

Aug. 3, 1965

F. JONES ETAL
 ROTARY WEB PRINTING MACHINE WITH PHOTO-ELECTRIC
 CONTROLLED FEEDING MEANS

3,198,114

Filed May 27, 1963

3 Sheets-Sheet 1

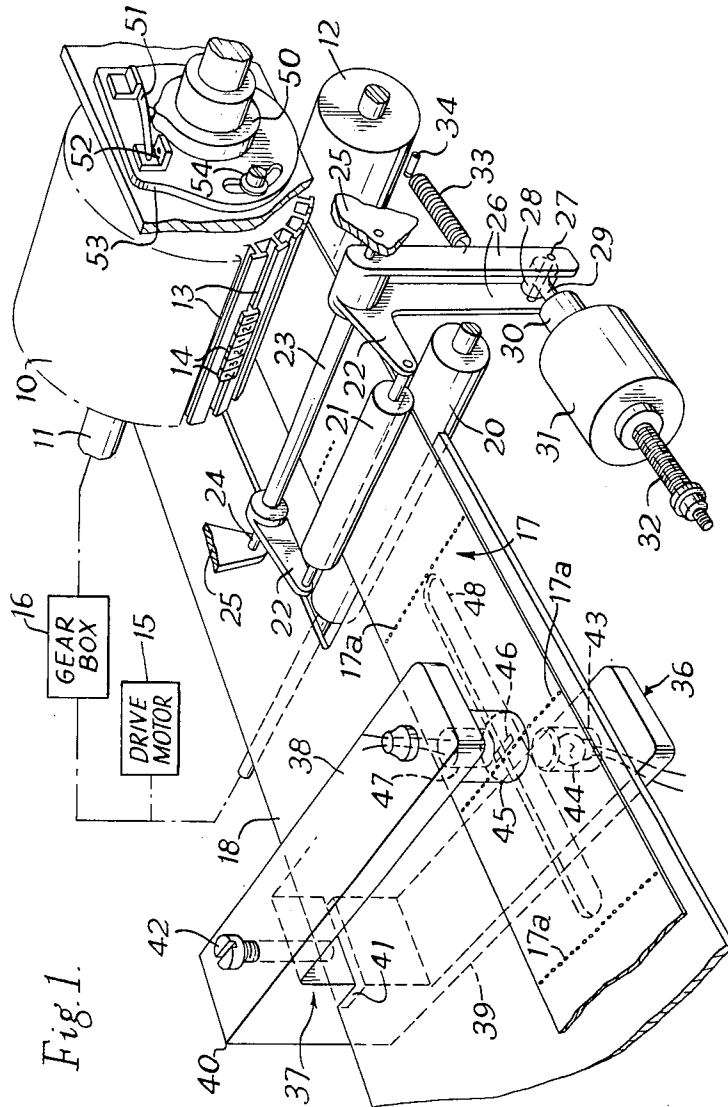


Fig. 1.

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3 Sheets-Sheet 2

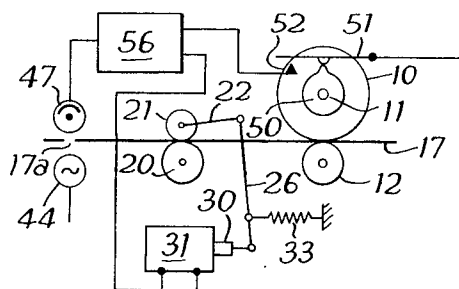


Fig. 2.

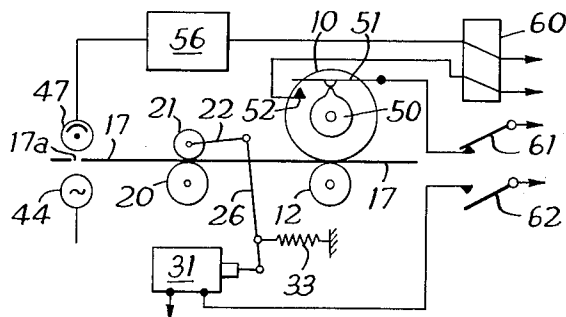


Fig. 3.

