

(12) **EUROPEAN PATENT APPLICATION**

(21) Application number: 86308306.9

(51) Int. Cl.4: **B41F 17/02 , B42D 19/00**

(22) Date of filing: **24.10.86**

(43) Date of publication of application:
27.04.88 Bulletin 88/17

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(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

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(54) **Production of books.**

(57) A method is provided of producing books that exhibit a single roll or scroll (9) upon which is inscribed the complete text and any accompanying illustrations or the like, the method comprising employing a printing machine (1) and a flexible photopolymer printing belt (2) carrying the complete text and any other material that is to be printed, the belt (2) being constrained to follow, during a printing operation, a spiral path around at least one rotary mounting drum (4) and to co-operate with a printing head (12) or another mounting drum to print on a transparent synthetic plastics or paper web (6) substantially as many images as there are spiral revolutions of the printing belt (2) around the mounting drum (4). The printed web (6) is laterally divided by a cutting mechanism (18) to form the book rolls or scrolls (9) and these are longitudinally separated from one another by a cutter (26). Each completely printed roll or scroll (9) is wound and entered into a cassette (50) and a reading frame (52) is provided in which any chosen cassette (50) can be temporarily lodged to enable it to be read by progressively advancing (62) it onto a receiving spool (58) by way of a transmission that will ensure that said roll or scroll (9) is only advanced up to a predetermined maximum amount at each operation of the means (62). Means (Figure 7) is provided by which the text may be illuminated when required and a manually operable fast return mechanism (Figure 12) is pro-

vided to return any finished roll or scroll (9) quickly into its synthetic plastics cassette (50). When opaque rolls or scrolls (9) are used, half the text may be printed on one side and the other half on the opposite side. The fast return mechanism (Figure 12) is then replaced by a second progressive return mechanism (62).

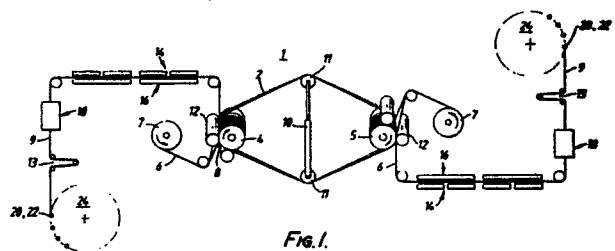


Fig. 1.

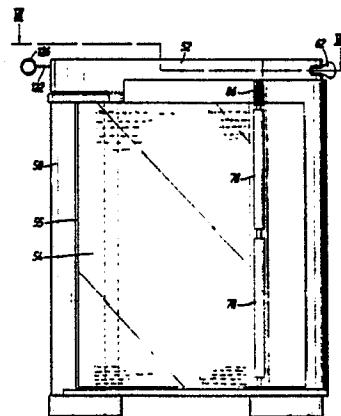


Fig. 5.

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PRODUCTION OF BOOKS

This invention relates to methods of producing books and to books produced by such methods. The conventional book, whether hardbark or paperback, has a number of disadvantages and is somewhat expensive to produce, whatever known printing process is employed. However, an alternative to the conventional book format has been known since antiquity and involves inscribing the complete text, with any illustrations, on a single sheet of material arranged in a roll or scroll that can be progressively wound from one holding roller to another to exhibit the text and any illustrations in a similarly progressive manner in the region in which the roll or scroll is exposed as it passes from one holding roller to the other. Except for very limited religious use, such "roll or scroll" books have been almost entirely superseded by multi-page books following the introduction of reliable methods of binding the pages and, subsequently, by the introduction of relatively fast printing presses.

An object of the present invention is to provide modern methods of producing "roll or scroll" books of the kind very briefly discussed above which methods will result in a modernised, compact and light-weight form of such books becoming available to the public at a significantly lower cost than is possible when they are produced in conventional "multi-page" format.

There is, in fact, no currently available method of mass-producing "roll or scroll" books and, in particular, there is no industrial printing machinery directed to such production. The nearest method of production to that proposed herein that is known to the present applicants is a belt press, essentially in the form of a web letter press, first built in 1968 by the Cameron-Walden Company. This press was intended to speed up the printing of books by producing multiple pages from a single printing head using a continuous synthetic plastics belt on which belt photopolymer plates, exhibiting a number of pages of text, were arranged. This method of printing represented a considerable technical advance as compared with employing the drums of rotary printing presses but the resultant strips of printed text were cut into individual pages for binding into, usually, cheaper paperback books of conventional format.

According to the invention, there is provided a method of producing books of the kind that exhibit a single roll or scroll upon which is inscribed the complete text and any accompanying illustrations or the like, characterised in that the method comprises employing a printing machine and at least one flexible printing belt carrying, in negative, at least half of the complete text and any other ma-

terial that is to be printed, the or each printing belt being arranged to follow a spiral path around the surface of at least one rotary mounting drum at a printing station during a printing operation to print simultaneously onto a web substantially as many images as there are spiral revolutions of each belt around the corresponding drum, employing a cutting mechanism to divide the web into a number of longitudinally extending rolls or scrolls corresponding to the number of printed images, separating completed rolls or scrolls longitudinally from one another, winding them onto spools, packing the wound spools into cassettes and providing a reading frame in which any chosen cassette can be temporarily lodged to enable its roll or scroll to be read by progressively advancing it in at least one direction from the cassette concerned onto a receiving spool of the reading frame.

For a better understanding of the invention, and, to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 is a diagrammatic elevation illustrating the production of "roll or scroll" books by a method in accordance with the invention;

Figure 2 is a side elevation, to an enlarged scale, showing further details of the construction and arrangement of parts that can be seen in Figure 1;

Figure 3 is a further side elevation, to an enlarged scale, showing details of the construction and arrangement of parts that can be seen at the left hand side of Figure 1 of the drawings;

Figure 4 is a part-sectional side elevation showing the roll-or scroll-text of a book produced in accordance with the invention contained in a cassette;

Figure 5 is a front elevation showing the cassette of Figure 4 arranged in a reading frame;

Figure 6 is a section taken on the line IV-IV in Figure 5;

Figure 7 is a basically similar view to that of Figure 6 but is at a lower level in Figure 5 and shows a front wall of the reading frame opened and the way in which one end of a "roll or scroll" book is engaged to be progressively moved through the frame;

Figure 8 is a sectional view showing the construction and arrangement of parts which are at the top right hand corner of the reading frame, as seen in Figure 5, in much greater detail;

Figure 9 is a section taken on the line IX-IX in Figure 8;

Figure 10 is a scrap view, to an enlarged scale, showing the construction and arrangement of parts that are visible towards the right hand side of Figure 5 of the drawings in greater detail;

Figure 11 is a sectional scrap plan view showing the arrangement of a spring-loaded roller carried by the openable front of the reading frame; and

Figure 12 is a sectional elevation showing a fast return mechanism, this mechanism being located at the top, left corner of the reading frame as seen in Figure 5.

