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(12) # EUROPEAN PATENT APPLICATION

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(71) Applicant: **MARKEM SYSTEMS LIMITED**
Ladywell Trading Estate Eccles New Road
Salford M5 2DA Lancashire(GB)

(72) Inventor: **Diggle, Steven John**
91 Bankhouse Road
Bury Lancashire(GB)

(74) Representative: **Massey, Alexander et al,**
MARKS & CLERK Scottish Life House Bridge Street
Manchester, M3 3DP(GB)

(54) **Improvements in or relating to printing apparatus.**

(57) A label printing machine comprises a label stock supply station, a printed label stock collection station spaced from the supply station, a first printing mechanism for printing background label information onto the label stock, a second printing mechanism for printing variable label information onto the label stock, the first and second printing mechanisms being spatially disposed along the label stock flow path between the supply and collection stations, and a microprocessor linked to the second printing mechanism for inputting selected information into said printing mechanism. An indexing mechanism is provided to index the label stock between the supply and collection stations in predetermined but variable steps between dwells during which printing is effected, and comprises a nip through which the label stock passes and defined by a pressure roller and an indexing roller driven by a stepping motor linked to and controlled by the microprocessor.

EP 0 134 719 A2

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IMPROVEMENTS IN OR RELATING TO PRINTING APPARATUS

This invention relates to printing apparatus used especially but not exclusively for printing labels and packaging material. For convenience, reference will hereinafter and in the claims be made solely to label printing but it is to be clearly understood that such reference is non-limitive.

It is an object of the present invention to provide a label printing apparatus which is more versatile than such existing apparatus.

According to the present invention there is provided a label printing machine comprising a label stock supply station, a printed label stock collection station spaced from the supply station, a first printing mechanism for printing background label information onto the label stock, a second printing mechanism for printing variable label information onto the label stock, the first and second printing mechanisms being spatially disposed along the label stock flow path between the supply and collection stations, and a microprocessor linked to the second printing mechanism for inputting selected information into said printing mechanism.

Preferably the printing machine comprises an indexing mechanism for indexing the label stock

in predetermined but variable steps between dwells during which printing is effected, the indexing mechanism comprising a nip through which the label stock passes and defined by a pressure roller and an indexing roller driven by a stepping motor linked to and controlled by the microprocessor.

Preferably the first printing mechanism comprises a printing head actuated by a ram operated by a one-revolution clutch via a crank, the clutch being controlled by a solenoid-operated spring-loaded brake lever with the solenoid operation being controlled by the microprocessor.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which :-

Fig. 1 is a diagrammatic perspective view of a label producing machine according to the invention;

Fig. 2 is a diagrammatic perspective view of the mechanical drive system of the machine;

Fig. 3 is a block diagram of the electronic/electrical control system of the machine;

Fig. 4 is a perspective view of the variable-information input printer and its mounting arrangement on the machine;

Figs. 5 and 6 are respectively fragmentary end and side views of the indexing mechanism of the machine;

Figs. 7 and 8 are respectively fragmentary front and plan views of a one-revolution clutch arrangement used in the control of the background printing ram and the cutting ram;

Figs. 9 and 10 are respectively front and plan views of the label stock supply or feed-off arrangement; and

Figs. 11 and 12 are plan views of two examples of labels produced by the machine having the same background printing but different variable information printed thereon.

The label printing machine comprises a keyboard-controlled microprocessor 20, a label stock supply or feed-off station 21, a microprocessor-controlled, variable information printing station 22, a background printing station 23 at which label stock LS and printing foil PF from a printing foil supply station 24 merge, a laminate supply station 25 (including a laminate backing collection device 26)

from which laminate film LF is delivered to the printed label stock LS to be applied to and to flow with the label stock LS, a die-cutting station 27 for cutting the laminate film LF to define label areas, a label stock indexing station 28, a laminate waste collection station 29 and a label stock (printed, laminated and cut) collection station 30.

The label stock supply or feed-off station 21 (Figs. 1, 9 and 10) comprises a drive shaft 31 onto which is detachably secured a supply reel 32 of label stock LS, the drive shaft 31 is continuously driven but the transmission of drive to the supply reel 32 is controlled by a brake 33 and a clutch 34 which are alternately operable by the micro-processor 20. A dancer or kicker roller 35 carried by a pivoted arm 36 is disposed downstream of the supply reel 32, in terms of label stock flow through the machine, which arm 36 is secured to a rotatable shaft 37 mounting a pair of cams 38 adapted, on shaft rotation, to operate a pair of over-ride microswitches 39 which control the brake 33 and clutch 34 in case of microprocessor malfunction.

The shaft 37 has fast thereon a bar 40 to which is secured a flexible element 41 which passes round a fixed guide 42 and is connected, in turn, to a spring 43 anchored to the machine frame 44, the spring 43 loading the arm 36 and consequently the kicker roller 35 to a position adjacent the supply reel 32.

The label stock LS extends from the supply reel

32 around the kicker roller 35 and then up and over two guide rollers 45, 46 into the variable-information input printing station 22.

The latter (see Figs. 1 and 4) incorporates a dot matrix printer 47 (although it will be manifest to any person skilled in the art that alternative forms of intelligent printer may be employed) linked to the microprocessor 20 as indicated at L and releasably secured (bolted or clipped) on a platform 48 which is adjustable along the label stock flow path. The platform 48 slides on rails 49 and mounts two gearwheels 50 mounted on a rotatable spindle 51 below same engageable with fixed racks 52. A knob 53 is secured to the spindle 51 to effect rotation thereof and of the gearwheels 50 to move the platform 48 to-and-fro along the rails 49. A lock nut 54 is provided on the spindle 51 to secure the platform 48 in adjusted position. Thus the dot matrix printer position can be adjusted to suit the size and/or format of the labels to be produced in any one run.

Downstream of the dot matrix printer 47 is the background printing station 23 within which is located a printing bed 55 on which the label stock LS dwells during printing. This printing bed 55 is height and level adjustable by conventional means known to those skilled in the art and not forming part of this invention.

