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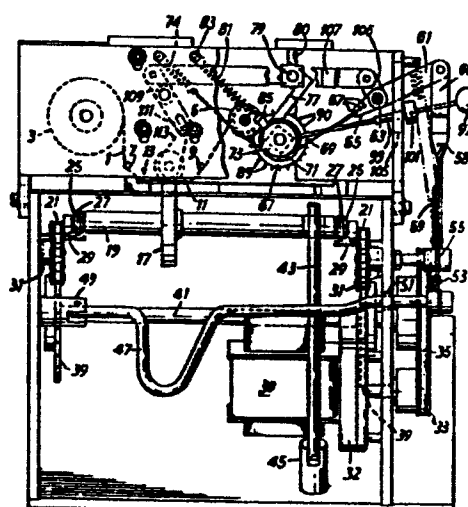
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54 **Printing machine.**

57 A printing machine in which a document is fed to a printing station (13) where an impression of a row of printing characters is delivered, on application of pressure between the document and the characters, to the document by a thin plastic inked tape (1) which passes from a supply spool (3) via the printing station to take-up spool (5) on which tape is incrementally wound between printing impressions.

In order to reduce swell of the take-up spool and axial movement of tape thereon, a rotatable cylindrical indexing member (87) provided with a circular series of projections (89) is biased into driving engagement with tape on the take-up spool so that several layers of tape are penetrated and tape in the outer layer perforated by a projection extends through apertures in inner layers formed by the projection thereby fixedly securing the outer layer relative to the inner layers.

Fig.1



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- 2 -

This invention relates to printing machines.

In printing machines in which a thin plastic inked tape delivers an impression of a row of printing characters to a document fed to a printing station, and a single drive means incrementally winds tape from a supply spool by way of the printing station to a take-up spool, a variety of problems may be encountered.

During printing, a row of printing characters is pressed against the tape at the printing station, and on release of pressure the tape generally remains in engagement with the characters. In typewriters or similar machines where only one character is printed at each stroke, the force needed to release the tape from the character is small, but for a row of characters, the force required can be substantial. If the force is applied suddenly, tape may unspool from the supply spool, or the tape may tear or break, and accordingly it is necessary to distribute the force in some way. Moreover, in some printing machines the configuration is such that, as the amount of tape wound onto the take-up spool increases, the plane of the tape passing from the print station to the take-up spool lies more nearly in the plane of the row of printing characters and the force needed to release the tape from the characters increases.

In many prior art machines the take-up spool becomes swollen; that is, it has a larger diameter for a given length of

- 3 -

tape wound thereon than the diameter of a supply spool supporting the same length of tape. Swelling may be caused by loose winding of tape onto the take-up spool. Also, the tape becomes embossed by impact of the printing characters which, particularly in association with loose winding, can cause substantial swelling. Such swelling should be avoided if possible. First, it can render the force needed to release tape from the characters unnecessarily large as described above. Secondly, it causes inefficient use of space within the machine and, if the supply spool and take-up spool are provided within a cartridge, the size of the cartridge required to accommodate the take-up spool may become unacceptably large. Thirdly, slippage of tape on the take-up spool is likely.

As the diameter of the take-up spool increases, and particularly if the tape is being tightly wound onto the spool, the tape has a tendency to move axially during winding. Thus, the surfaces formed by the edges of tape wound on the take-up spool, instead of being flat and lying perpendicular to the axis of rotation of the spool, become conical. This axial movement introduces additional stresses to the winding mechanism and there is a danger of the tape breaking.

Tape is wasted if the take-up spool is incremented through a fixed angle between printing strokes, and the wastage increases as the diameter of the tape on the take-up spool increases. Consequently it is preferable to wind tape onto the take-up spool

- 4 -

in equal increments.

Various propositions have been made to overcome these problems, but they generally employ a good deal of additional complex mechanism which is undesirable.

It is accordingly an object of the present invention to provide an improved and simplified printing machine.

The present invention consists in a printing machine comprising a printing station and a printing device for presenting a row of printing characters to the printing station; a supply spool and take-up spool with a thin plastic inked tape extending therebetween by way of the printing station; means for applying pressure between the row of printing characters and a document fed to the printing station so that an impression of said row is delivered by the tape to the document during dwell of the tape at the printing station; and a drive means for incrementally winding said tape from the supply spool onto the take-up spool, characterized in that the drive means comprises a generally cylindrical rotatable indexing member provided with a circular series of projections extending around the circumference of the member and the axis of rotation of the member extending parallel with the axis of rotation of the take-up spool, and biasing means biasing, in operation, the indexing member into driving engagement with tape on the take-up spool with sufficient force to penetrate several layers of tape so that tape in the outer layer perforated by a projection extends through apertures in inner layers formed by the projection thereby fixedly securing the outer layer relative to the inner layers.