Referring to the accompanying drawings and initially to the first three Figures thereof, these Figures somewhat diagrammatically show printing machinery constructed and arranged to produce "roll or scroll" books in accordance with the invention. The printing machinery is generally designated 1 in Figure 1 of the drawings and it will be seen from this Figure that a number of parts are effectively duplicated so that, naturally, such parts will not be described in detail twice. There are two mounting drums 4 and 5 which, during operation of the machinery 1 both rotate in the same direction and at the same speed. It will be evident from Figure 1 that the axes of rotation of the two drums 4 and 5 are non-perpendicularly inclined to the general plane of that Figure whilst being parallel to one another, a single continuous printing belt 2 being wound helically around both drums 4 and 5 (see Figure 2). The belt 2 is a photopolymer printing belt and carries successive "negative" pages 3 of the complete text that are to be printed one after the other onto a web that is preferably transparent polyethelene or other synthetic plastics film 6 having a thickness of between 15 microns and 20 microns. The printing belt 2 itself may have a thickness of, for example, substantially 3 millimetres. The axial length of each relatively large diameter similar drum 4 and 5 is variable to deal with books of different standard lengths and, to accommodate minor differences in length between various books that can be printed using the same rollers 4 and 5, the effective spacing between the two rollers 4 and 5 can be increased or decreased by increasing or decreasing the spacing between two jockey rollers 11 rotatably mounted at the opposite ends of a variable length carrier frame 10 whose length may be mechanically adjustable in any one of a number of different ways including, as diagrammatically illustrated, the use of telescopically co-operating frame parts that maybe moved relative to one another by manually or power-driven screw-threads or by pneumatically or hydraulically operated or other means.

The previously mentioned similar inclination of the axis of rotation of each mounting drum 4 and 5 is sufficient to compensate for the winding pitch of the printing belt 2 around each of them and has the result that each negative page plate 3 on the printing belt 2 meets printing stock 8 (Figure 1), afforded by the film 6 or other web, in substantially precisely parallel relationship with the width thereof. It should, perhaps, be mentioned at this point that, instead of using separate negative pages 3 on the printing belt 2 to produce positive images of separate pages on the synthetic plastics film 6, a paper web may take the place of that film 6 and/or the belt 2 may carry a continuous text, not arranged in "separate page" format, for printing in a continuous manner onto the plastics film or paper 6. With the latter arrangement, the eventual text for distribution to the public will be similar to the format dating from antiquity but the way in which that text is stored and handled is greatly modernised as will become apparent below.

When a single location on the printing belt 2 leaves the drum 4 it passes via one of the jockey rollers 11 to the corresponding end of the other mounting drum 5. Said location is then constrained to follow a spiral path around the rotating drum 5 and eventually leaves its opposite end to return, via the other jockey roller 11, to the corresponding end of the first roller 4 to move spirally along the latter and re-trace its path as many times as may be required. Printing heads 12 are stationed alongside each of the drums 4 and 5 and the region in which each 360° winding of the belt 2 around the corresponding drum 4 or 5 passes one of these printing heads 12 effectively constitutes a printing station having its own web handling unit. Each such station, as will be evident from Figure 2 of the drawings, prints a separate copy of the book roll or scroll although, at any given instant, each printing station is printing a separate page of one of the number of laterally neighbouring rolls or scrolls that are comprised by each film 6 or other web. Thus, the printing machine 1 is effectively a multiplex printing machine. The film 6 is fed from rotary supply drums 7 to the printing stations that have just been mentioned and thence, after printing, through driers 14 which may, if necessary, be combined with coolers 16. The film (or paper) 6 next enters longitudinal cutting mechanism 18 which cuts or slits the film or paper 6 into as many book rolls or scrolls 9 as have been printed laterally across it (see Figure 2). The now separate rolls or scrolls 9 pass through a known roller mechanism 13 in which at least one of the rollers is bodily movable in position to increase or decrease the lengths of the rolls or scrolls 9 that it will contain. This prevents any difficulties occurring during the winding of the individual rolls or scrolls 9

onto spools 20, particularly at the beginning and end of each such winding when the uniform speed of movement of the rolls or scrolls 9 will be temporarily interrupted. It is not essential that there should be two mounting drums 4 and 5 and only a single one may, if desired, be provided. Alternatively, it would be possible to arrange for the belt 2 to co-operate with three or even more mounting drums. Paper or other substantially opaque webs may be printed on both sides in the same basic way. Under these circumstances, two parallel mounting drums will co-operate at the or each printing station instead of one such drum (4 or 5) and a printing head 12. Two printing belts 2, each carrying, in negative, half of the text and any other material of the book that is to be printed also co-operate with the pairs of juxtaposed mounting drums to print, in a single operation, a plurality of complete books on each opaque web 6, the first half of each such book on one side thereof and the second half on the other side.

The printed book rolls or scrolls 9 pass from the roller mechanism 13 to a revolving turret 24 of carousel form upon which turret 24 there are assemblies of the spools 20, which are made of a synthetic plastics material, each spool 20 being destined to receive and retain a corresponding single complete book roll or scroll 9. As can be seen in Figure 3 of the drawings, a cut-off knife 26 is arranged alongside each roll or scroll 9 adjacent to the turret 24 and is, in fact, mounted in such a way that it can move through a short distance at the same speed as the rolls or scrolls 9. The arrangement is such that, when the junction between the start and finish ends of two longitudinally successive rolls or scrolls 9 is reached, the corresponding knife 26 is operated to divide them at the correct point whilst simultaneously attaching a hooking lip 56 to the end of the already wound roll or scroll 9 and attaching the opposite end of the next longitudinally succeeding roll 9 to the central shaft or stem 22 of the spool 20 onto which that roll or scroll 9 is to be wound. Each spool 20 is wound, on the turret 24, around the axis of the respective shaft or stem 22 at a speed corresponding to that of the delivery of the film or paper 6 from the corresponding printing station, the respective roller mechanism 13, as already mentioned above, operating to neutralise any difficulties which might otherwise occur during working of the corresponding knife 26 as discussed above. The hooking lips 56 are of thin, rigid, inwardly (towards the central shaft or stem 22 of each spool 20) angled configuration and, as can be seen towards the foot of Figure 3 of the drawings, each such hooking lip 56 remains projecting through an opening in the wall of a synthetic plastics cassette 50 that houses the corresponding filled spool 20. The cassettes 50

and spools 20 will easily hold the text and any drawings or the like of what would be considered to be a long conventionally produced multi-page book. Purely for example, the roll or scroll 9 carrying a text running to 700 pages will be about 38 to 40 metres in length.

Each individual filled spool 20 is, as already mentioned, placed in a corresponding synthetic plastics cassette 50 which, initially, is open at one end and which has a slot in its cylindrically curved wall through which slot the corresponding hooking lip 56 protrudes. An end cap 51 (Figures 4 and 12) is placed onto the remainder of the cassette 50 and is glued, thermally welded or otherwise permanently secured in place. It will be noted from Figure 4 of the drawings that the centre of the end cap 51 and the centre of the thicker cap at the opposite end of the cassette 50 both comprise simple plain bearings that rotatably co-operate with the flanges at the opposite ends of the spools 20 in allowing the rolls or scrolls 9 readily to be wound into, or out of, the cassettes 50 through the slots in their cylindrical walls.