Above the printing bed 55 is an assembly 56 of a heater box and printing head adapted releasably to mount the type required for background printing. The heater/printing assembly 56 is carried by a ram 57 movable by a crank 57A or other conventional means for converting rotary motion into linear motion connected to a continuously-driven shaft 58 (see Figs. 2, 7 and 8) through a one-revolution clutch 59 having a circumferential cam track 60 in the driving clutch plate and in which engages one end of a pivotal lever 61 urged by a spring 62 into the cam track 60 normally to immobilise the clutch 59. The lever 61 is pivoted to release the clutch 59, i.e. to allow same to engage to drive the ram down and then up, by a actuator pin 63 controlled by a solenoid 64 linked to the microprocessor 20 as indicated at L and thereby controlled by the microprocessor 20.

Printing foil PF activated by heat is supplied to the background printing area to overlie the label stock LS during each printing operation.

The printing foil PF is fed from a supply reel 65 mounted on a freely rotatable spindle 66 and passes under guides 67 and 68 and then across the label stock flow path at the background printing area, down round an upper guide rod 69 and a lower guide rod 70 and back across but under the label stock flow path, through a nip 71 and onto a collection reel 72 detachably secured on a driven shaft 73.

The nip 72 is defined by a bottom freely-rotatable rubber-covered pressure roller 74, whereof the pressure can be adjusted in any convenient known manner, and an indexing roller 75 fast on a driven shaft 76. At one end (the non-driven end), the shaft 76 is connected by a gearing 77 and a toothed belt 78 to the collection reel shaft 73 to drive same when the indexing roller 75 is driven.

The indexing roller shaft 76 has on its other end a gearwheel 79 with which meshes a gearwheel 80 driven by a crank arm 81 connected by a linkage 82 to a rotatable lever 83 to which, in turn, is adjustably secured a bar 84 fast on a continuously rotatable shaft 85 driven from the machine drive to be described later. The rotatable lever 83 is position adjustable along the bar 84 to vary the effective length of the lever/bar combination 83, 84 and consequently the stroke of the crank arm 81. In this way, the indexed length of printing foil PF is controlled.

Above the background printing station 23 and the die cutting station 27 is the laminate supply station 25. The laminate is a transparent adhesive-backed film strip LF supplied with a removable paper backing strip BS. It is supplied on a reel 86 which is detachably mounted on a rotatable shaft 87 for rotation therewith, the shaft 87 is connected to the machine drive via an alternately operable brake

88 and clutch 89 in the same manner as the label stock supply station and for this reason the laminate supply station 25 will not be described in detail. The laminate passes from the supply reel 86 around a guide roller 90 carried by a driven shaft 91 and then down and around a dancer or kick roller 92 carried by a pivotal arm 93 arrangement identical with that of the label stock supply or feed-off station and then up to two guide spindles 94, 95 where the laminate film LF and backing paper BS separate, the laminate film LF with adhesive side remote from the guide spindle 95 passing down towards the printed label stock LS. The backing paper BS passes around the guide spindle 94 onto a collection reel 96 rotatable with a continuously rotatable spindle 97 driven from the machine drive.

The adhesive backed laminate film LF passes under through a pressure nip 98 incorporating a bottom pressure roller 99 between which nip the printed label stock LS also passes whereby the laminate film LF is pressed onto the printed label stock LS to adhere thereto.

It will be manifest that initial separation of the film and backing paper is effected by the operator when the machine is being threaded before the machine is operated for a label production run.

The now printed and laminated label stock (simply referenced LS) passes to the die cutting

station 27. This is identical in construction and operation to the background printing station save that the printing/heating assembly is replaced by a support head 100 to the underside of which is replaceably fitted a cutting die or rule (not shown) of a configuration determined by the desired label format. For convenience parts of the cutting station identical with parts of the background printing station are designated by the same references but with the suffix "X".

The printed, laminated and cut label stock LS now passes through the indexing station 28 (Figs. 1, 5 and 6) which comprises two rollers defining a nip 101 through which the label stock passes. The nip is defined by a bottom indexing roller 102 directly driven by a stepping motor 103 linked to the microprocessor 20 as indicated at L and thereby controlled by the microprocessor 20, and a top rubber-covered pressure roller 104 carried in a frame 105 pivotally mounted at 106 on the machine frame 107. A pressure screw 108 acts on the frame 105 to permit pressure adjustment.

The use of a stepping motor for indexing purposes in a label printing machine instead of the conventional system of an indexing motor operating through cams and levers allows superior control of the indexing operation and removes the risk of incorrect operation, or even non-operation,

of the indexing mechanism resulting from jamming or other irregular functioning of the cams and levers.

The printed, laminated and cut label stock LS now moves under a roller 109 at the downstream side of which the cut waste laminate film LW passes upwardly to be wound on a collection reel 110 rotatably fast but detachably mounted on a shaft 111 driven from the shaft 97 of the backing paper collection reel 96.

The label stock LS continues through a nip defined by guide rollers 112, 113 to the label stock collection station 30.

The latter comprises a shaft 114 rotated continuously by the machine drive on which is mounted a collection reel 115 for the finished label stock LS. The latter after passing through the nip rollers 112, 113 passes down around guide rollers 116, 117 and then around a dancer or kick roller 118 carried by a spring-loaded pivotal arm 119 and a final guide roller 120 to the collection reel 115.

The machine drive (Fig. 2) comprises an electric motor 121 and a reduction gear 122 from the output shaft 123 various drives are transmitted by chain transmissions, i.e. chain and gearwheel transmissions.

A chain transmission 124 connects the output shaft 123 to the drive shaft 31 of the label stock feed-off reel 32, the rotation of which shaft is,

of course, controlled by the alternately operating brake 33 and clutch 34.

A chain transmission 125 connects the output shaft 123 and the drive shaft 114 of the label stock collection reel 115.

A transfer chain transmission 126 connects the output shaft 123 to an upper shaft, i.e. the shaft 58 which drives the printing/heating assembly ram 57 through the one-revolution clutch 59 and crank 57A described above.

A chain transmission 127 connects the shaft 58 to a second and parallel shaft 58X which drives the cutting ram 57X through the one-revolution clutch 59X and crank described above.

A chain transmission 128 connects the shaft 58X to the shaft 85 which drives the rotatable lever 83 of the drive to the printing foil indexing roller 75.