- 5 -

Preferably, the indexing member is provided with two circular series of projections extending around the circumference of the member. Mitigation of various of the problems described above, such as the axial movement of tape on the take-up spool, may be assisted by the indexing member having the two series of projections situated in relation to the take-up spool at locations equally spaced from the centre-line of tape on the take-up spool, and preferably, each series has the same number of projections and each projection in the second series lies on a line parallel to the axis of rotation of the member through a respective projection in the first series.

Advantageously, the drive means comprises a reciprocable driving mechanism whereby the indexing member is driven in one sense only and through a predetermined angle by each reciprocation of the driving mechanism, so that the indexing member effects winding onto the take-up spool of equal increments of tape upon respective reciprocations of the driving mechanism.

In one form of the invention the means for applying pressure between the row of printing characters and a document fed to the printing station comprise an impression wheel rotatably mounted on a shaft carried at respective ends thereof on parallel endless bands driven by powered wheel means in engagement with one at least of said bands, the ends of the shaft when traversing the upper run of the endless bands resiliently engaging respective rails as the impression wheel performs a printing stroke.

- 6 -

Suitably, the shaft of the impression wheel at the completion of each printing stroke actuates the reciprocable driving mechanism.

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

Figure 1 is a rear elevation of a printing machine according to the invention;

Figure 2 is a side elevation of the printing machine of Figure 1; and

Figure 3 is a front elevation of the printing machine of the preceding Figures.

The drawings illustrate a printing machine comprising a printing station 13 and a printing device in the form of printing box 12. At the printing station 13 is located a print table 15 to which documents to be printed, for example cheques or lottery tickets, are fed. The printing box 12 is a number wheel counter of known form and presents a row of printing characters at the printing station for forming a printing impression on a document fed to print table 15. After each printing stroke the counter is advanced to change one or more characters of the row as hereinafter indicated. The printing machine further comprises a supply spool 3 on which tape 1 is held in a known manner by a tape tensioning spring, not shown, and a take-up spool 5. The tape is thin and consists of a plastic, for example polyethylene, coated with ink on one side thereof, the term "ink" being employed herein to designate any form of marking material.

- 7 -

The tape 1 extends with the inked side thereof facing downwardly, from supply spool 3, around guide 7, beneath a lower member 11 of the printing box 12 which provides a horizontal run of tape at printing station 13, and around guide 9 to the take-up spool 5. Thus at printing station 13, the tape passes between print table 15 and lower member 11. Beneath print table 15 is provided a printing impression wheel 17 for applying pressure between the row of printing characters presented by printing box 12 and a document fed to the printing station 13, so that an impression of the row is delivered by the inked tape to the document during dwell of the tape at the printing station. During each printing stroke the impression wheel 17 projects through a slot in the print table to press the document to be printed against the row of printing characters, and to this end wheel 17 is rotatably mounted on a transverse shaft 19 the ends of which are secured to respective parallel endless chains 21 each of which passes over a pair of guide sprockets 23. At each end of the shaft 19 inwardly of the connection thereof with the corresponding chain 21 is a roller 25 carrying a resilient tyre 27. When the parts of the chains 21 to which the ends of the shaft 19 are secured are each disposed in the upper run of the corresponding chains the tyres 27 of rollers 25 engage respective rails 29 provided by brackets 31 secured to the sides of the machine. Thus on driving of the chains 21 as the wheel 17 traverses the slot in the table 15 to perform the printing stroke the tyres 27 press

on the rails 29 and cushion the force between the wheel 17 and the row of printing characters presented by printing box 12 so that the likelihood of damage to the characters is reduced. Where characters are provided in bar coded form it is most important to prevent damage to the characters which could result in failure to print the bar code in a form which could be correctly read. The cushioning of the printing stroke could be effected in other ways, for example, by having a resilient mounting of the printing box on the machine frame or by having the impression wheel 17 resiliently mounted on the shaft 19.

