Oct. 16, 1962 G. PÉREZ 3,058,362

TAPE FEED MECHANISMS

Original Filed Aug. 30, 1957

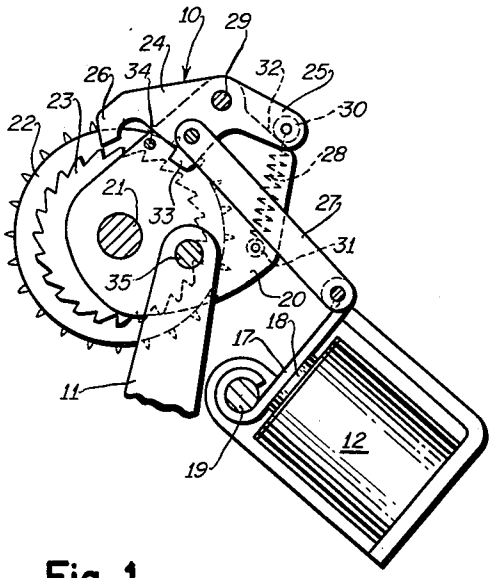

Fig_1

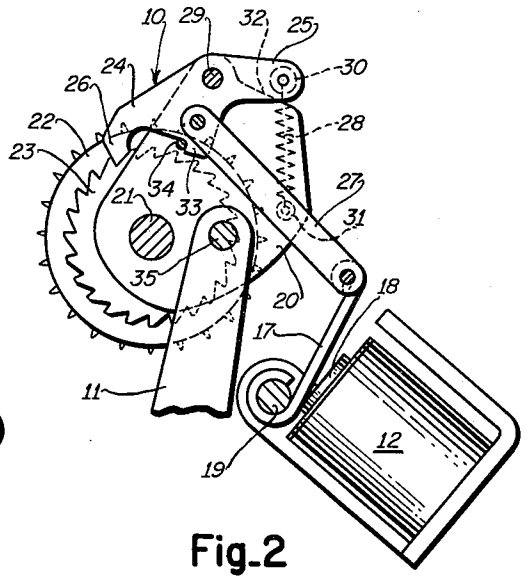

Fig_2

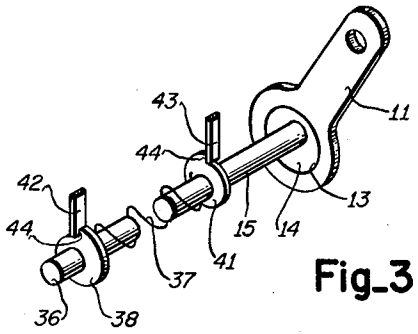

Fig_3

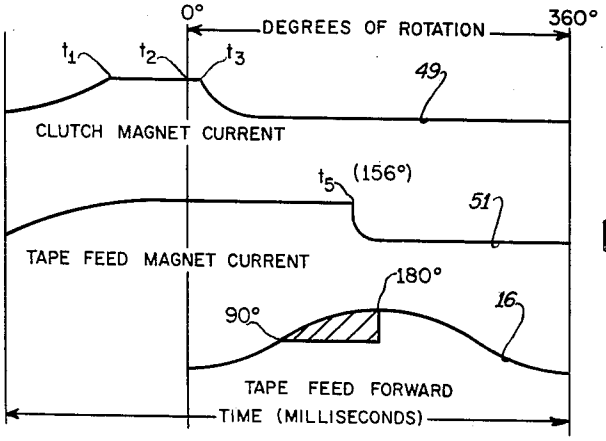

Fig_4

INVENTOR
GUILLERMO PÉREZ
BY Thomas S. Ross
Joseph R. Spalla
ATTORNEYS

United States Patent Office 3,058,362 Patented Oct. 16, 1962

3,058,362

TAPE FEED MECHANISMS

Guillermo Pérez, Bristol, Conn., assignor to Royal McBee Corporation, Port Chester, N.Y., a corporation of New York

Original application Aug. 30, 1957, Ser. No. 681,354, now Patent No. 2,997,231, dated Aug. 22, 1961. Divided and this application June 7, 1961, Ser. No. 115,369
3 Claims. (Cl. 74—142)

This application is a division of application Serial No. 681,354 filed August 30, 1957 and now Patent No. 2,997,231.

This invention relates to tape feed mechanism, and more particularly it relates to a tape feed mechanism having electromagnet means operative in conjunction with a drive member to couple tape indexing means to said drive member.

Heretofore electromagnetically operated tape feed mechanisms have employed electromagnets adapted when energized to mechanically drive pawl means into a ratchet wheel to effect an incremental movement of a drum to which the ratchet wheel is secured whereby a tape driven by the drum is incrementally fed relative to a punching or reading station. The employment of electromagnets to perform such a power function requires that they be of considerable size and power whereby force sufficient to overcome the inertia of and to move the masses of the elements involved can be generated. Also the speed of operation in systems so constituted is limited by the pull-in time of the electromagnet.