A chain transmission 129 connects the shaft 58X and the shaft 87 of the laminate feed-off reel 86 and the shaft 91 of the guide roller 90. In the case of the feed-off reel shaft 87, the rotation of this is, as aforesaid, controlled by the alternately operating brake 88 and clutch 89.

A chain transmission 130 from the shaft 58 drives the backing paper take-up reel shaft 97 from which a chain transmission 131 extends to drive the laminate waste take-up reel shaft 111.

A manual drive is provided for use in "inching" the machine drive, during the machine threading operation for example. This comprises a shaft 132 with a gearwheel 133 at one end for engagement with a gearwheel 134 on the motor shaft 135. The shaft 132 and consequently its gearwheel 133 is normally urged away from the motor shaft gearwheel 134 by a spring 136.

Let us assume that the label printing machine is ready for use. In this condition (1) label stock LS is threaded through the machine from the supply take-off reel 32 to the collection reel 115; (2) printing foil PF is threaded across the label stock flow path between its supply take-off reel 65 and collection reel 72; (3) laminate film LF is threaded through the machine to the collection reel 115 with a start-off length of backing paper BP wound on its collection reel 96 and a start-off length of waste laminate LW wound on its collection reel 110; (4) the background printer type is set up and the heater box is activated; (5) the appropriate cutting die or rule is fitted to the cutting head; (6) the variable information and other parameters, for example indexing length and rate of label production, is fed into the microprocessor 20 by the operator.

The machine is now actuated and, as aforesaid, predetermined lengths of label stock LS and laminate

film LF are delivered into the flow system, usually one label length at a time, the label/stock indexing and the printing foil indexing and the printing and cutting rams and the dot-matrix printer being operational.

The label printing operation then runs with a series of dwells during each of which variable information is printed on a label area (stage 1), background information (stage 2) is printed on a "stage 1" label area by the heated background printing head and hot printing foil, and a "stage 2" label area is cut by the cutting die or rule (stage 3). The machine continues in this manner until the label production run is completed.

Referring now to the electrical/electronic controls for the machine these are illustrated in the block diagram (Fig. 3). The electrical/electronic circuitry does not form part of the present invention and suitable convenient circuitry will be well known to those skilled in the art.

The microprocessor has a keyboard 137 and V.D.U. 138. It directly controls the dot matrix printer 47 and the indexing stepping motor 103. Through an electrical interface 139 to the label printing (L.P.) machine it controls the machine electrics 140, for example, the electric drive motor 121, the electrical heating of the heater box of the background printer, and also through the electrical interface 139 it controls the solenoid valves 64

of the one-revolution clutches 59, 59X.

The microprocessor additionally via control logic circuitry 141 is controlling linked via the override microswitches 39 to the brake 33, 88 and the clutch 34, 89 of the label stock feed-off reel shaft 31 and the laminate feed-off reel shaft 87 to alternately operate the brakes and the clutches.

The dot matrix printer 47, in this instance, has its customary paper feed drive rendered inoperative and its customary main drive is employed to move its print head across the label stock.

This print head may, for example, have a fortyeight character set with a 3mm. character height. It can, for example, print two lines of information, 84mm. wide, at a speed of two lines per second.

Merely as an example it is indicated that such a printer can print up to eighty (80) labels per minute depending on the amount of variable information to be printed.

While reference has been made to a dot matrix printer it will be appreciated that any other form of intelligent printer may be employed in the present invention. Examples of such printers are ink jet printers, thermal printers and laser printers.

The indexing stepping motor 103 may, for example, be advanced in steps of 0.010 of an inch and have a step rate of 1650 steps per second.

The label stock feed-off station 21 and the laminate feed-off station 25 at regular predetermined intervals supply a controlled (brake and clutch) predetermined length (usually one label length) of label stock LS and laminate film LF to the flow path through the machine and in consequence of this the stepping motor 103 is not loaded by having to pull the label stock LS and laminate film LF off the supply reels. The stepping motor's sole function is to index the combined label stock and laminate film.

It is envisaged that the label stock supply reel shaft 31 and the laminate supply reel shaft 87 may, alternatively, be driven by stepping motors controlled by the microprocessor, or by one stepping motor with appropriate transmissions to the two shafts.

The following is one possible modus operandi of the microprocessor controlled dot matrix printer.

When switching on the microprocessor the following display is shown on the screen:

MAIN MENU

0 Enter label details from keyboard

1 Enter label details from storage

2 Feed unprinted material

3 Foil print only

4 PRINT FULL LABELS

5 Alter variable text

6 Alter position of variable text

7 Alter material index length

8 Store label details on cartridge

9 Set up serial number

By selecting "0" the following examples of parameters, inter alia, can be entered:

(i) width of label

(ii) index length

(iii) number of lines of variable text

(iv) variable text

The selection of "1" has self evident results, namely pre-recorded instructions are entered into the microprocessor.

Selecting "2" permits unprinted label stock to be indexed through the machine a selected predetermined length (the machine may possibly be inched for threading by selecting "2").

By selecting "3" background printing only is effected for a selected number of labels.

The selection of "4" prints both variable and background information for a selected number of labels.

The results of selecting "5", "6", "7" and "8" are self evident.

The selection of "9" permits a serial number function to be operated starting with a selected serial number and incrementing or decrementing for a selected number of labels.

It will be manifest that a selection of any number will produce of the screen data from which the operator will choose that necessary to give him the result he requires.

Examples of two labels with the same background information but with different variable information are illustrated in Figs. 11 and 12.

It is envisaged that :-

(a) movement of the dot matrix printer to obtain register can be eliminated and instead, the steps can be counted and an off-set sub-routine built in the microprocessor software.

(b) hot foil stamping printing instead of the customary ink ribbon printing can be employed in the dot matrix printer.

(c) there may be bi-directional printing by the dot matrix printer over the full width of the label with rapid positioning of same.

(d) there may be employment of software to give three character sizes in, say 3mm. increments from the dot matrix printer.

(e) there may be provision for more than two lines of variable information.

(f) there may be development of a software sub-routine to compute from the label date the number of labels (printed foil only) needed in order to register the cutter.

(g) provision may be made to assign locations in the microprocessor and/or for plug-in programmes for label data once entered.