The chains 21 are driven from an electric motor 30 which by way of a gear box 32 drives a pulley 33 the latter being coupled by means of a belt 35 to a further pulley 37. Rotatable with the further pulley 37 is a pair of sprockets 39 which are connected by a cross shaft 41 and which engage the lower run of the respective chains 21 and tension and drive the same.

At the completion of each printing stroke, the shaft 19 as it passes around sprockets 23 from the upper to the lower run of the chains 21 effects reciprocation of a reciprocable driving mechanism for the purpose of indexing the take-up spool 5 as hereinafter described.

The reciprocable driving mechanism includes an upright rod 43 pivotally mounted at its lower end in a support 45 and having an upper part disposed in the path of the shaft 19. A further horizontally disposed rod 47 is pivotally supported in a support 49 located at the side of the

machine opposite the motor driven belt 35 and extends through a horizontal slot 51 in the side of the machine adjacent the belt 35. The end of the rod 47 which projects through the slot 51 is pivoted to a forward end of a link 53 a rearward end of which is pivotally connected to a bell crank 55 which is pivotally supported at 57 on the side of the machine. A tension spring 59 connected between the bell crank 55 and the side of the machine biases the bell crank upwardly which in turn biases the link 53 rearwardly and further biases the rod 47 into engagement with upright rod 43 and with the forward end of the slot 51.

Pivotally connected to the bell crank 55 is an upwardly extending link 58 which is formed with bifurcations 60 in an upper part thereof and between which is pivotally secured an arm 61 which is secured to a shaft 63 which extends parallel with the axes of the supply and take-up spools 3 and 5 so that reciprocation of the end of the arm 61 secured to link 58, which occurs each time, when at the end of a printing stroke, the rod 43 is engaged by the transverse shaft 19, effects rotary reciprocation of the shaft 63.

Secured to the shaft 63 is a crank 65 formed with holes 67 which enable the throw of the crank to be adjusted. Attached to one of the holes 67 is one end of a cord 69 which passes round a pulley 71 of a clutch 73 and the other end of which is attached to an end of a tension spring 74 the opposite end of which is anchored to the side of the machine. The clutch 73 has an output member secured to a shaft 75 which extends parallel with the spools 3 and 5 and the clutch provides a one-way drive means for the shaft 75 which is rotated through a constant angle, which depends on the throw of the crank 65 after each printing stroke.

The shaft 75 is pendently supported from the top of the machine by means of drop links 77 secured to the shaft and pivoted to an upper

- 10 -

parallel rod 79 mounted by members 80 from the top of the machine. The structure comprising the clutch 73, shaft 75 and links 77 is biased towards the take-up spool 5 by means of a tension spring 81, the opposite ends of which are connected to respective anchorages 83, 85 on the body of the machine and secured relative to the shaft 75.

A cylindrical indexing member 87 is mounted on shaft 75 for rotation therewith at a location facing tape wound onto the take-up spool 5 so that the axis of rotation of member 87 extends parallel with the axis of rotation of the take-up spool. Extending around the circumference of the member are two circular series 88 and 90 of projections 89. Biassing means comprising spring 81 biases the member into driving engagement with tape on the take-up spool with sufficient force to penetrate several layers of tape so that tape in the outer layer perforated by a projection extends through apertures in inner layers formed by the projection thereby fixedly securing the outer layer relative to the inner layers. The take-up spool 5 comprises a cardboard former (not shown) and prior to several turns of tape having accumulated on the former the projections 89 penetrate the few turns of tape on the former and the former itself. The two series of projections are situated in relation to the take-up spool at locations equally spaced from the centre-line of tape on the take-up spool. Each series has the same number of projections 89 and each projection in series 88

- 11 -

lies on a line parallel to the axis of rotation of member 87 through a respective projection in series 90. The spacing of projections in each series is such that, even when the diameter of tape on the take-up spool is small, two projections penetrating the tape, one from each series, are not withdrawn from the top few layers of tape as the indexing member rotates until the next two succeeding projections have perforated and formed apertures in more than one layer of the tape.

With the projections thus arranged and the indexing member 87 biased into driving engagement with tape on the take-up spool so that several layers of tape are penetrated by projections, the tape is tightly wound and swelling of the take-up spool and the tendency for tape to slip on the spool are inhibited. Also, because several layers of tape are penetrated the force needed to release the tape from the row of printing characters at each print stroke is distributed, and there is little axial movement of tape on the take-up spool.

