as 51, actuates feed clamp 26 in the feed and reverse directions, whilst a cam such as 31, via roller such as 52, actuates feed clamp 27 in the same directions. The feeding and reverse movements of one feed clamp are timed to take place alternately with those of the other clamp. Springs such as 55 disposed between feed clamps 26 and 27 serve the same purposes for both clamps as do springs such as 11 in the first described embodiment. Grippage of the tape by each feed clamp during movement in the feed direction and release of the tape by each feed clamp in the reverse directions is accomplished by a similar sort of cam means co-operating with spring means such as 57 and spring means such as 58—shown associated with feed clamp 27, and in a manner described for the first embodiment. Although for the purposes of illustration in FIG. 3, only one rocking arm 53 (equivalent to rocking arm 40 of the first embodiment) has been shown for feed clamp 27, a similar rocking arm is provided for feed clamp 26. Each rocking arm is actuated, when allowed, by a cam, not shown, co-operating with spring means such as 57 and 58 to enable its associated feed clamp to operate, via rockers such as 56, to grip the tape during movement of the feed clamp in the feed direction, and to release the tape during movement in the direction reverse to the feed direction. A relay such as 34 is provided for each feed clamp each with an interposer 54 to co-operate with its particular rocking arm such as 53 so as to maintain the rollers such as 28 out of engagement with their associated cams (not shown) when required.

Backward movement of the tape is prevented by the spring loaded pawl 35 in a manner described previously.

The feed clamps 26 and 27 are caused to operate to feed the tape alternately by sending alternate current pulses to the noted relays 34.

FIG. 4 shows the relative timing of the various cams in the apparatus.

Line A shows the timing of the punching cam which has uniformly accelerated and decelerated motion, the depth of penetration of the punch being one-third of the lift so that during a cycle of 2.5 ms. the punch is in the paper for 1 millisecond and clear of the paper for one and a half milliseconds. A time of one and a half milliseconds is available for feeding the tape.

Lines B and C in FIG. 4 show the timing of the two feed cams which operate alternately. Each cam has one and a half milliseconds lift and one millisecond dwell.

Lines D and E show the timing of the clamping of the paper tape. Each clamping cam has 1.5 ms. lift and 1 ms. dwell. Just above each of the lines D and E is shown the path of the tip of the relay armature end, and the rocker end. Above line D, for example, the paper is clamped during the interval marked *a*, the relay controlling the rocker commencing to operate at a time *t1* when a signal commences. The other relay commences to operate at time *t2* when a second signal commences. The first relay remains operated to overlap the operation of the second relay.

While the principles of the invention have been de-

scribed above in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention.

What I claim is:

1. A mechanism for feeding tape in a step-by-step manner comprising an elongated feed gripper having a pair of anvils at one end adapted to have limited relative movement into a tape gripping position or a tape releasing position, means for pivotally mounting the other end of said gripper to permit limited oscillating movement of said gripper, whereby said anvils are moved alternately in a tape feeding direction and in a direction reverse to said tape feeding direction, first spring means for urging said gripper towards one limit of its movement, first cam means for alternately moving said gripper towards the other limit of its movement, second spring means for urging said anvils into one of their positions, second cam means for causing said anvils to move towards the other of their positions, so as to grip the tape when said anvils are moving in a tape feeding direction and to release said tape when said anvils are moving in a direction reverse to said tape feeding direction, and electromagnetically controlled interposer means for inhibiting the action of said second cam means except when tape feeding is desired.

2. A mechanism, as defined in claim 1, further comprising a holding clamp adapted to have limited movement into tape holding and tape releasing positions, third spring means for causing said holding clamp to move towards one of its positions, and means operated by the second cam means to move said holding clamp against the action of said third spring means so as to cause said holding means to assume its tape holding position when the gripper is moving in a direction reverse to the feeding direction and to assume its tape releasing position when the gripper is moving in the feeding direction.

3. A mechanism, as claimed in claim 1 further comprising a spring operated retention pawl arranged to prevent said tape moving in a direction reverse to said feed direction.

4. A mechanism for feeding tape in a step-by-step manner comprising first and second elongated feed grippers arranged in succession in the path of the tape through the mechanism, each comprising a pair of anvils at one end adapted to have limited relative movement into a tape gripping position or a tape releasing position, means for pivotally mounting the other end of said gripper to permit limited oscillating movement of said gripper, whereby said anvils are moved alternately in a tape feeding direction and in a direction reverse to said tape feeding direction, first spring means for urging said gripper towards one limit of its movement, first cam means for alternately moving said gripper towards the other limit of its movement, second spring means for urging said anvils into one of their positions, second cam means for causing said anvils to move towards the other of their positions, so as to grip the tape when said anvils are moving in a tape feeding direction and to release said tape when said anvils are moving in a direction reverse to said tape feeding direction, and electromagnetically controlled interposer means for inhibiting the action of said second cam means except when tape feeding is desired, and means for operating the first and second cam means of each of said first and second grippers so that the grippers are moved alternately, one moving so that its anvils move in a feeding direction, while the other is moving so that its anvils move in a direction reverse to said feeding direction, said interposer means of said first and second grippers being so arranged that at the end of the feeding movement of each gripper, said gripper will remain open until the other girpper has gripped the tape.

5. A mechanism, as claimed in claim 4 which further comprises a spring operated retention pawl arranged to prevent said tape moving in a direction reverse to said feed direction.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 1,767,692 | Morin | June 24, 1930 |
| 1,825,821 | Rosenthal | Oct. 6, 1931 |
| 1,946,874 | Nicholas | Feb. 13, 1934 |
| 2,389,556 | Siegerist | Nov. 20, 1945 |

OTHER REFERENCES

| | | |
|---|---|---|
| 1,124,738 | France | July 2, 1956 |