(h) alternative methods of entering label geometry may be employed.

(i) provision may be made for variation in the size of the fixed print area.

CLAIMS:

1. A label printing machine comprising a label stock supply station, a printed label stock collection station spaced from the supply station, a first printing mechanism for printing background label information onto the label stock, a second printing mechanism for printing variable label information onto the label stock, the first and second printing mechanisms being spatially disposed along the label stock flow path between the supply and collection stations, and a microprocessor linked to the second printing mechanism for inputting selected information into said printing mechanism.

2. A label printing machine as claimed in claim 1, in which the first printing mechanism is position stationary relative to the label stock flow path while the second printing mechanism is position adjustable relative thereto.

3. A label printing machine as claimed in claim 2 in which the second printing mechanism is mounted on a platform movable to-and-fro a predetermined distance along the label stock flow path, means being provided to lock the platform in adjusted position determined by the label format to be printed.

4. A label printing machine as claimed in claim 3 in which the platform rests on guide rails and is

movable by rotatable gearing carried by the platform engaging fixed racks below the platform.

5. A label printing machine as claimed in any one of claims 2 to 4 in which, in terms of label stock flow path, the second printing mechanism is upstream of the first printing mechanism.

6. A label printing machine as claimed in any one of claims 2 to 5 comprising an indexing mechanism for indexing the label stock in predetermined but variable steps between dwells during which printing is effected, the indexing mechanism comprising a nip through which the label stock passes and defined by a pressure roller and an indexing roller driven by a stepping motor linked to and controlled by the microprocessor.

7. A label printing machine as claimed in claim 6 comprising a laminate supply station for delivering adhesive-backed laminate film to the label stock flow path downstream of the first and second printing mechanisms and upstream of the indexing mechanism, there being a pressure nip in the label stock flow path through which printed label stock and the laminate film pass to adhere them together.

8. A label printing machine as claimed in claim 7 in which the laminate supply station comprises a collection reel for a backing strip which is peeled from the laminate to expose the

adhesive surface of the laminate film prior to the latter moving into the label stock flow path.

9. A label printing machine as claimed in claim 7 or 8 comprising a laminate cutting station downstream of the pressure nip and including a cutting head movable vertically relative to a support surface for the printed and laminated label stock and a ram connected to the cutting head for effecting the vertical movement thereof.

10. A label printing machine as claimed in claim 9 in which the ram is operated by a one-revolution clutch via a crank, the clutch being controlled by a solenoid-operated spring-loaded brake lever with the solenoid operation being controlled by the microprocessor.

11. A label printing machine as claimed in claim 9 or 10 comprising, downstream of the laminate cutting station, a reel for collecting waste cut laminate film.

12. A label printing machine as claimed in any one of claims 1 to 11 in which the first printing mechanism comprises a hot foil printing mechanism having a printing head and heater box assembly vertically movable under the control of a ram and cooperating with a printing bed, and printing foil supply and collection reels and guide rollers defining a printing foil flow path crossing thelabel stock flow path at the printing

bed whereby the printing head and heater box act on the label stock and overlying printing foil.

13. A label printing machine as claimed in claim 12, comprising a printing foil indexing mechanism disposed upstream of the printing foil collection reel in terms of the printing foil flow path, the indexing mechanism comprising a pressure roller and an indexing roller defining a nip with the indexing roller being driven via gearing and a crank pivoted to a length-adjustable rotatable lever arrangement.

14. A label printing machine as claimed in claim 12 or 13 in which the ram is operated by a one-revolution clutch via a crank, the clutch being controlled by a solenoid-operated spring-loaded brake lever with the solenoid operation being controlled by the microprocessor.

15. A label printing machine as claimed in any one of claims 7 to 14, in which, at each of the label stock and laminate supply stations, a drive shaft for the supply reel is controlled by an alternately operated brake and clutch controlled by the microprocessor via override microswitches controlled by cams on a swinging arm carrying a kicker or dancer roller around which the label stock or laminate moves, whereby for each rotational movement of the drive shaft there is dispensed a predetermined length of label stock or laminate.

16. A label printing machine as claimed in any one of claims 1 to 15 in which the microprocessor is directly controlled by an operator using a keyboard or is controlled by software delivered into the microprocessor by way of a cartridge.