The reciprocable driving mechanism drives the indexing member in one sense only and through a predetermined angle during each reciprocation, and the positive driving connection afforded between the indexing member 87 and tape on the take-up spool ensures that after each printing stroke equal lengths of tape are wound onto the take-up spool, and wastage of tape is avoided.

In order to enable replacement of the spools 3 and 5, member 87 is withdrawable from the take-up spool. To this end a collar 91 is

- 12 -

secured to the shaft 75 and fixed to the collar is a handle 93 comprising a rod 95 fixed at one end to the collar, a knob 97 at the end of the rod 95 opposite the collar, a short sleeve 99 fixed to the rod and a stop collar 101 secured to the sleeve 99. The sleeve 99 in the operative position of the member 87, i.e. in which the projections 89 penetrate several layers of tape on the spool 5, extends through a large part of the aperture of a keyhole slot 105 in the side of the machine. In this position the stop collar 101 limits travel of the indexing member towards the take-up spool. By pulling on the knob 97, the sleeve 99 is moved to a position where its inner end is located outside the keyhole slot so that the knob 97 can then be lowered and released to bring the inner end of the sleeve 99 into abutting relationship with the narrower part of the keyhole slot aperture in which position the indexing member 87 is held with its projections withdrawn from tape on the take-up spool. Raising of the knob 97 restores the indexing member 87 to its original operative position under the influence of tension spring 81.

Secured to the shaft 63 is a further crank 106 which is connected pivotally to an end of a horizontal link 107 the opposite end of which pivotally connects with one end of an arm 109 which is pivotally secured intermediate its ends to the side of the machine and at the end thereof remote from the link 107 is formed with a fork 111. The fork 111 engages an element on an

- 13 -

end of a lever 113 which pivots about an axis co-axial with the number wheels of the counter mechanism forming the printing box 12.

It will be apparent that the spools 3 and 5 can if desired be provided in the form of a cassette for ready replacement. Suitably, the documents to be printed may be stored in a stack in a supply mechanism fixed to the machine which causes one document at a time to be supplied to the printing station. In this instance a discharge mechanism is also provided which removes the document from the printing station after printing.

CLAIMS:

1. A printing machine comprising a printing station (13) and a printing device (12) for presenting a row of printing characters to the printing station; a supply spool (3) and take-up spool (5) with a thin plastic inked tape (1) extending therebetween by way of the printing station; means (17) for applying pressure between the row of printing characters and a document fed to the printing station so that an impression of said row is delivered by the tape to the document during dwell of the tape at the printing station; and a drive means for incrementally winding said tape from the supply spool onto the take-up spool, characterised in that the drive means comprises a generally cylindrical rotatable indexing member (87) provided with a circular series of projections (89) extending around the circumference of the member, the axis of rotation of the member extending parallel with the axis of rotation of the take-up spool, and biasing means (81) biasing, in operation, the indexing member into driving engagement with tape on the take-up spool with sufficient force to penetrate several layers of tape so that tape in the outer layer perforated by a projection extends through apertures in inner layers formed by the projection thereby fixedly securing the outer layer relative to the inner layers.

- 2 -

2. A printing machine as claimed in claim 1, characterised in that the indexing member is provided with two circular series (88,90) of projections extending around the circumference of the member.
3. A printing machine as claimed in claim 2, characterised in that the two series of projections are situated in relation to the take-up spool at locations equally spaced from the centre-line of tape on the take-up spool.
4. A printing machine as claimed in claim 3, characterised in that each series has the same number of projections and each projection in the second series lies on a line parallel to the axis of rotation of the member through a respective projection in the first series.
5. A printing machine as claimed in any preceding claim characterised in that the drive means comprises a reciprocable driving mechanism (60,61,63,65,69,71) whereby the indexing member is driven in one sense only and through a predetermined angle by each reciprocation of the driving mechanism, so that the indexing member effects winding onto the take-up spool of equal increments of tape upon respective reciprocations of the driving mechanism.