A reading frame 52 that is shown in Figure 5 and other following Figures is provided to receive each book roll or scroll 9 in its corresponding cassette 50 to enable the text to be read easily and conveniently whilst protecting the roll or scroll 9 from dirt and damage and, when required, providing illumination and/or magnification. The chosen cassette 50 is a push snap fit into the reading frame 52 where it then forms one of the lateral sides of said frame 52 whilst also serving as a handle of the frame. The reading frame 52 is again formed from a synthetic plastics material and has an openable front wall 54 (see Figure 7) all or most of which is transparent and through which, in use, the text is visible. When entering a fresh cassette 50 into the reading frame 52, the front wall 54 is first opened to bring it to substantially the position shown in Figure 7 following which the hooking lip 56 is pulled away from the cassette 50 drawing with it the corresponding end of the roll or scroll 9 concerned. There is a second receiving spool 58 permanently rotatably mounted in the reading frame 52 at the opposite lateral side thereof from the side which receives selected cassettes 50 and its central shaft or stem is formed with an inclined groove or detent 60 into which the lip 56 is entered. The wholly or principally transparent front wall 54 is then closed, being retained in this position by a simple "snap" catch 55 that can be seen in Figure 7.

There is a page-shift lever 62 which projects from a slot in the reading frame 52 and which is operable, against the action of a spring 106, to rotate the "permanent" spool 58 in a direction in which it will wind the selected roll or scroll 9 from

its cassette 50 onto that spool 58. The geometry is such that one full movement of the pivotally mounted lever 62 will produce a one-page advance of the book roll or scroll 9 concerned. Inside the reading frame 52, the lever 62 comprises an arcuately toothed portion 64 whose centre of curvature coincides with the axis about which the complete lever 62 is pivotable. The teeth of the portion 64 mesh with those of a small diameter pinion 66 mounted axially on a drum 68 of a sun and planet system, said drum 68 effectively affording a gear box. Three planet pinions 72 are rotatably mounted on corresponding shafts which are spaced apart from one another at 120° intervals around the axis of rotation of the "permanent" spool 58, said shafts projecting from the upper (in the drawings) surface of a clutch disc 74. The central shaft or stem of the "permanent" spool 58 projects beyond the upper (in the drawings) end through the centre of the clutch disc 74 and into the drum 68 where it carries a central sun pinion 76 whose teeth are in mesh with those of the three surrounding planet pinions 72. The internal surface of the curved wall of the drum 68 is provided with teeth 70 which also mesh with those of the three planet pinions 72. The small pinion 66 which meshes with the arcuately toothed portion 64 is hollow (see Figure 6) and surrounds the shaft which project axially from the drum 68 by way of a one-way drive mechanism 108 comprising sprags or balls and inclined surfaces and being arranged to jam and transmit drive when the pinion 68 tends to be rotated in one direction and to slip and transmit no drive when the pinion is rotated in the opposite direction. Thus, when the lever 62 is turned in one direction, no drive will be transmitted to the "permanent" spool 58 whereas, when it is turned in the opposite direction, the spool 58 will be driven at a multiplied speed by way of the multiplying transmission afforded by the sun and planet pinions in the drum or gear box 68.

A relatively small diameter rubber or other resiliently surfaced roller 78 (Figures 5, 6, 7, 10 and 11) bears against the front surface of the book roll or scroll 9 when the front wall 54 of the reading frame 52 is closed, the roller 78 having substantially the same axial length as the width of the roll or scroll 9 with which it co-operates. The roller 78, which is itself resiliently surfaced, is resiliently mounted in a bulging portion of the reading frame front wall 54 at locations close to its opposite ends and at a substantially central location therealong. The bulging portion of the front wall 54 is slotted to receive the central shaft of the roller 78 and, as can be seen best in Figure 11, the mouth of each slot is slightly constricted at 54C so that the central shaft of the roller 78 can only enter the slot concerned under pressure and by temporary resilient

deformation of the constriction 54C. A helical compression spring 54D is trapped in each slot and tends to urge the corresponding portion of the central shaft of the roller 78 outwardly from that slot through the constriction 54C concerned but is of insufficient strength to overcome the resilient opposition of the walls of the constriction 54C concerned. When the front wall 54 is closed, the resilient roller 78 constitutes one side of a gate 80 whose opposite side is afforded by a smoothly radiused and quite slippery edge 82 of a magazine 84 of the reading frame 52 in which magazine 84 the "permanent" spool 58 of the reading frame 52 is rotatably disposed. The springs 54D urge the resiliently surfaced roller 78 against the front of the book roll or scroll 9 to an extent which is sufficient to ensure that, when said roll or scroll 9 is wound further onto the "permanent" spool 58 by operation of the page-shift lever 62, the resiliently surfaced roller 78 will be rotated around its own longitudinal axis.

The upper end (in the drawings) of the central shaft of the resiliently surfaced roller 78 carries a worm gear 86 whose surface is engaged by a short, arcuate row of teeth 88 formed at one end of a lever 90 whose opposite end is turnable about a pivot 94 whose axis coincides with the axis of curvature of the arcuate row of teeth 88. A helical tension spring 92 bears between the lever 90 and an anchorage on the body of the reading frame 52 so that turning of the lever 90 about its pivot 94 in an anti-clockwise direction as seen in Figure 10 of the drawings is opposed by said spring 92. The pivot 94 about which the lever 90 is turnable is carried by lugs forming parts of a strong leaf spring 96 and, thus, the lever 90 and its pivot 94 are displaceable in position to a limited extent against the resilient opposition of the leaf spring 96. It can be seen in Figures 8 and 9 of the drawings that the lever 90 has a flat side 98 that will normally be substantially vertically disposed when occupying the position shown in the drawings. This side 98 of the lever 90 bears against the rounded end of a short rod 100 whose opposite end carries a concave clamp 101 whose knurled or otherwise roughened concave surface bears against the similarly knurled or otherwise roughened convex periphery of the clutch disc 74 thus normally preventing that disc 74 from rotating. When the resiliently surfaced roller 78 is revolved about its own longitudinal axis in the manner described above, the worm gear 86 is rotated with it and the lever 90 is turned relatively slowly about its pivot 94 in an anti-clockwise direction as seen in Figure 10 of the drawings against the opposition of the spring 92. Eventually, and after a complete page width of the roll or scroll 9 has passed through the transparent viewing window of the reading frame front wall 54,

a recess 102 in the relatively thick lever 90 comes into register with the rounded end of the short rod 100 and a spring 99 urges that end into the recess 102 so that the concave clamp 101 at the other end of the rod is withdrawn from engagement with the periphery of the clutch disc 74. The disc 74 can then rotate with the result that drive from the drum or gear box 68 is no longer transmitted to the "permanent" spool 58.