17. A label printing machine substantially as hereinbefore described with reference to the accompanying drawings.

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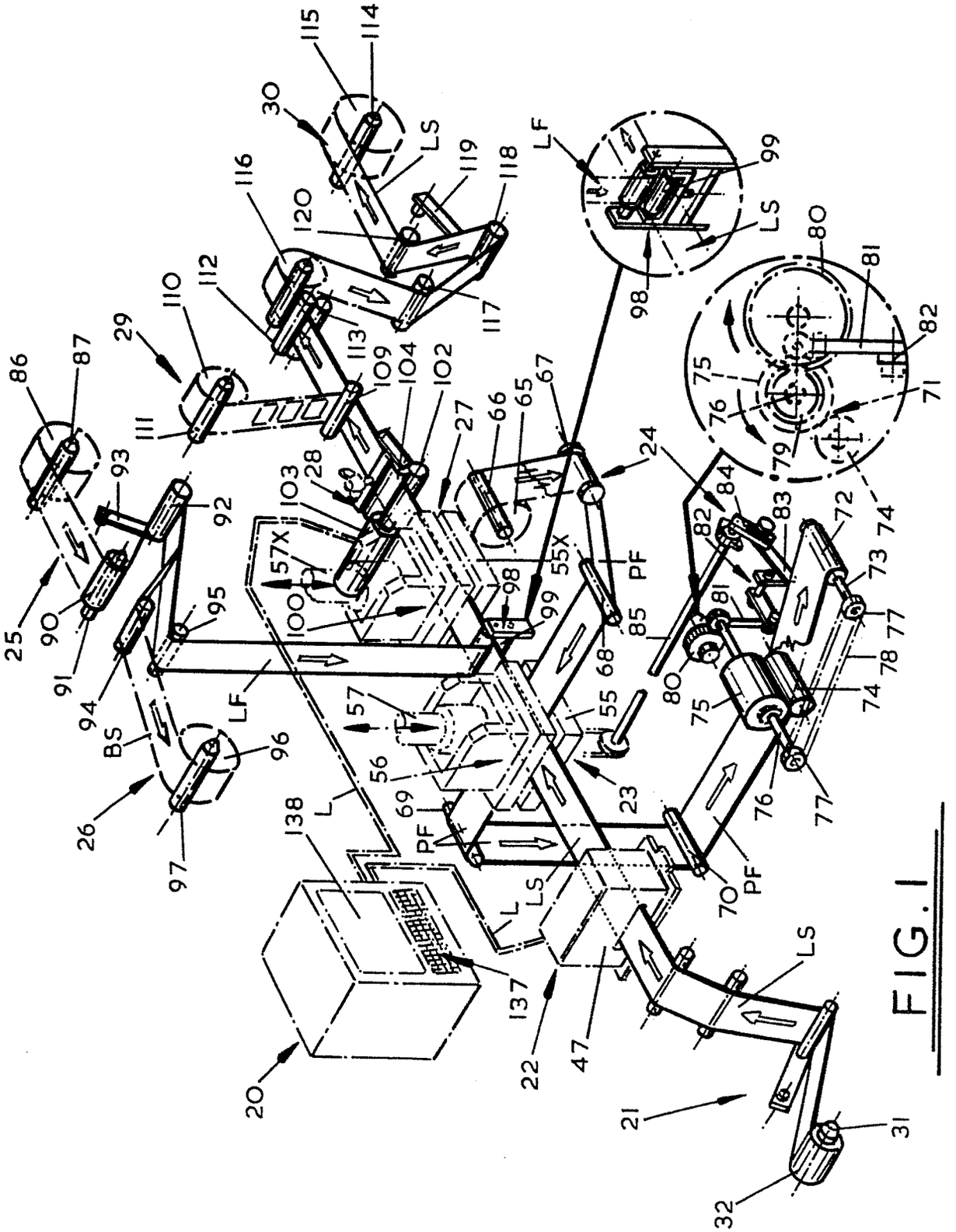

FIG. 1

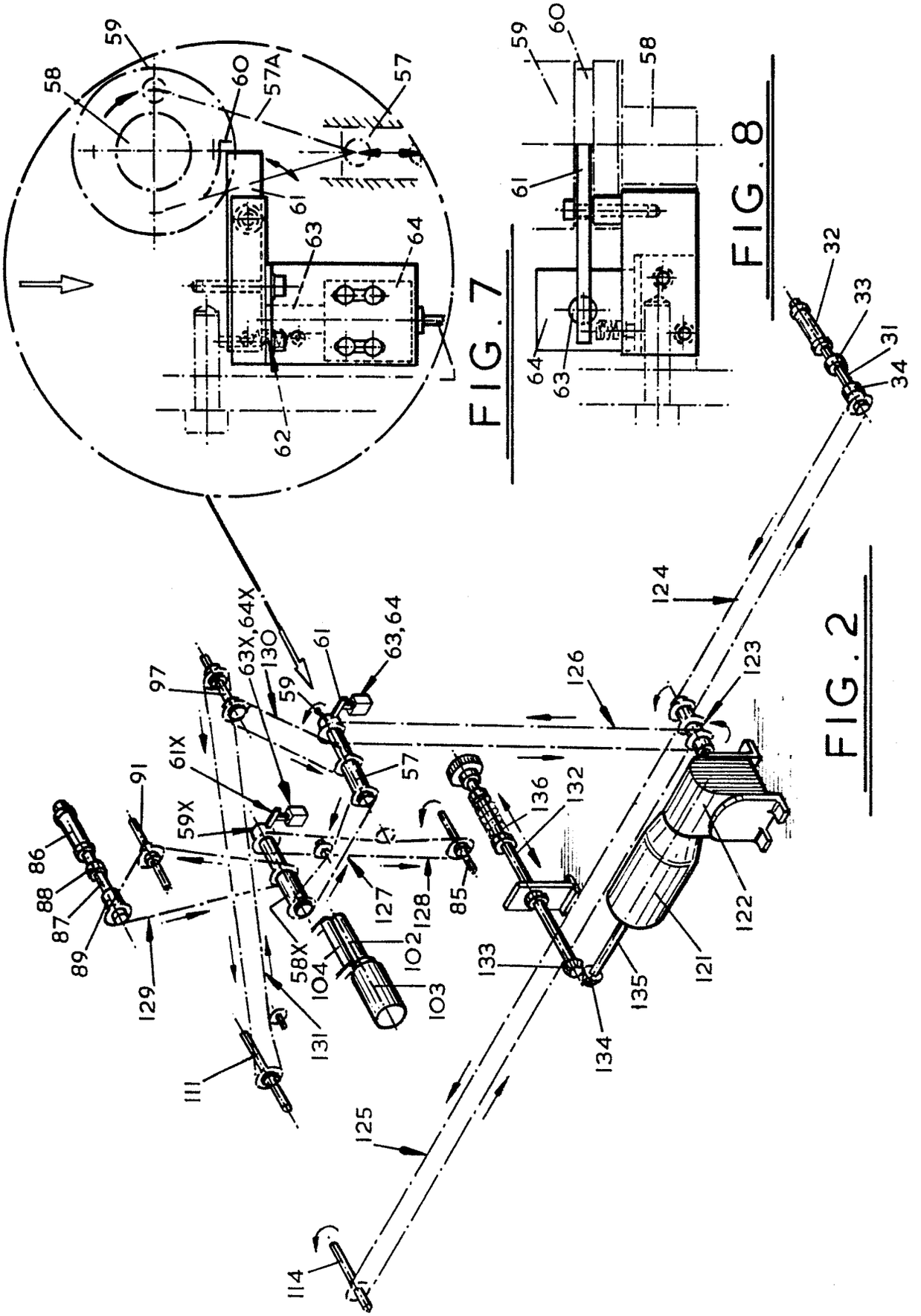
59
58
60
57A
57
61
63
64
62
L
FIG. 7
59
60
58
61
64
63
FIG. 8
32
33
31
34
124
126
123
122
121
135
134
133
132
136
85
128
127
102
103
104
58X
131
111
129
89
87
88
86
91
59X
61X
97
63X,64X
130
59
61
63,64
57
125
114