- 3 -

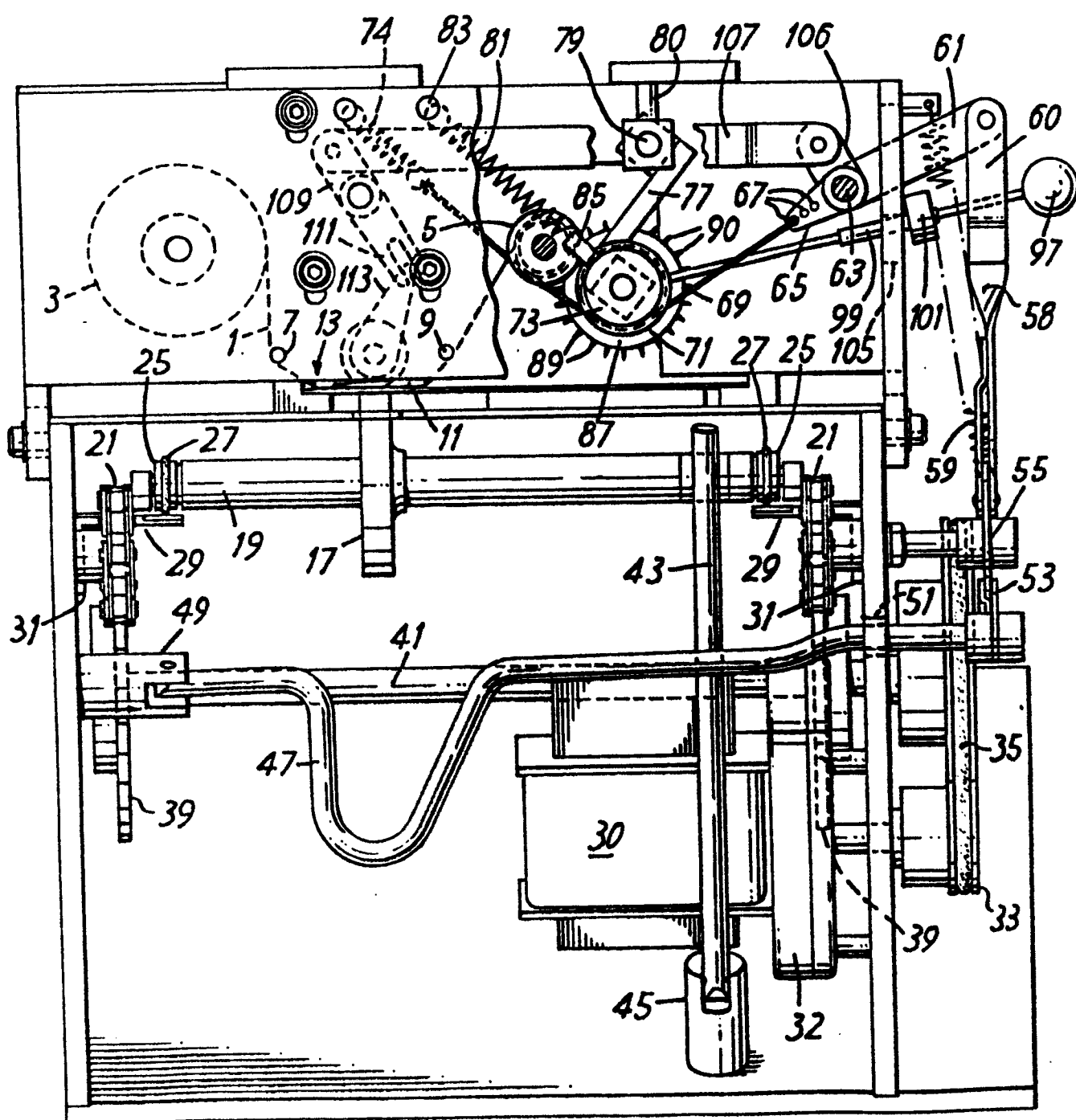
6. A printing machine as claimed in any preceding claim characterised in that the means for applying pressure between the row of printing characters and a document fed to the printing station comprise an impression wheel (17) rotatably mounted on a shaft (19) carried at respective ends thereof on parallel endless bands (21) driven by powered wheel means (39) in engagement with one at least of said bands, the ends of the shaft when traversing the upper run of the endless bands resiliently engaging respective rails (29) as the impression wheel performs a printing stroke.

7. A printing machine as claimed in claim 6, characterised in that the resilient engagement of the ends of the shaft (19) with the rails (29) is effected by rollers (25) at respective ends of the shaft on each of which is provided a tyre (27).

8. A printing machine as claimed in claim 6 or claim 7, characterised in that the shaft of the impression wheel at the completion of each print stroke actuates the reciprocable driving mechanism.