This invention embodies a novel construction of tape feed mechanism which permits an electromagnet of minimum size and power to be utilized thereby to realize a very rapid and efficient electromechanical coupling of a drive source with a tape indexing mechanism. Efficient use of electrical power is realized by utilizing the power of a cyclic drive source to close and open the air gap between the electromagnet armature and pole piece. In accordance with the invention the cyclic drive source is coupled to the electromagnet armature by a link connected between the armature and a pawl rotatably mounted on but normally biased against rotation relative to the drive source. The construction of the cyclic drive source and associated elements is such that when the drive source is at one limit of its cycle, at which time the armature is adjacent its pole piece, and the electromagnet is energized, the armature is restrained causing the pawl on the cyclic drive source to rotate and couple the drive source to a ratchet as the drive source moves toward the other limit of its cycle.

An object of the invention therefore is in the provision of a rapid and efficient tape feed mechanism.

Another object of the invention is to provide a tape feed mechanism wherein only the holding power of an electromagnet is utilized to couple a drive source to a tape indexing mechanism.

A still further object of the invention is in the provision of a high speed tape feed mechanism employing a pawl and ratchet construction wherein the pawl couples a cyclic drive to the ratchet and in combination with the drive moves the ratchet through an increment.

Another object of the invention is in the provision of a pawl and ratchet mechanism wherein the pawl is coupled to the ratchet mechanism by the action of a cyclic power source in conjunction with the holding power of an electromagnet.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof and wherein:

FIGURE 1 is a side view of a tape feed mechanism in accordance with the invention showing the position of the elements when the cyclic drive source is at one limit of its motion;

FIGURE 2 is a side view similar to FIGURE 1 showing the position of the elements when the cyclic drive source is at the other limit of its motion;

FIGURE 3 is a diagrammatic perspective view of the drive means; and

FIGURE 4 is a timing diagram explanatory of the operation of the tape feed mechanism.

Referring now to the drawings wherein an exemplary embodiment is illustrated there is shown in FIGURES 1 and 2 a tape feed mechanism generally designated by reference numeral **10** operable under control of a tape feed drive arm **11** and a tape feed electromagnet **12**. As seen in FIGURE 3 the tape feed drive arm has a circular cutout **13** in its lower end adapted to receive a circular cam **14** to which is eccentrically secured a shaft **15**. As the shaft **15** rotates through a 360° cycle the tape feed drive arm **11** is driven through an up and down motion as illustrated by curve **16** in FIGURE 4. The electromagnet **12** is provided with an armature **17** having one end pivotally mounted on the electromagnet frame as at **19** whereby the armature is movable toward and away from the pole piece **18** of the electromagnet. The tape feed mechanism comprises an actuator **20** rotatably mounted on the shaft **21** of a tape feed roll **22** which has a ratchet wheel **23** concentrically secured thereto. A pawl **24** is rotatably mounted intermediate its tail end **25** and its ratchet engaging end **26** to the actuator as at **29**. The pawl is also articulately coupled to the free end of armature **17** by a link **27**. A pawl biasing spring **28** is connected between a stud **30** on the tail end of the pawl and a cooperating stud **31** on the actuator whereby stud **30** abuts edge **32** of the actuator under the action of spring **28** and pawl **24** is properly positioned relative to the ratchet wheel and biased against rotation relative to the actuator. The pawl is also provided with a projection **33** on its lower edge which is adapted to cooperate with a fixed stop bar **34** suitably secured to a frame member (not shown). The actuator **20** is provided with a stud **35** whereby it is rotatably connected to the tape feed drive arm **11** which as heretofore stated is adapted to be driven through an up and down motion by the cam **14** and shaft **15**. As shown in FIGURE 1 the normal position of the elements is such that the armature is in zero air gap position.

Referring to FIGURE 3 the shaft **15** which powers drive arm **11** is adapted to be coupled to a continuously rotating drive shaft **36** by a wrap spring clutch which, as is well known to the art, comprises a helical coupling spring **37** wrapped concentrically about the drive **36** and driven shaft **15**. The ends of the spring **37** respectively are attached to a clutch control disk **38** rotatably mounted on shaft **36** and a clutch control disk **41** rotatably mounted on shaft **15**. The normal diametral dimension of the spring is such that shafts **36** and **15** will be coupled thereby, with rotation of the shaft **36** serving to tighten the grip of the spring. The spring is normally disengaged by relatively rotatively displacing the control disks **38** and **41** in a direction which will expand the spring. The spring is held in disengaged condition by a fixed and a rotatably mounted interponent **42** and **43** respectively which cooperate with steps **44** on the periphery of the disks **38** and **41** whereby relative rotation of the disks under the action of the radially expanded spring is prevented. Interponent **43** comprises the armature of a clutch electromagnet, the energization of which pulls interponent **43** out of engagement with its associated step

on disk **41** whereupon the spring wraps and couples the shafts **36** and **15**. As is understood in the art upon de-energization of the clutch electromagnet during a cycle interponent **43** will re-engage the step on control disk **41** after the shaft **15** completes a 360° revolution thereby to cause the spring to unwrap.