FIG. 2

316

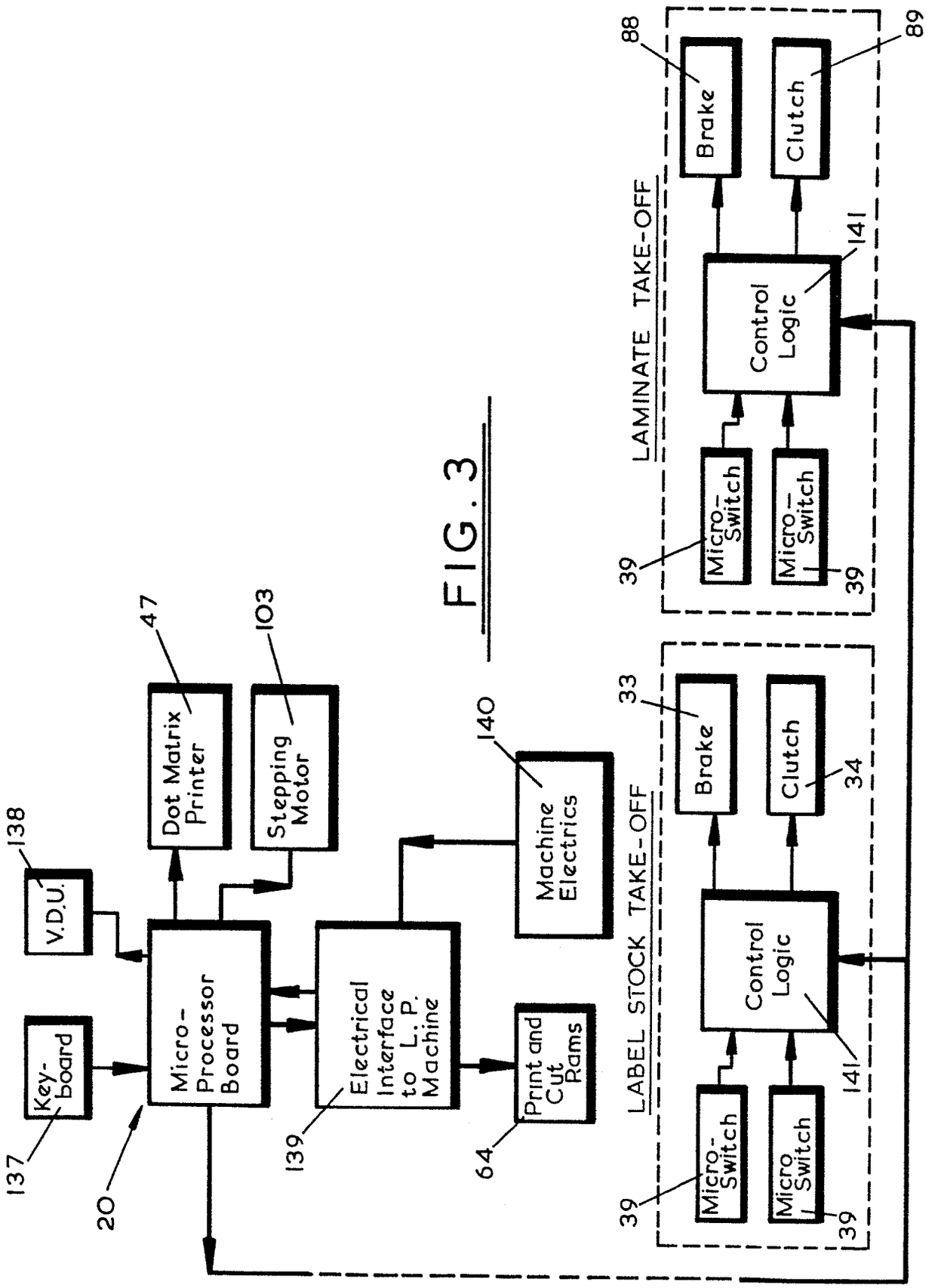
Key-board
V.D.U.
Micro-Processor Board
Dot Matrix Printer
Stepping Motor
Electrical Interface to L.P. Machine
Machine Electrics
Print and Cut Rams
LABEL STOCK TAKE-OFF
LAMINATE TAKE-OFF
Brake
Clutch
Control Logic
Micro-Switch
137
138
20
47
103
139
140
64
33
34
88
89
141
39