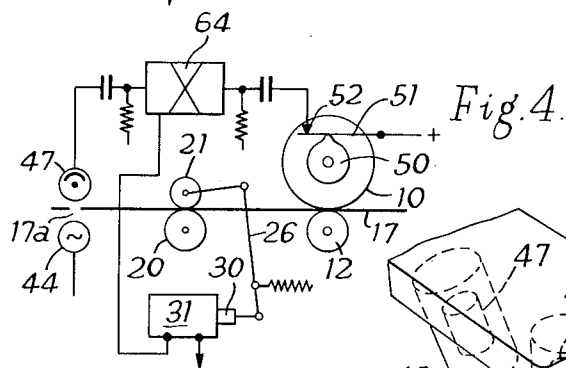
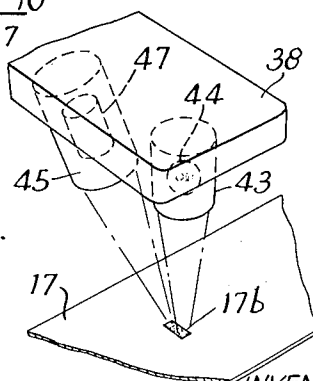


Fig. 4.

Fig. 5.



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5 F. JONES ETAL 3.
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3 Sheets-Sheet 3

CONTROLLED FEEDING MEANS

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ROTARY WEB PRINTING MACHINE WITH PHOTO-ELECTRIC CONTROLLED FEEDING MEANS

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17 Claims. (Cl. 101-228)

This invention relates to ticket and like printing machines adapted to effect a printing operation on each of a series of discrete printing areas arranged in serial strip form, for example, a perforated ticket strip. The invention is more particularly concerned with improved electronic arrangements for controlling the feed movement of the strip printing material so as to ensure accurate registration and positioning of the printed image within each discrete printing area to which it is applied.

A ticket or like printing machine in accordance with the invention comprises a rotatable drum carrying the printing image and a co-operating counterpressure member, intermittently operable feeding means for moving the strip-form element forwardly through the printing zone between said drum and said counterpressure member and electrically operated control means for controlling the strip feed movement imparted by said feeding means, said control means including photo-electric means for sensing a marking on said strip form element identifying each discrete printing area and providing an output signal which is arranged to cause cessation of the strip feed movement and further contact means controlled by said printing drum and arranged to cause re-commencement of the strip feed movement.

In order that the nature of the invention may be more readily understood embodiments thereof will now be described by way of illustrative example and with reference to the accompanying drawings wherein like reference characters indicate like parts and in which:

FIGURE 1 is a perspective and partly schematic view of one practical arrangement according to the invention.

FIGURE 2 is a schematic circuit diagram of the arrangements of FIG. 1.

FIGURE 3 is a schematic diagram illustrating an alternative control system.

FIGURE 4 is a schematic diagram of another modified control arrangement.

FIGURE 5 is a schematic perspective of an alternative form of photoelectric sensing system, and

FIGURE 6 is a fragmentary perspective view similar to a part of FIG. 1, showing a modified strip drive arrangement.

Referring first to the embodiment shown in FIGS. 1 and 2, which is a ticket printing machine for applying a chosen printed image to each of a series of tickets which, at the time of printing, are in the form of a continuous strip transversely perforated at intervals for subsequent separation into individual tickets. In the drawing 10 indicates a printing member in the form of a drum secured to a shaft 11 which is journaled in fixed position bearings, not shown, immediately above a counter-pressure roller 12 which is preferably journaled in bearings, also not shown, which can be adjusted in position towards and away from the printing drum 10 in order to effect accurate control of the printing pressure in already well known manner. The drum 10 has the usual form including a series of axially directed and circumferentially spaced type-receiving channels 13 into which various chosen type characters 14 can be fitted in order to set up the required printing image form. The shaft 11 and drum 10 are arranged to be continuously rotated at a chosen

operating speed as by means of a drive motor indicated schematically at 15 and coupled to the shaft 11 through suitable gear box or other speed reducing means indicated schematically at 16.

The strip form ticket material shown at 17, with its transverse rows of perforations 17a, is fed in an intermittent manner through the printing zone between the drum 10 and the counterpressure roller 12 over a horizontal feed table 18.