The operation of the tape feed mechanism will now be explained, reference being directed to FIGURES 1, 2 and 4; FIGURE 4 showing the times of energization and de-energization of the clutch and feed electromagnets related to angular degrees of rotation of shaft **15** and the tape feed drive arm motion over one cycle resulting from rotation of shaft **15**.

Energization of the tape feed and clutch electromagnets may be effected in response to signals periodically or aperiodically generated upon operation of a business machine. It is to be here noted that where signals are periodically generated at a constant rate the necessity for intermittently coupling shaft **15** to a continuously driven shaft **36** may be dispensed with and shaft **15** itself may be continuously driven; the tape feed signals being delivered to the electromagnet **12** in synchronism with the motion of the now continuously rotating shaft **15**.

As is apparent from FIGURE 4 the energization of the clutch electromagnet at time t_0 results in a current (curve **49**) therethrough which is sufficiently built up to pull its armature i.e. interponent **43** from engagement with the clutch control disk **41** at time t_1 thereby permitting the spring to wrap and couple shafts **36** and **15** whereby a cycle of the latter is started at time t_2. After a cycle has started the clutch electromagnet may be de-energized whereby the drive and driven shafts **36** and **15** respectively will be uncoupled at the end of a 360° cycle. Since the tape feed electromagnet **12** is already energized at time t_2, as illustrated by current curve **51**, upon upward movement of the tape feed drive arm **11** and rotation of the actuator **20** counterclockwise, the pawl, rotatably mounted on the actuator **20** and linked to the armature **17** is restrained by the energized electromagnet, and rotates relative to the actuator **20** under the action of the drive arm **11**. When the drive arm **11** reaches a position corresponding to 90° rotation of shaft **15** the pawl will have rotated into engagement with the ratchet **23**. Continued rotation of shaft **15** to 180° moves the drive arm **11** further in the up direction as shown by curve **16** thereby continuing the counterclockwise rotation of the actuator, causing the pawl **24** to lock with and rotate the ratchet **23** one tooth. As is apparent, after the pawl locks with the ratchet, and while the pawl is rotating the ratchet, no further relative movement of the pawl and actuator can occur thereby permitting, during the 90–180° feed interval, the forcible withdrawal of the armature **17** away from the pole piece **18**, until the electromagnet **12** is de-energized; the latter occurring when the drive arm reaches a position corresponding to 156° as shown by curve **51**. After 180° rotation of shaft **15** the actuator **20** begins a clockwise rotation due to the downward motion of arm **11**. During the 180° to 360° interval the pawl **24** is therefore disengaged from the ratchet and returned to normal. As is apparent from FIGURE 2 which shows the 180° position of shaft **15** overtravel of the ratchet **23** due to its inertia is prevented by stop bar **34** which, when engaged by the pawl projection **33**, acts to increase the pressure of the pawl tooth **26** on the ratchet **23**.

It should be understood that the foregoing disclosure relates to only a preferred embodiment of the invention and that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purposes of the disclosure which do not constitute departures from the spirit and scope of the invention.

The invention claimed is:

1. Ratchet indexing mechanism comprising drive means, means oscillating said drive means between predetermined limits of motion, a pawl rotatably mounted on said drive means, means normally biasing said pawl against rotation relative to said drive means, control means operative at one limit of motion of said drive means to effect the rotation of said pawl relative to said drive means as said drive means oscillates toward its other limit of motion, and ratchet means engageable with and driven by said rotated pawl.

2. A tape feed mechanism comprising a feed roll, a ratchet concentrically mounted for movement with said roll, cyclically operable means rotatably mounted on the shaft of said feed roll, a pawl rotatably mounted on said cyclically operable means, means normally biasing said pawl against rotation relative to said cyclically operable means, an electromagnet and associated armature, link means for coupling said pawl and armature, and means for driving said cyclically operable means between predetermined limits, said electromagnet being adapted to be energized at the beginning of a cycle of said cyclically operable means whereby as a cycle progresses said pawl is restrained by said armature and caused to rotate relative to said cyclically operable means into driving engagement with said ratchet.

3. A tape feed mechanism comprising a feed roll, a ratchet concentrically mounted for movement with said feed roll, cyclically operable means rotatably mounted on the shaft of said feed roll, a pawl rotatably mounted on said cyclically operable means, means normally biasing said pawl against rotation relative to said cyclically operable means, control means operative at one limit of motion of said cyclically operable means to effect rotation of said pawl relative to said cyclically operable means as said cyclically operable means moves toward its other limit of motion, ratchet means engageable with and driven by said rotated pawl, and means operative in association with said pawl for preventing inertial overtravel of said ratchet and feed roll.

No references cited.