Further displacement of the page-shift lever 62 brings a projection 103 (Figure 8) which it carries into displacing engagement with the free end of the leaf spring 96 thus moving the lever 90 to the left as seen in Figure 10 of the drawings so that its teeth 88 are no longer in engagement with the worm gear 86 and the spring 92 immediately returns it about the pivot 94 in a clockwise direction as seen in Figure 10. As this rapid displacement occurs, the rounded end of the rod 100 moves along the recess 102 and over an incline 104 (Figure 9) that joins the floor of the recess 102 to the flat side 98 of the lever 90. The result is that the rod 100 is pushed back to the right, as seen in Figure 8 and 9 of the drawings, against the action of the relatively weak spring 99, the clamp 101 again coming into movement-preventing engagement with the periphery of the clutch disc 74. This re-establishes drive from the drum or gear box 68 to the "permanent" spool 58 but the page-shift lever 62 is, by this time, at the end of its possible angular displacement in one direction so that it must return to the opposite end of the slot in the body or casing of the reading frame 52 through which it projects before it can again be displaced in the same direction. This return movement of the page-shift lever 62 does not drive the hollow pinion 66 since it will be remembered that said pinion 66 houses a one-way drive mechanism 108 which will prevent the pinion 66 from rotating the drum 68 by revolving freely relative to that drum 68 when rotated by the lever 62 in this direction. The arrangement which has just been described ensures that every finger-or thumb-operated "flicking" motion of the lever 62 advances the book roll or scroll 9 by not more than one page width. In fact, as the scroll or roll 9 wound onto the spool 58 becomes progressively thicker, a progressively shorter displacement of the lever 62 is necessary at each operation thereof. However, the clutch mechanism that has just been described ensures that not more than one page width is advanced whatever point in the roll or scroll 9 being read has been reached.

Each "page" moves through the very narrow gap between the transparent front wall 54 of the reading frame 52 and a cream-white, flat, translucent, reading plate 110 (Figure 7) that lies immediately behind it. If, as will usually be the case, the roll or scroll 9 is transparent synthetic plastics film

with the text and any other illustrations printed to one side in successive separate page format, the white background provided by the reading plate 110 will give very good contrast for the printing whether it be merely monochrome black or polychrome print. Figure 7 of the drawings illustrates the provision of three lamps 112 located behind the translucent reading plate 110 together with two rechargeable or other batteries 114 and an on/off switch 116. Instead of using small fluorescent tubes or other sources of electrical illumination as the lamps 112, the flat, cream-white translucent reading plate 110 may be replaced by a sheet of electro-luminescent synthetic plastics material such as that known by the Registered Trade Mark "Lisa". This material will glow to an extent sufficient to provide adequate illumination for the print on the roll or scroll 9 when electrically energised by the batteries 114 and is a particularly efficient and electrically economic way of providing any artificial illumination that may be required.

When the book roll or scroll 9 has been fully read by advancing it one page at a time from its cassette 50 onto the "permanent" spool 58 using the page-shift lever 62 in the manner described above for each page advance, it will be necessary to return the whole roll or scroll 9 back into its cassette 50 to allow that cassette to be removed from the reading frame 52 so that another cassette 50 can be substituted. Figure 12 of the drawings shows how this may be quickly brought about. A return mechanism is housed in the reading frame 52 above (in the drawings) the end of any cassette 50 which carries the corresponding end cap 51. The return mechanism is not illustrated, and will not be described, in full detail, but comprises upper and lower sun and planet gearing units 116 and 118 that are both very similar in construction and arrangement to the sun and planet gearing which is associated with the drum or gear box 68 that can be seen best in Figure 8 of the drawings and that has already been described above. A pulley drum 120 is arranged above and around the upper sun and planet gearing unit 116 and has wound around it, with one end secured thereto, a nylon or similar cord 122 whose opposite end projects through a hole 124 to carry a pull ring 126 of larger diameter than is the hole 124. A one-way drive mechanism which is not illustrated interconnects the centre of the rotatably mounted pulley drum 120 and an input stub shaft 128 of the upper sun and planet gearing unit 116 and, upon pulling the cord 122 by way of the ring 126, the unit will be rotated and will produce a greatly increased speed of rotation of a central output shaft. This central output shaft is also the input stub shaft of the lower sun and planet gearing unit 118 and the output shaft of this lower unit 118 is arranged to drive, by way of a

simple dog clutch 130, the central shaft or stem 22 of the spool 20 in the cassette 50 whose book roll or scroll 9 is being re-wound. The "double" speed increase that is provided by the two series-linked units 116 and 118 enables a roll or scroll 9 very quickly to be re-wound without tedious repetitive movement of the cord 122. A helical spring 132 of clock spring form is wound internally of the pulley drum 120 between an anchorage on that drum and an anchorage on the casing of the reading frame 52 and, upon releasing the pull ring 126, the spring 132 will re-wind the cord 122 back onto the pulley drum 120 until the ring 126 is alongside, or very close to, the hole 124. The one-way mechanism associated with the input stub shaft 128 enables this re-winding of the cord 122 to be accomplished without driving the sun and planet gearing units 116 and 118.

As previously mentioned, it is not essential that the text and any illustrations should appear on the book rolls or scrolls 9 in separate page form and, if preferred, the text and any illustrations may be printed continuously but it will be apparent that, under these circumstances, the lines of text will need to extend parallel to the longitudinal axes of the cassettes 50 rather than perpendicular thereto as they do in the embodiment that has already been described in detail. This is the only significant difference as compared with what has already been described and the mechanism that transmits motion from the lever 62 to the "permanent" spool 58 can be arranged so as to move the text onwardly in steps whose lengths substantially correspond with the width of the viewing window in the front wall 54 of the reading frame 52. Under these circumstances, the frame 52 will, of course, be held at right angles to the position in which it appears in Figure 5 so that the lines of text can be read horizontally. Similarly, the handles of the frame 52 which are afforded by the installed cassette 50 and the casing or magazine 84 of the spool 58 will also be disposed horizontally for use with rolls or scrolls 9 carrying "continuous" rather than "separate page" text. Whatever format is adopted for the printing on the book rolls or scrolls 9 when one of them has been finished and has been re-wound into its cassette 50 in the manner described with particular reference to Figure 12 of the drawings, the front wall 54 is opened, the hooking lip 56 is disengaged from the recess 60 in the central shaft or stem of the "permanent" spool 58 and the thumb or finger can be used to engage the drive of the spool 20 in the end cap 51 of the cassette 50 concerned to complete the very short re-winding that will be necessary to bring the hook lip 56 to the gap in the cylindrically curved wall of the cassette 50.

The frame 52 may omit the plate 110 and be arranged so that each chosen roll or scroll 9 passes, for reading, between two parallel panes of transparent plastics material or, if preferred, glass. This is appropriate for reading opaque rolls or scrolls bearing text on both sides as mentioned earlier herein. Once one half of a book has been read, the roll or scroll concerned is returned, page by page, to the cassette 50, merely reading the second half thereof from the opposite side of the complete frame 52. When this construction is adopted, the fast return mechanism described with particular reference to Figure 12 of the drawings is replaced by a page advance mechanism exhibiting a second lever 62, this mechanism being very similar to the one that has already been described for operating the spool 58.

It is envisaged that the cassettes 50 should be supplied in strong synthetic plastics holders which will protect the cassettes from both dirt and damage and that can carry, on their outer surfaces, details of the corresponding "books". Such an arrangement is convenient for public and private library use for both adults and children and, in most cases, will enable the same amount of text to be carried in a smaller volume of space than would be possible using a conventional "bound page" book with similar print size.