Means for feeding the ticket strip 17 comprise a horizontal friction feed roller 20 suitably journaled in machine frame parts, not shown, so that its uppermost peripheral region lies substantially in the same plane as the upper surface of the feed table 18. This roller 20 is also arranged to be continuously driven from the drive motor 15, preferably at a peripheral speed equal to that of the type-face surfaces of the characters 14 carried on the drum 10. Immediately above the roller 20 is disposed a parallel pressure applying roller 21 journaled at each end in the free ends of two spaced lever arms 22 each of which is secured at its opposite end to a tubular pivot shaft 23 which is itself freely rotatable about a horizontal spindle 24 mounted at each end on fixed frame parts as shown at 25. At one end of the roller 21 the lever arm 22 is made integral with a pair of dependent parallel arms 26 between the lower ends of which is disposed a transverse cross pin 27 forming a pivotal connection with a boss 28 at one end of a rod 29 which is rigidly secured at its opposite end to the reciprocating plunger 30 of an electromagnetic solenoid 31 held in fixed position on the machine framework by means not shown. The solenoid may include adjustable bias spring means 32 for controlling its plunger while a tension spring 33 connected between one of the dependent arms 26 and a fixed position pin 34 operates to rotate the lever arm system 22, 23, 26 whereby the pressure applying roller 21 is normally urged downwardly towards the feed roller 20 so as to press the ticket strip 17, positioned between the two rollers, into contact with the continuously driven feed roller and thereby to cause forward movement of the ticket strip towards the drum 10. Upon energisation of the solenoid 31, however, the lever system is rocked against the action of the spring 33 to separate the roller 21 from the roller 20 whereby no forward movement is then imparted to the ticket strip.

The means for controlling the energisation of the solenoid 31 include photoelectric sensing means indicated generally at 36 and which comprise a U-shaped support frame 37 having two parallel arms 38 and 39 disposed respectively above and below the feed table 18. The junction limb 40 between the arms is conveniently slotted as shown at 41 to accommodate the thickness of the table plate 18 while a clamping screw 42 permits the photoelectric sensing means 36 as a whole to be adjusted in the direction of feed movement of the ticket strip 17 and then secured at the desired location.

On the upper side of the lower arm 39 is mounted a lamp housing 43 containing a light source in the form of a small electric lamp 44 and, if desired, associated optical means such as a condenser lens, while on the underside of the upper arm 38 and in axial alignment with the lamp housing 43 is secured a housing 45 whose lower end wall is in the form of a mask plate provided with a narrow rectangular slot 46 having its length dimension parallel with the transverse direction of the ticket strip. Within the housing 45 is located photo-sensitive means 47, for instance, a photo-cell or similar device such as a photo-transistor. The table plate 18 is provided with an elongated slot 48 disposed to lie parallel with the longitudinal or feed direction of the ticket strip 17 and in alignment with the common axes of the two

housings 43, 45 in order to allow the passage of light from the lamp 44 through the perforations 17a of the ticket strip to the photo-sensitive means 47.

The solenoid control means include a came disc 50 secured on the shaft 11 of the printing drum 10 and having a projection arranged, once in each revolution of the drum 10, to separate a switch contact on a switch blade 51 from a stationary contact 52 upon which it normally rests. The contacts 51, 52 are both mounted, in suitable insulated manner upon a plate 53 which is capable of a limited amount of angular adjustment movement about the axis of the shaft 11 to permit precise control of the particular position in each revolution of the drum at which switch operation takes place. Clamping screws, as shown at 54, permit securing of the switch plate in its chosen position.

Referring now to FIG. 2, the output from the photo-cell 47 is applied to the input terminals of an amplifier 56 whose output terminals are connected to the solenoid through the normally-closed contacts 51, 52 controlled by the cam disc 50 on the shaft 11.