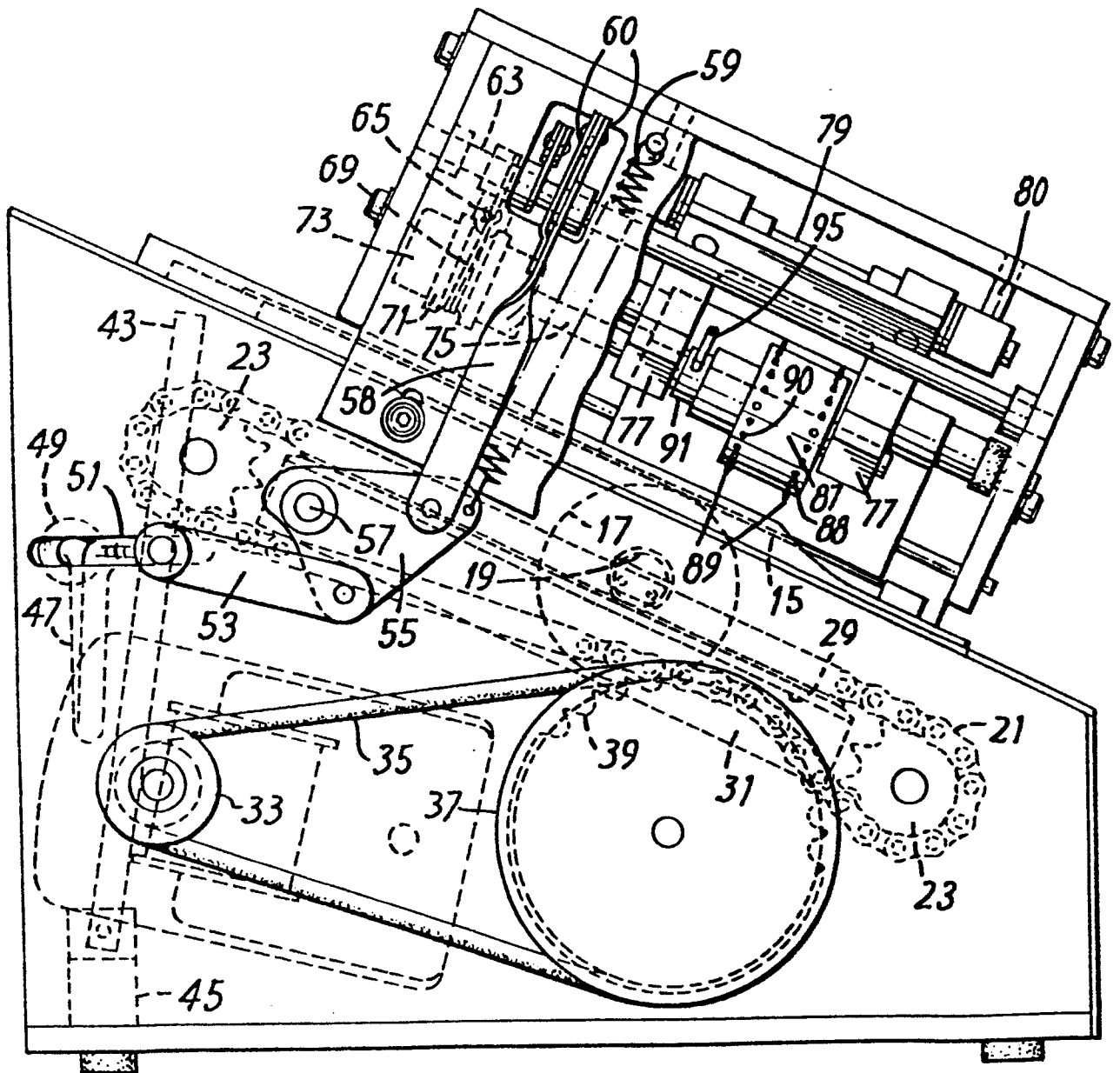
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FIG. 1