It would be possible, for persons with poor eyesight, to arrange a simple holder in front of, and connected to, the openable front wall 54 of the reading frame 52 in which holder a flat lens of known formation could be removably arranged to assist any person requiring such help to read the text on any standard book roll or scroll 9. This arrangement does away with the need for "large print" books of the kind that are now available in public libraries and for private sale to persons with defective vision.

Claims

1. A method of producing books of the kind that exhibit a single roll or scroll (9) upon which is inscribed the complete text and any accompanying illustrations or the like, characterised in that the method comprises employing a printing machine (1) and at least one flexible printing belt (2) carrying, in negative, at least half of the complete text and any other material that is to be printed, the or each printing belt (2) being arranged to follow a spiral path around the surface of at least one rotary mounting drum (4) at a printing station during a printing operation to print simultaneously onto a web (6) substantially as many images as there are spiral revolutions of each belt (2) around the corresponding drum, employing a cutting mechanism

(18) to divide the web (6) into a number of longitudinally extending rolls or scrolls (9) corresponding to the number of printed images, separating (26) completed rolls or scrolls (9) longitudinally from one another, winding them onto spools (20), packing the wound spools (20) into cassettes (50) and providing a reading frame (52) in which any chosen cassette (50) can be temporarily lodged to enable its roll or scroll (9) to be read by progressively advancing it (62) in at least one direction from the cassette (50) concerned onto a receiving spool (58) of the reading frame (52).

2. A method according to claim 1, characterised in that the printing machine (1) comprises a plurality of rotary mounting drums (4, 5), and in that the same printing belt or belts (2) is or are each arranged to follow a spiral path, during a printing operation, around each of said drums (4, 5), there being means to co-operate with the belt or belts (2) at each drum (4, 5) to produce a corresponding printing station at which a respective web (6) may be printed on one or both sides from the belt or belts (2).

3. A method according to claim 1 or claim 2, characterised in that the text and any other material that is to be printed is arranged, in negative, upon the or each flexible printing belt (2) in a "separate" page format, and in that a transmission between the progressive advance mechanism (62) of the reading frame (52) and the receiving spool (58) is constructed and arranged to advance the roll or scroll (9) carried by any cassette (50) temporarily lodged in the reading frame (52) by one page width at each operation thereof.

4. A method according to claim 1, characterised in that the webs (6) onto which the text and any other material is printed comprise transparent synthetic plastics film having a maximum thickness of substantially 20 microns.

5. A method according to any preceding claim, characterised in that, at the or each location (26) at which the completely printed rolls or scrolls (9) are divided longitudinally from one another, means is provided to secure a hooking lip (56) to one end of one roll or scroll (9), and to secure the opposite end of the adjoining roll or scroll (9) to the central shaft or stem (22) of the spool (20) onto which that roll or scroll (9) is to be wound.

6. A method according to any preceding claim, characterised in that at least one rotary turret (24) of carousel formation is provided, which turret (24) is supplied with a plurality of empty spools (20) to receive the fully printed, laterally divided (18), and longitudinally separated (26) rolls or scrolls (9).

7. A method according to any preceding claim, characterised in that the reading frame (52) is provided with an openable front wall (54) of wholly or partly transparent formation, and in that, when

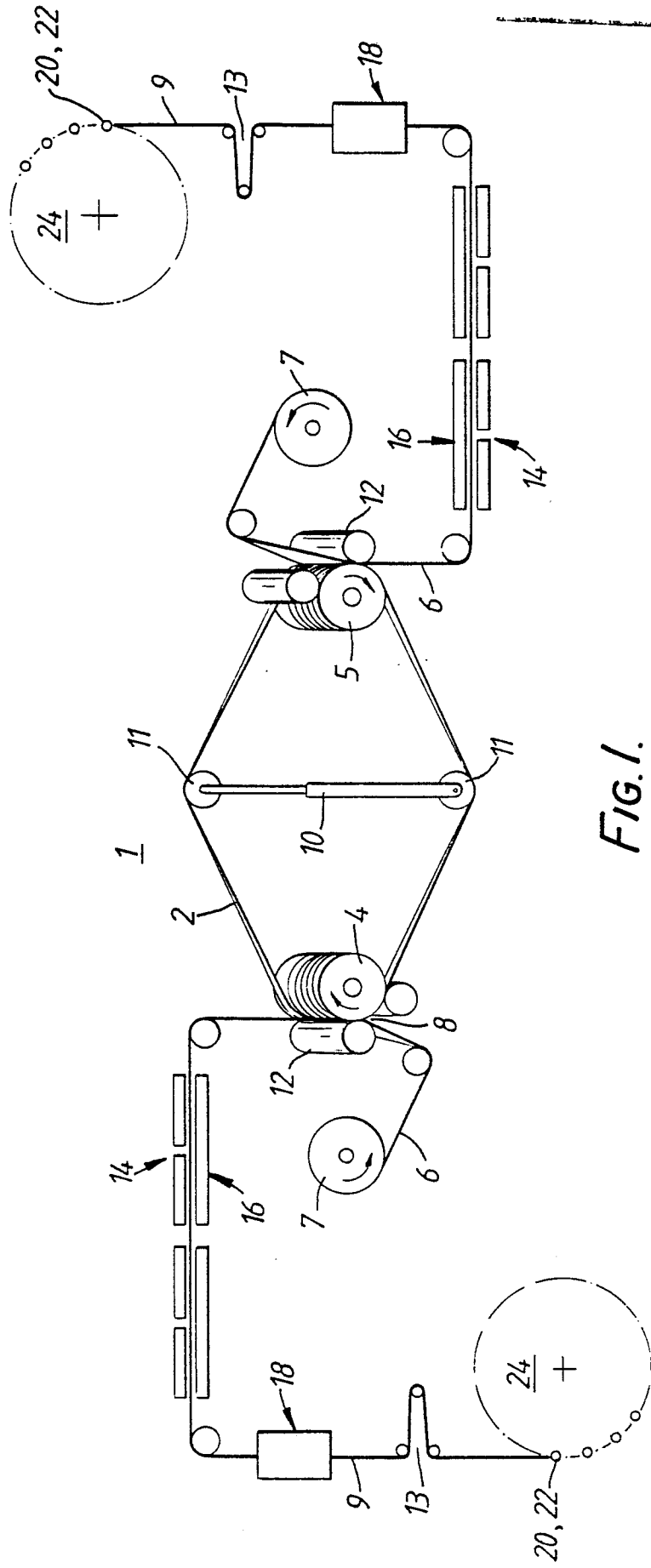
opened, the roll or scroll (9) of any selected cassette (50) can have one end region thereof wound over a flat reading plate (110), the openable front wall (54) subsequently being closed after engagement of the free end of the roll or scroll (9) concerned with the receiving spool (58).

8. A method according to claim 7, characterised in that the flat reading plate (110) is formed from an electroluminescent material, and in that electricity supply means (114, 116) is provided to enable any selected roll or scroll (9) to be illuminated from its rear when required.

9. A method according to any preceding claim, characterised in that the progressive advance means (62) is connected to the receiving spool (58) by a transmission (Figures 8, 9, 10, 11) which comprises a one-way drive (108) and clutch means (74, 90, 101, 102) arranged automatically to withdraw drive from the receiving spool (58) when a predetermined length of advance of the roll or scroll (9) has been effected, and in that a manually operable fast return mechanism (Figure 12) is provided to re-wind into its cassette (50) any finished book roll or scroll (9).