In the operation of the arrangement described, if the solenoid 31 is not energised, the roller 21 is pressed downwardly onto the feed roller 20 and in consequence the ticket strip material 17 is fed forwardly into the printing zone between the printing drum 10 and the counter-pressure roller 12. It will be understood that, except when the inserted type characters 14 are passing through the printing zone, there is no gripping contact between the strip 17 and the opposing drum 10 and roller 12. This feed movement continues until a row of transverse perforations 17a of the strip 17 arrive at a position coincident with the optical axis of the photoelectric sensing means 36 whereupon light from the lamp 44 passes through certain of the perforations and the mask slit 46 to illuminate the photo-cell 47 which then provides an increased output voltage. This voltage is applied to the input of the amplifier 56 whose increased output current is then applied through the now-closed contacts 51, 52 to cause energisation of the solenoid 31 with consequent raising of the pressure roller 21 and the prompt cessation of any further feed movement of the ticket strip 17. In the meantime, the drum 10 is rotating constantly and at a chosen predetermined point of its revolution, usually just as the first row of type characters 14 are about to contact the underlying ticket material 17, the cam 50 causes opening of the contacts 51, 52 with consequent de-energisation of the solenoid 31. The solenoid is accordingly released to cause the roller 21 again to be applied to the ticket material 17 to recommence forward feed movement thereof. Such forward feed movement removes the row of perforations 17a from their previous alignment with the optical axis of the photoelectric sensing means 36 so that the previous output from the amplifier 56 ceases and the solenoid 31 is not re-energised until the arrival of the next following row of perforations 17a causes a repetition of the operation cycle. The position of arrest of the ticket strip at each operation in order to await the instant of release set by the closure of the contacts 51, 52 is adjustable by movement of the sensing means 36 bodily along the feed table 18. The forward feed movement of the ticket strip continues regardless of whether the type characters 14 on the drum 10 themselves effect any feed motion of the ticket strip and in consequence it is unnecessary to provide the conventional arcuate or other feed means on the printing drum as used hitherto in order to ensure continued feed movement of the strip by an amount substantially equal to that of each ticket. The conventional positioning means to locate the strip accurately after each feed movement are also rendered unnecessary.

Various modifications may clearly be made. For example, the drum controlled contacts 51, 52 may be arranged to short-circuit the solenoid 31 instead of opening its energisation circuit or to apply a blocking bias to the amplifier 56. Another alternative is shown in

FIG. 3 where the photoelectric sensing means 36 and the associated amplifier 56 are arranged, as by the inclusion of a differentiating network in the amplifier input circuit, to provide only a transient output pulse at each arrival of a row of perforations 17a at the sensing means 36. This output pulse is applied to one winding of a double-wound relay 60 whose other winding is included in a lock-in circuit through contacts 61 of the same relay. This lock-in circuit includes the contacts 51, 52 controlled by the drum 10, such contacts being normally closed and opened by the cam 50 at the appropriate instant in each operation cycle. Further contacts 62 of the relay control energisation of the solenoid 31. With this arrangement, the arrival of the perforations 17a at the sensing system causes momentary energisation of the relay 60 by the amplifier 56; the relay locks-in and closes contacts 62 to energise the solenoid 31. At the appropriate instant drum contacts 51, 52 open the lock-in circuit to release the relay 60 whereupon contacts 62 also open to de-energise the solenoid and allow renewed feed movement of the strip 17.

The strip feed arrangements may be reversed so that the solenoid 31 is energised in order to hold the pressure applying roller 21 in contact with the ticket material 17 and the underlying feed roller 20, a cessation of the ticket drive being effected by de-energising such solenoid thereby allowing separation of the rollers 20, 21 by biasing spring means.

Another alternative arrangement is illustrated in FIG. 4. This modification is particularly suitable for dealing with the problem of possible overshoot of the ticket material 17, due to inertia, beyond each position where its perforations 17a are in alignment with the optical axis of the sensing means 36. In this modification a pulse form output derived from the photo-cell 47 at each passage of the perforations 17a through the sensing means 36 is applied as a trigger pulse to one trigger input terminal of a bistable trigger circuit 64, for instance, a conventional Eccles-Jordan circuit or an equivalent transistor circuit. The opposite or reset trigger terminal of such circuit is arranged to be provided with short pulses derived from the momentary closure of the contacts 51, 52 controlled by the drum 10. One of the two alternative trigger circuit outputs, that which is energised when the circuit is set, is supplied to energise the solenoid 31 either directly or through suitable relay means. The operation of this arrangement is substantially similar to that already described, the pulse developed in the photo-sensing system by the passage of a row of perforations between the light source and photo-cell cause generation of a pulse which sets the trigger circuit to the state at which its output energizes the solenoid 31 thereby feed movement of the strip is suspended until the following pulse provided at the drum contacts serves to reset the trigger circuit to its opposite state whereupon the solenoid is de-energised and feed movement of the strip recommenced.