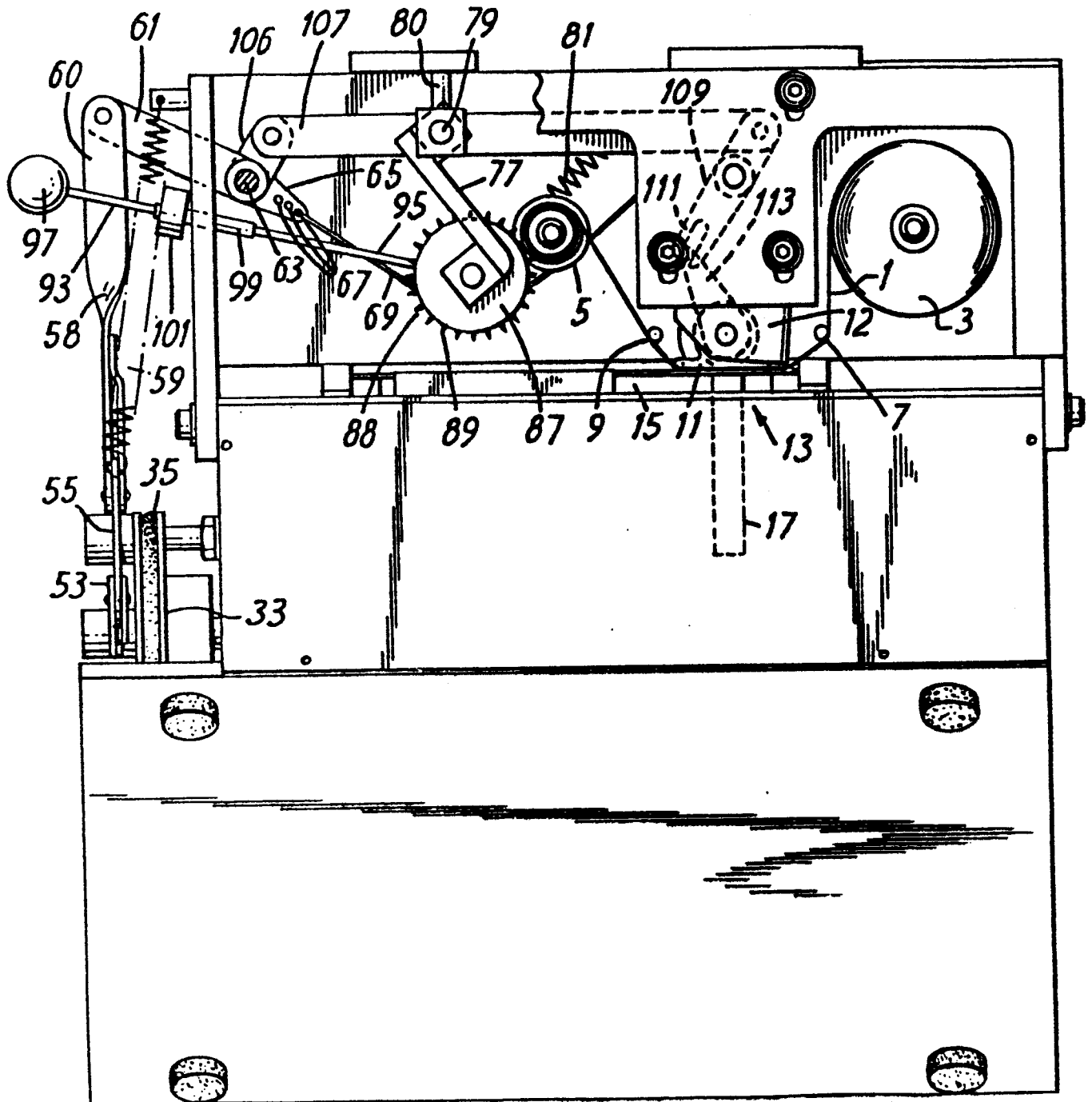
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FIG. 2



3/3

FIG. 3





European Patent
Office

EUROPEAN SEARCH REPORT

Application number
EP 79 30 1421

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DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<u>US - A - 3 217 638</u> (GOTTSCHO) * Column 6, line 25 - column 7, line 2; figures 2,3 * --	1	B 41 K 3/58 B 41 F 31/16
	<u>DE - C - 391 928</u> (BULLOCK) * Page 1, lines 39-64; figures 1,3 * --	6	
	<u>US - A - 3 134 324</u> (MARTIN MACHINE) * Column 1, line 67 - column 2, line 23; figures 1-3 * ----	6	TECHNICAL FIELDS SEARCHED (Int.Cl. ³) B 41 K B 41 F B 41 L B 65 C B 65 H
			CATEGORY OF CITED DOCUMENTS X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
The present search report has been drawn up for all claims			&: member of the same patent family, corresponding document
Place of search The Hague		Date of completion of the search 16-10-1979	Examiner LONCKE