FIG. 3

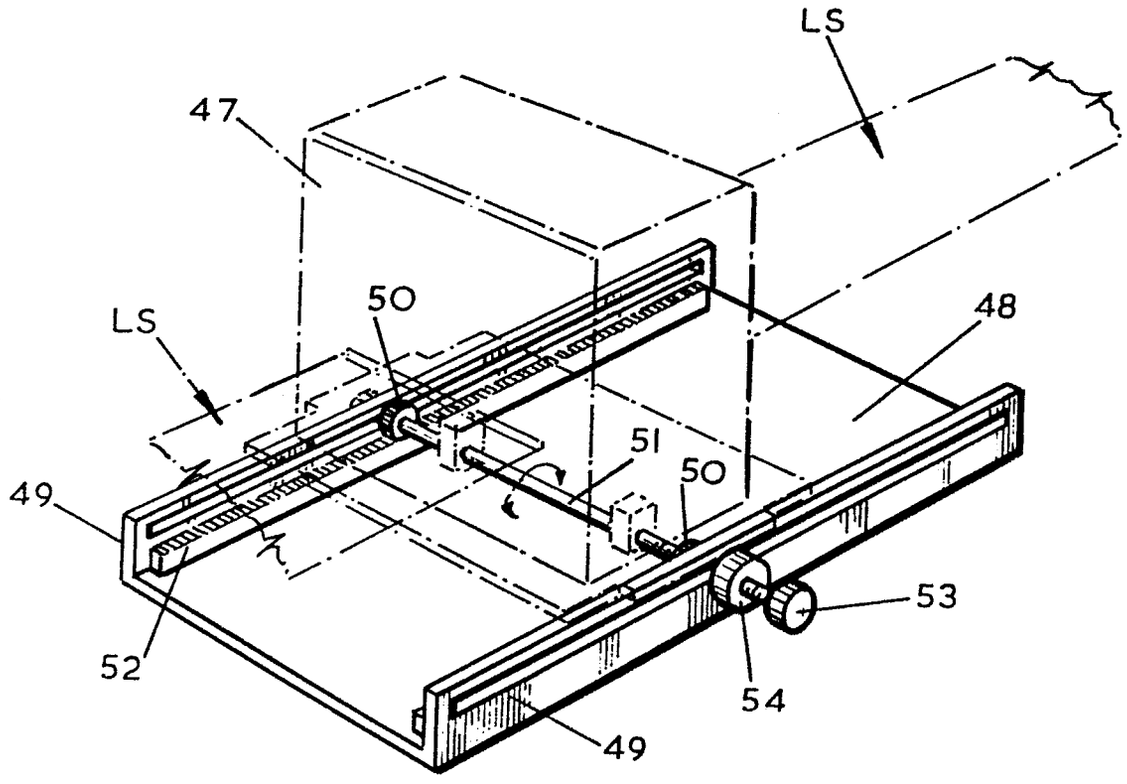

FIG. 4

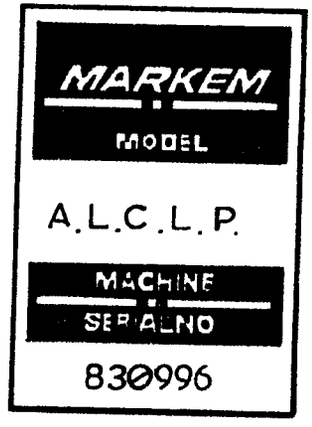

FIG. 11

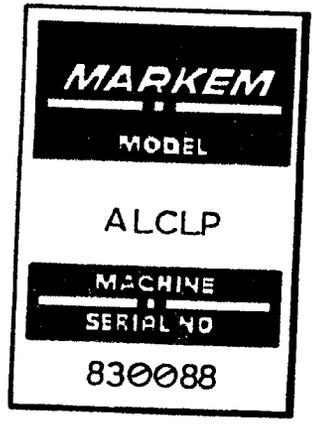

FIG. 12

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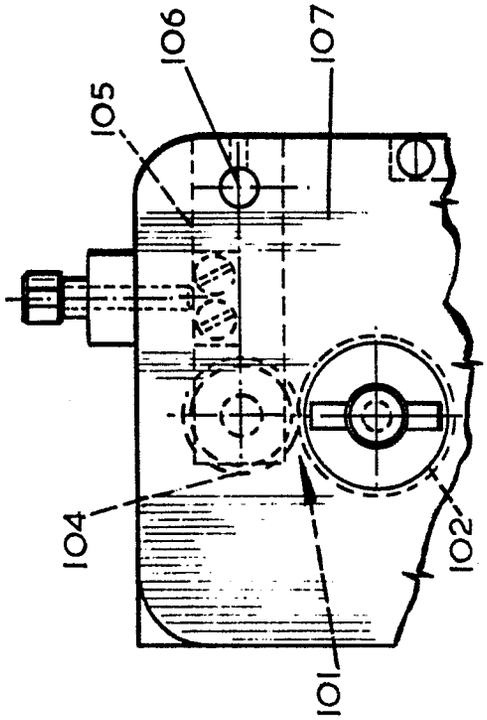