Instead of employing the transverse row of ticket perforations as the identifying mark to be sensed by the photo-sensing unit, the photo-sensing means may be arranged to co-operate with an edge notch provided in the ticket or other printing strip at each defined printing area or, in another alternative, with a preprinted marking made on the face or on the underside of the strip material at a predetermined position relative to each of the successive defined printing areas. The sensing of this marking is then effected by light reflective methods such as shown in FIG. 5 where the light source 44 and the photo-cell 47 are both located on the same side of the ticket or other strip and are operative upon non-reflective markings 17b on the strip 17.

FIG. 6 shows an alternative arrangement for effecting the necessary controlled intermittent feeding of the ticket strip material. In this arrangement an upper feed member 65, conveniently in the form of several short, axially spaced apart friction rollers 66, is secured to a spindle

5

67 journaled in fixed position bearings, not shown, while the lower feed member 68, also in the form of a group of short spaced-apart rollers 69 aligned with the rollers 66, is secured to a spindle 70 supported at each end in slidable or pivotal bearing blocks 71 which are continuously urged by spring means 72 towards the upper roller member whereby the ticket strip 17 is always gripped between the two members.

A pair of intermeshing gearwheels 73, 74 secured respectively to the spindles 67, 70 ensure that the roller members revolve in unison. A sleeve 75 on one end of the upper spindle 67 carries a pinion 76 at one end in continuous engagement with a gear wheel 77 driven continuously by the drive motor 15 (FIG. 1). This sleeve extends through the stationary operating coil 78 of an electromagnetic clutch 79 of which one armature disc 80 is secured to the opposite end of the sleeve 75 and the other armature disc 81 to the spindle 67. When the clutch is energised the discs 80, 81 are effectively locked together and drive motion is transmitted from the gear wheel 77 to the upper spindle 67 and through gearwheels 73, 74 to the lower spindle 70.

At the opposite end of the spindle 67 is located an electromagnetic brake 82 comprising a stationary operating coil 83 and an associated fixed armature disc 84 adjacent which is disposed a second armature disc 85 secured to the spindle 67. The clutch 79 and brake 82 are arranged to be energised alternately, that is to say, when the sensing means 36 is detecting a perforation or marking on the ticket strip 17, the clutch is de-energised and the brake energised whereby both feed members 65, 68 are held stationary and the ticket strip arrested. When the switch contacts 51, 52 (FIG. 1) are operated by rotation of the drum 10, the brake is de-energised and the clutch engaged to transmit drive movement to the two feed members 65, 68 and the intervening ticket strip 17 from the motor driven gearwheel 77.

Control of the clutch and brake energisation is conveniently effected by an arrangement resembling that already described in connection with FIG. 4. A trigger type circuit 64 including alternately conductive transistors controlling the current supply to the respective coils 78 and 83, is switched from one state to the other and back again by pulses derived respectively from the sensing means 36 and the drum-controlled switch contacts 51, 52.

I claim:

1. A ticket or like printing machine for effecting a printing impression on each of a series of discrete printing areas of a strip-form element which is provided with a series of spaced markings thereon, each marking defining a different successive one of said printing areas, which machine comprises a rotatable drum carrying a projecting printing image extending over a part only of the circumference of said drum, a counterpressure member co-operating with said rotatable drum to form a printing zone to impress said printing image in said strip-form element, intermittently operable strip feeding means for moving said strip-form element forwardly through said printing zone and control means for controlling the operation of said strip feeding means to start and stop the strip feeding movement imparted thereby, said control means including photo-electric means for sensing one of said markings in said strip-form element to provide an output control signal, electrically operated means coupled to said strip-feeding means and supplied with said control signal to cause cessation of feeding movement of said strip-form element by said strip feeding means at a position where the next discrete printing area is in correct positional relationship to the printing image in said drum, said control means further including contact means coupled to and operated by the rotation of said drum and also connected to said electrically operated means to cause re-commencement of strip feeding movement by said strip feeding means at least by the time when the leading edge of said printing image arrives at said printing zone.

6

2. A ticket or like printing machine in accordance with claim 1 in which said intermittently operable strip feeding means comprises a friction feed roller disposed transverse to and on one side of the strip-form element, said friction feed roller being arranged for continuous rotation, and a pressure-applying roller parallel with said friction feed roller and disposed on the opposite side of said strip-form element, said pressure applying roller being movable towards and away from said friction feed roller by said electrically operated means to cause such strip-form element to be engaged with and moved by or released from engagement with said friction feed roller.

3. A ticket or like printing machine in accordance with claim 2 in which said pressure-applying roller is carried in a rockable support framework.