10. A book when produced by a method in accordance with any preceding claim.

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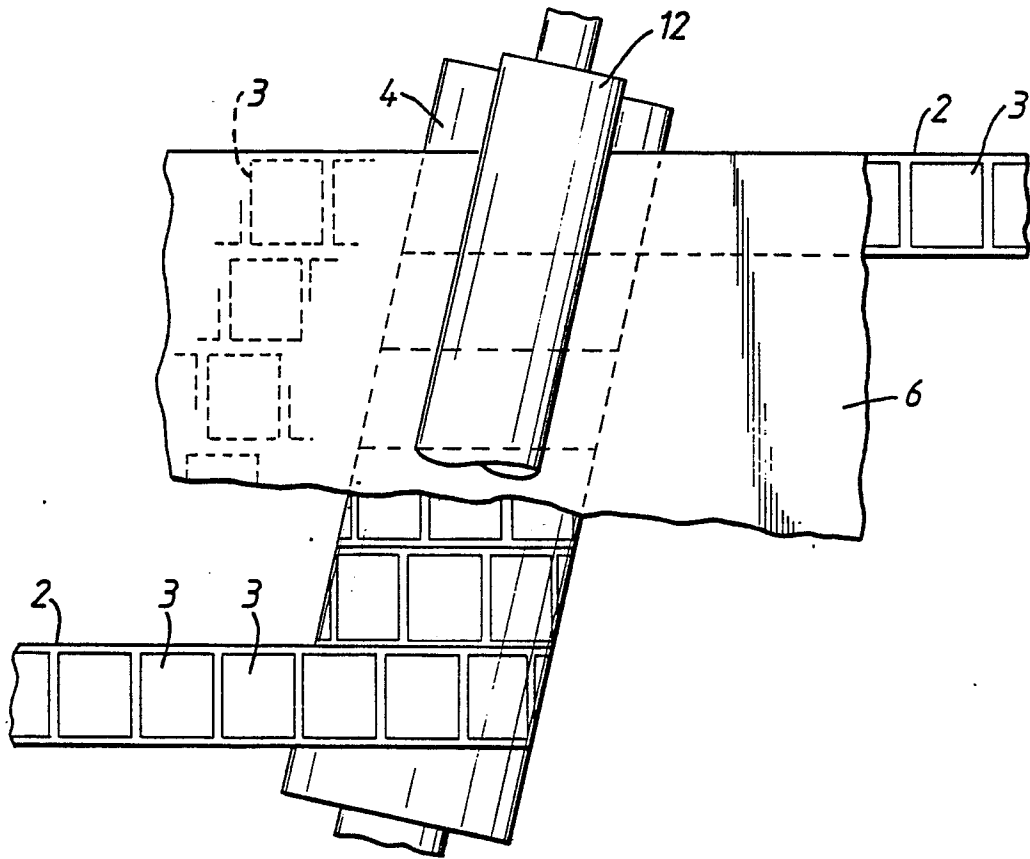


FIG. 2.



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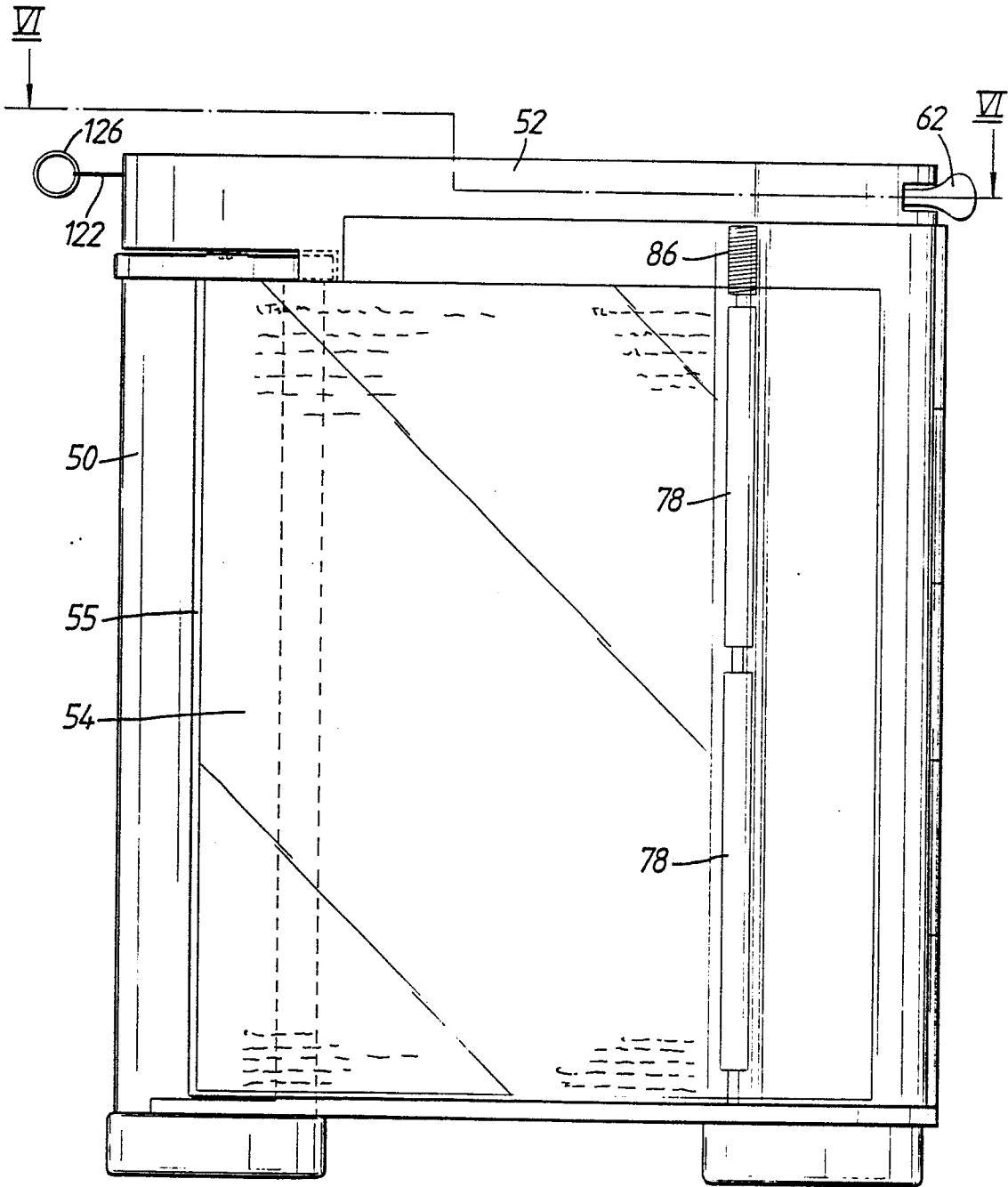


Fig. 5.