FIG. 6

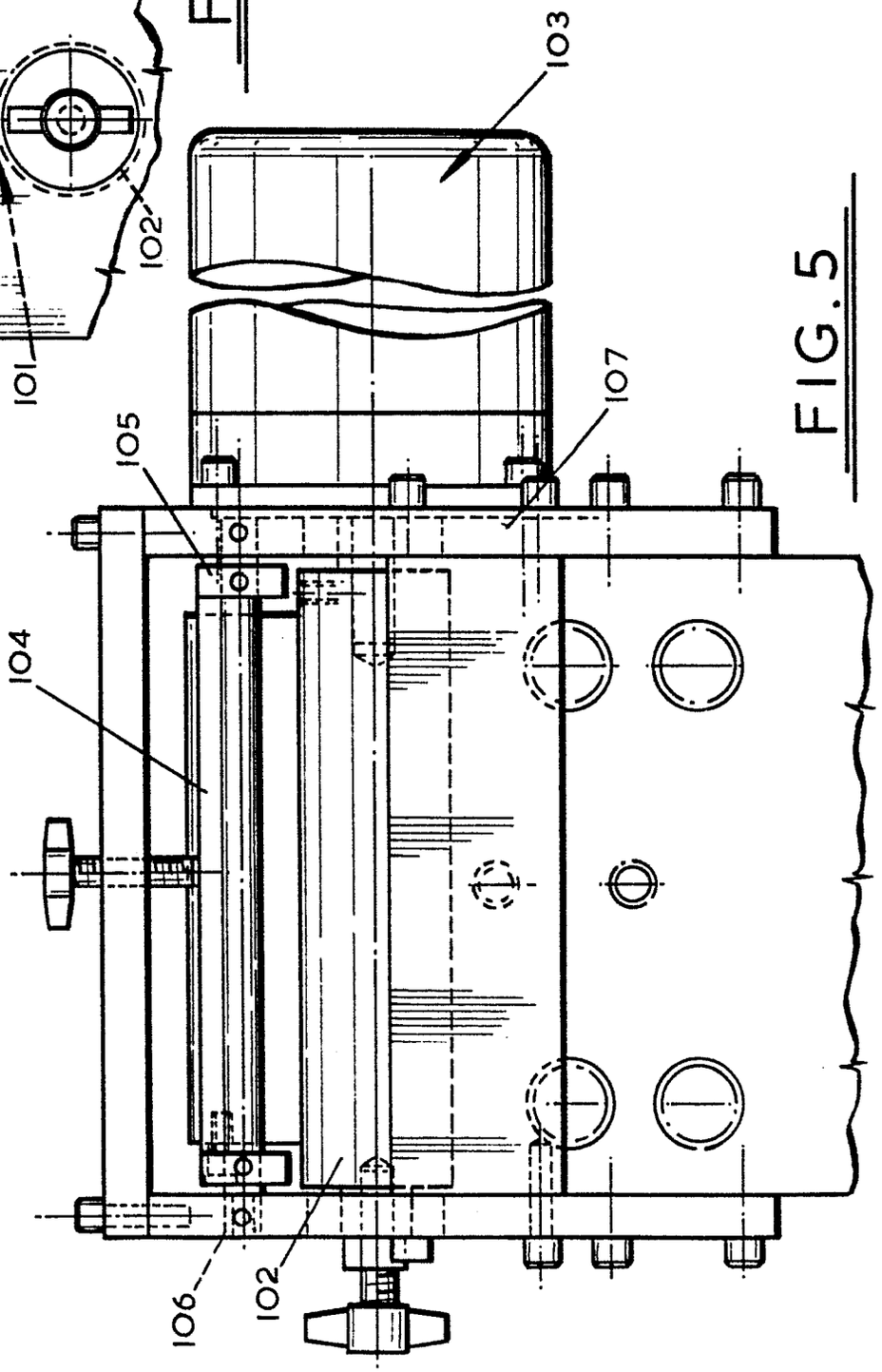

FIG. 5

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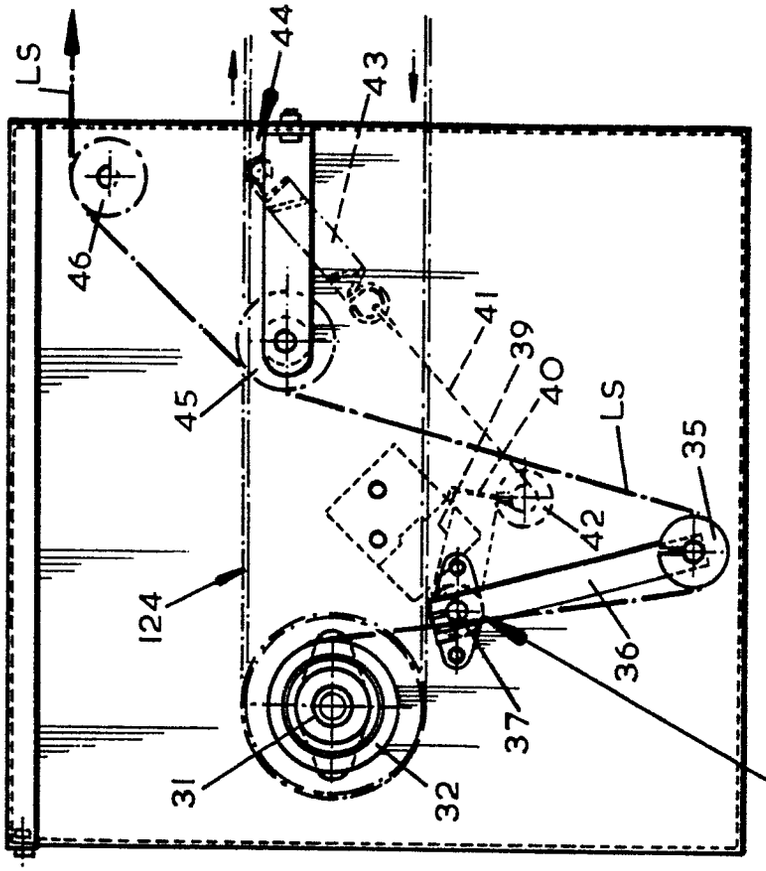
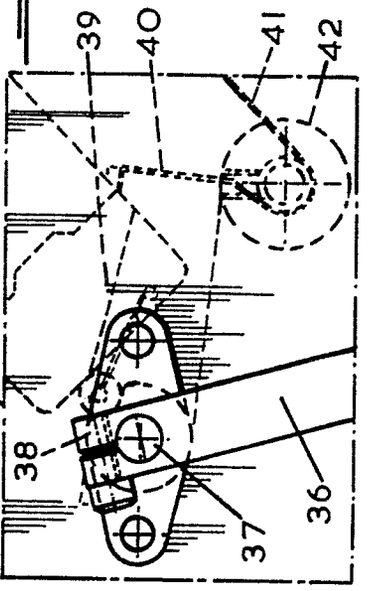


FIG. 9



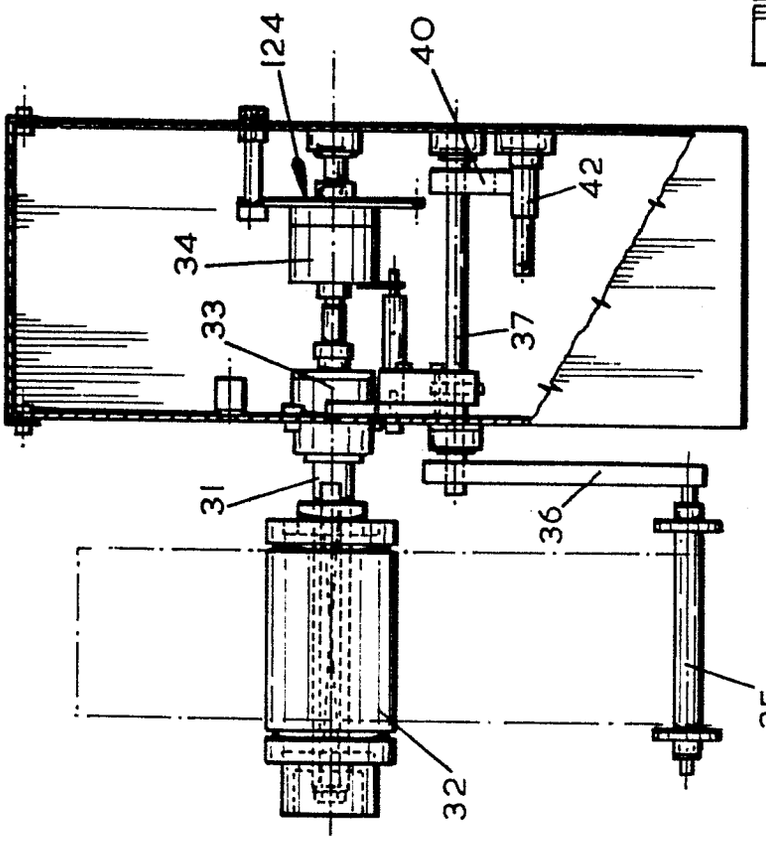


FIG. 10