4. A ticket or like printing machine in accordance with claim 3 in which said pressure-applying roller is normally spring urged into the position where said strip-form element is moved by said friction feed roller.

5. A ticket or like printing machine in accordance with claim 4 in which said electrically operated means comprises electromagnetic means for controlling the movement of said pressure-applying roller.

6. A ticket or like printing machine in accordance with claim 1 in which said intermittently operable strip feeding means comprises a pair of parallel friction feed roller members adapted to receive and grip the strip form printing element therebetween, electromagnetic braking means coupled to said feed members, and in which said electrically operated means comprises electromagnetic clutch means coupled between said feed members and a continuously rotating drive power source and means operated by said control signal and said contact means for energising said brake and clutch alternately.

7. A ticket or like printing machine according to claim 6 in which said pair of friction feed roller members are interconnected by gearing to rotate in unison.

8. A ticket or like printing machine in accordance with claim 1 in which said drum-controlled contact means comprises a rotatable cam coupled to said drum and stationary make/break switch contacts controlled by said cam.

9. A ticket or like printing machine in accordance with claim 8 in which said stationary contacts are adjustable angularly about the axis of rotation of said cam.

10. A ticket or like printing machine in accordance with claim 1 in which said photoelectric means comprise a light source and a photoelectric device mounted upon a common support which is adjustable in position along a path parallel with the length of the strip-form element.

11. A ticket or like printing machine in accordance with claim 10 for use with strip-form element provided with transverse rows of perforations to define the successive discrete printing areas in which said support includes a part carrying said light source on one side of the strip-form element and an interconnected further part on the other side of such strip-form element carrying said photoelectric device at a position in alignment with said light source.

12. A ticket or like printing machine in accordance with claim 11 in which a mask having a narrow slit therein disposed transverse to the direction of feed movement of the strip-form element is interposed between said light source and said photoelectric device.

13. A ticket or like printing machine in accordance with claim 5 in which the output from said photoelectric means is applied to the input of an amplifier and the output from such amplifier is supplied said electromagnetic means.

14. A ticket or like printing machine according to claim 1 in which said control means includes a bistable trigger circuit having an output connected to said electrically operated means to control the strip feed movement and in which said trigger circuit has a first input connected to said photoelectric means to be set into one condition by

pulses derived from said photoelectric means and a second input connected to said contact means to be set into its opposite condition by pulses derived from said contact means.

15. A ticket printing machine for effecting a printing impression on each of a series of discrete printing areas of a perforated ticket strip, said machine comprising a fixed framework, a printing drum rotatable in said framework and provided with a plurality of type-receiving channels around a part of its periphery, a cooperating pressure roller rotatable about an axis parallel to said drum, a stationary feed table defining a strip feed path leading to the printing zone between said printing drum and said pressure roller, a strip feed roller disposed below said feed path of said ticket strip at a position between said feed table and said printing zone, said feed roller being mounted in said framework for rotation about a fixed position axis, drive means for constantly rotating said feed roller in unison with said printing drum, a pressure applying roller disposed above said feed path of said ticket strip and immediately adjacent said feed roller in arms of a rockable lever system pivotally mounted in said fixed framework, spring means urging said lever system to a position where said pressure applying roller is in contact with said ticket strip to cause the latter to engage and be driven by said feed roller, electromagnetic means coupled to said rockable lever system to cause said pressure applying roller to be raised from contact with said ticket strip when said electromagnetic means is energised, an elongated slot in said feed table underlying said ticket strip feed path and disposed parallel with the direction of feed movement, a U-shaped support frame adjustably secured to said feed table for movement parallel to said slot, said support frame having upper and lower arms extending across said ticket strip feed path and parallel with said feed table, photoelectric sensing means and an energising light source therefor mounted respectively upon one and the other of the opposing faces of said support frame arms at a position to be operative through said slot in said feed table, a cam disc arranged for rotation with said printing drum, contact means operated by said cam disc and adjustably secured on said fixed framework and electric control circuit means for causing energisation of said electromagnetic means by light from said light source passing to said photo-sensing means through perforations in said ticket strip to raise said pressure applying roller and thereby to arrest said ticket strip with the discrete area thereof next in order to be printed in a correct positional relationship to the position of type mounted in said channels of said printing drum and whereby said cam operated contact means causes de-energisation of said electromagnetic means to lower said pressure applying roller and re-commence feeding movement of said ticket strip at least by the time of arrival in said printing zone of a first operative type element mounted in said channels of said drum.