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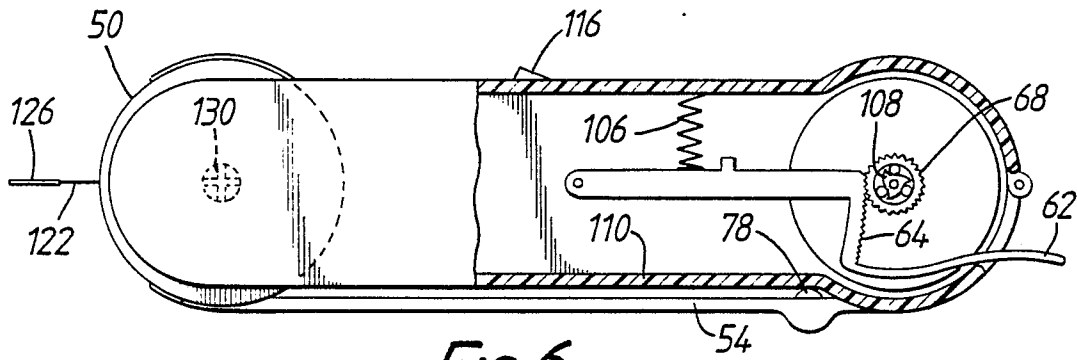


FIG. 6.

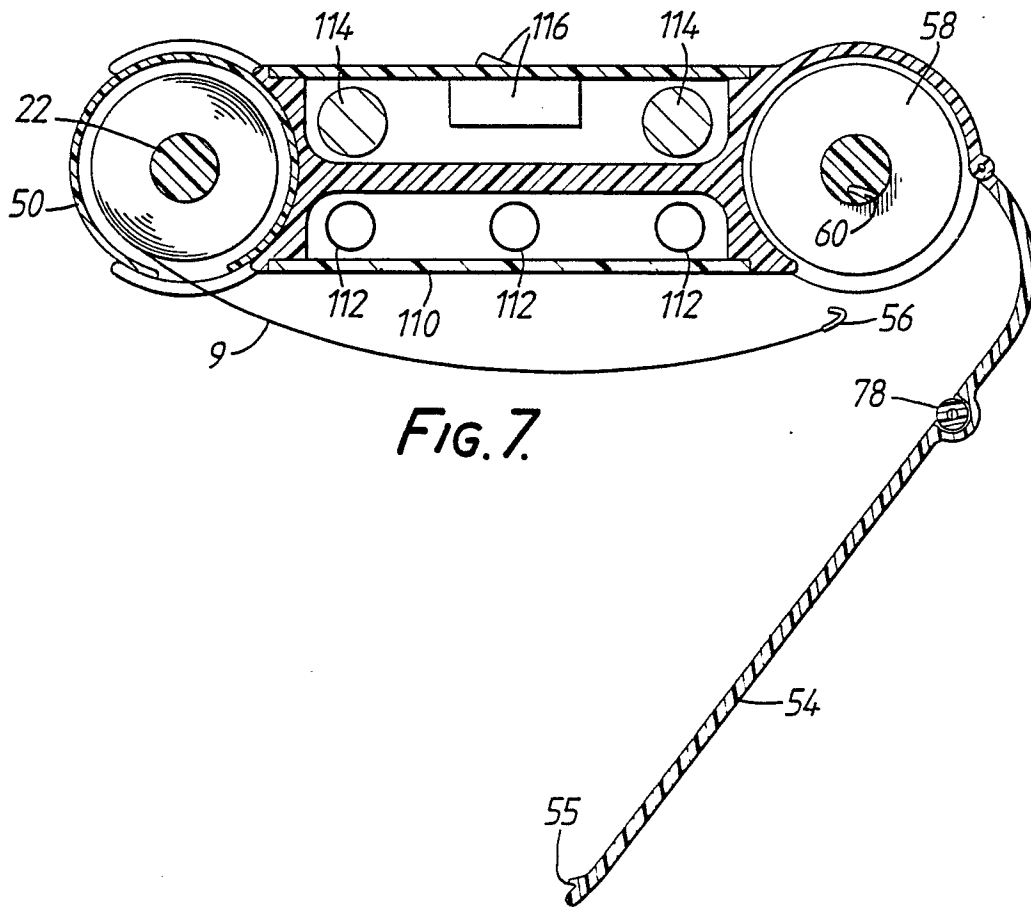


FIG. 7.



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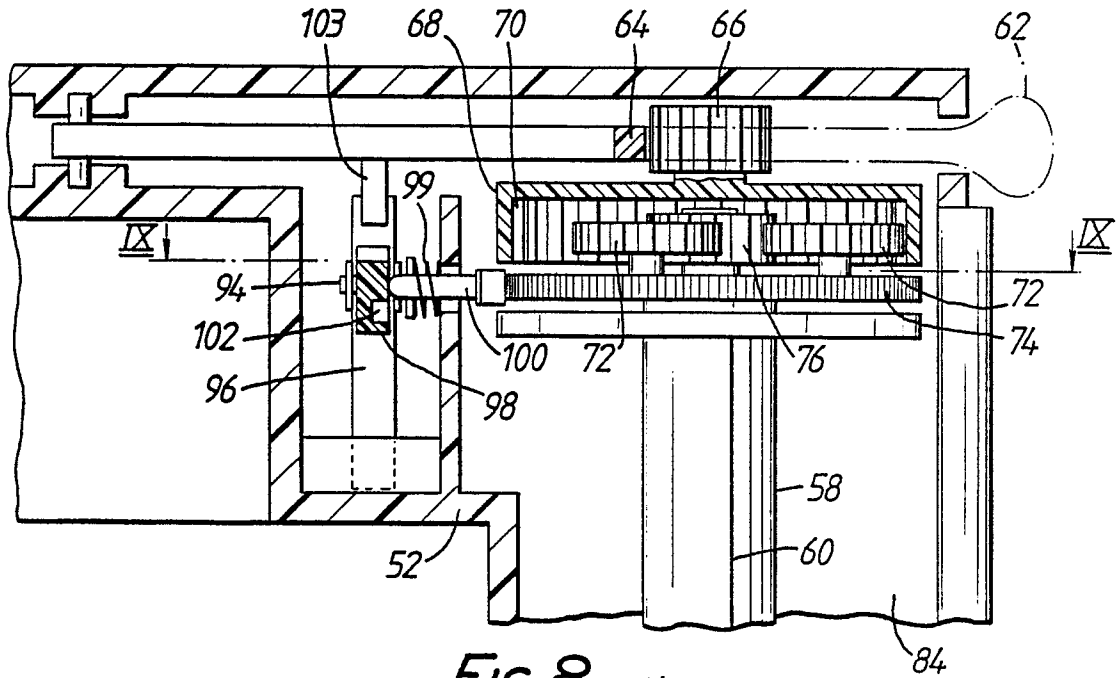


FIG. 8.