16. A ticket printing machine for effecting a printing impression on each of a series of discrete printing areas of a perforated ticket strip, said machine comprising a fixed framework, a printing drum rotatable in said framework, said drum being provided with a plurality of parallel axially directed type-receiving channels around a part only of its periphery, a cooperating pressure roller mounted in said framework for rotation about an axis parallel to said drum, a horizontal stationary feed table defining a strip feed path leading to the printing zone between said printing drum and said pressure roller, a strip feed roller disposed transverse to and on one side of said ticket strip feed path at a position between said feed table and said printing zone, said feed roller being mounted in said framework for rotation about a fixed position axis, power drive means for constantly rotating said feed roller in unison with said printing drum at a common peripheral speed, a pressure applying roller

disposed on the side of said ticket strip feed path opposite that of said feed roller and immediately adjacent and parallel with said feed roller in a rockable lever system pivotally mounted in said fixed framework, spring means urging said lever system towards the position where said pressure applying roller is in contact with said ticket strip and causes the latter to engage and be driven by said feed roller, an electromagnetic solenoid coupled to said rockable lever system to cause said pressure applying roller to be raised from contact with said ticket strip when said electromagnetic solenoid is energised, an elongated slot in said feed table underlying said ticket strip feed path and disposed parallel with the direction of strip feed movement, a sensing means support frame adjustably secured to said feed table for movement parallel with said slot, said support frame including upper and lower arms extending across said feed table on opposite sides of said strip feed path, photoelectric sensing means and an energising light source therefor mounted respectively upon one and the other of the said support frame arms at a position to be operative through said slot in said feed table, a cam disc secured for rotation with said printing drum, contact means operated by said cam disc and adjustably secured on said fixed framework and electric control circuit means for causing energisation of said solenoid by light from said light source passing to said photo-sensing means through perforations in said ticket strip to raise said pressure applying roller and thereby to arrest said ticket strip with the discrete area thereof next in order to be printed upon in a correct positional relationship to the position of type mounted in said channels of said printing drum and whereby said cam operated contact means causes de-energisation of said solenoid to lower said pressure applying roller and re-commence feeding movement of said ticket strip before the arrival in said printing zone of a first operative type element mounted in said channels of said drum.

17. A ticket printing machine for effecting a printing impression on each of the series of ticket forming parts of a perforated ticket strip, said machine comprising a fixed framework, a printing drum rotatable in said framework and provided with a plurality of type-receiving channels around a part only of its periphery, a cooperating pressure roller rotatable in said fixed framework about an axis parallel to said drum, a stationary feed table defining a strip feed path leading to the printing zone between said printing drum and said pressure roller, a first transverse spindle disposed on one side of said ticket strip feed path, a second transverse spindle disposed on the opposite side of said ticket strip feed path and in alignment with said first spindle, ticket drive rollers on each of said spindles positioned to grip said ticket strip therebetween, gear means interconnecting said spindles for causing rotation thereof in unison, electromagnetic clutch means having a driven element thereof interconnected with said first spindle and a driving element thereof connected to drive means for said printing drum, electromagnetic brake means having one element rigidly secured to said framework and the other element thereof connected to said first spindle, an elongated slot in said feed table underlying said ticket strip feed path and disposed parallel with the direction of feeding movement, a U-shaped support frame adjustably secured to said feed table, said support frame having upper and lower arms extending across and parallel with said feed table, photoelectric sensing means and an energising light source therefor mounted respectively upon one and the other of the opposing faces of said U-shaped arms at a position to be operative through said slot in said feed table, a cam disc secured for rotation with said printing drum, contact means operated by said cam disc and adjustably secured said fixed framework and electric control circuit means for causing said electromagnetic brake means to be energised and said electromagnetic clutch means to be de-energised by the passage of light from

said light source to said photo-sensing means through perforations in said ticket strip and for causing said electromagnetic brake means to be de-energised and said electromagnetic clutch means to be energised to cause movement of said ticket strip towards said printing zone by operation of said contact means at an instant immediately prior to the arrival at said printing zone of a first set of type elements mounted in said printing drum.

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10 ROBERT E. PULFREY, *Primary Examiner*.
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