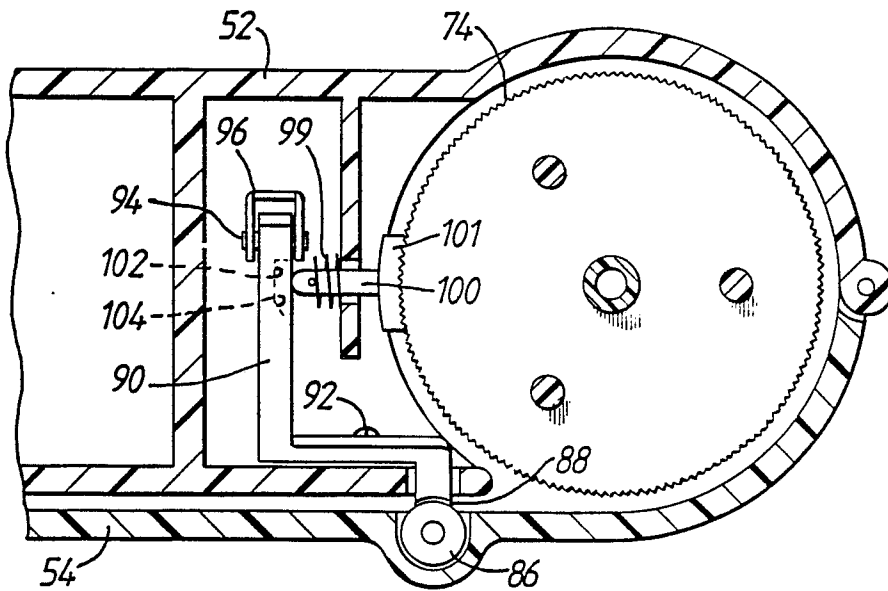


FIG. 9.

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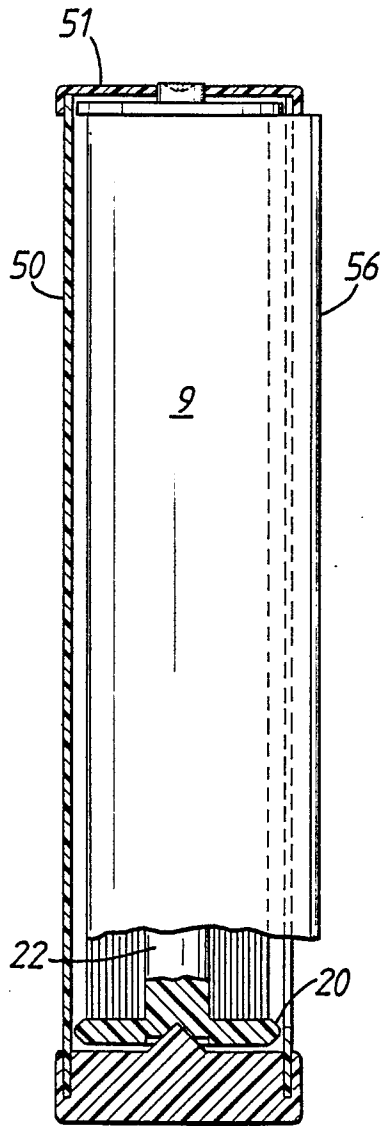


FIG. 4.

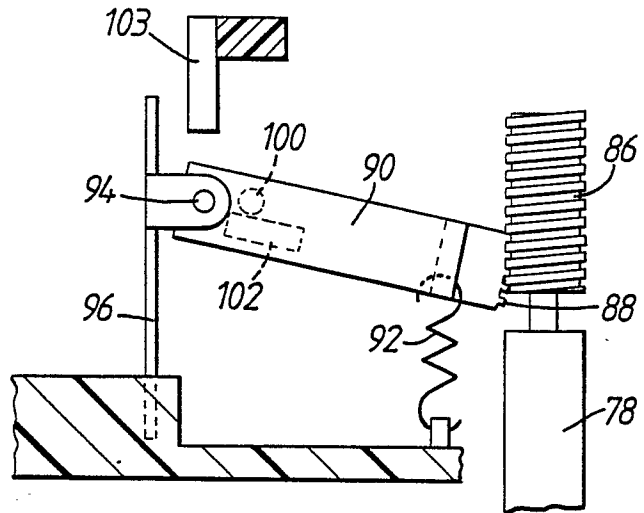


FIG. 10.

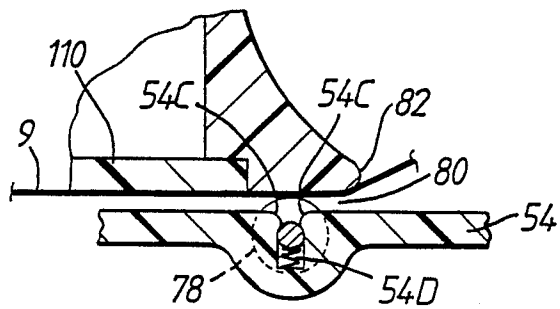


FIG. 11.

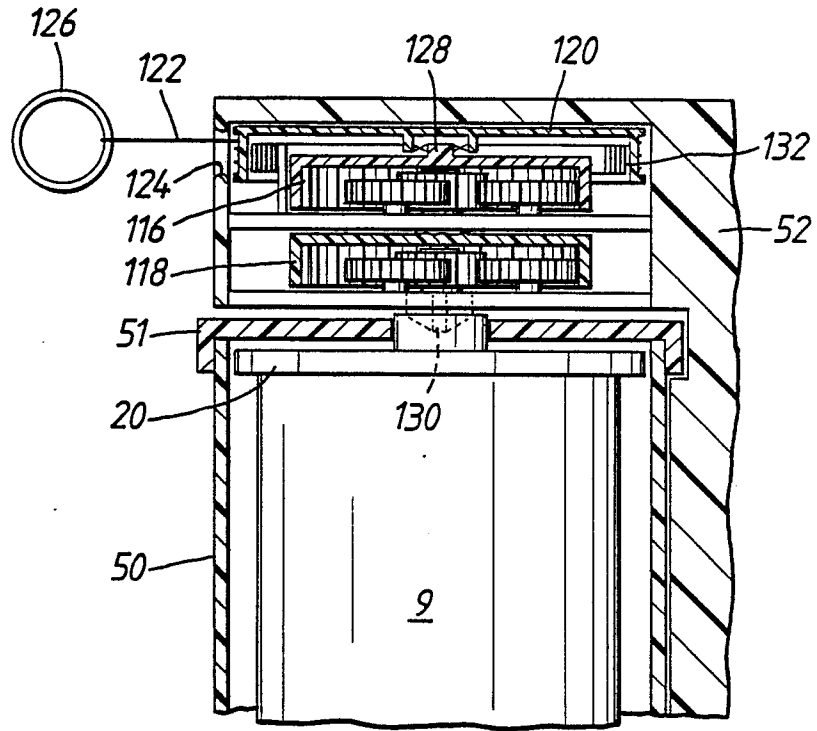


FIG. 12.



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	US-A-2 066 179 (HAMMERMILL PAPER) * Whole document *	1	B 41 F 17/02 B 42 D 19/00
A	FR-A- 990 033 (SEMPERIT) * Whole document *	2	
A	GB-A-1 446 346 (ELLIS) * Page 2, lines 19-82; figures *	7*	
A	US-A-2 629 043 (HOLTJE) * Column 1, line 53 - column 2, line 52; figures *	8	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			B 42 D B 41 F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25-06-1987	Examiner LONCKE J.W.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>			