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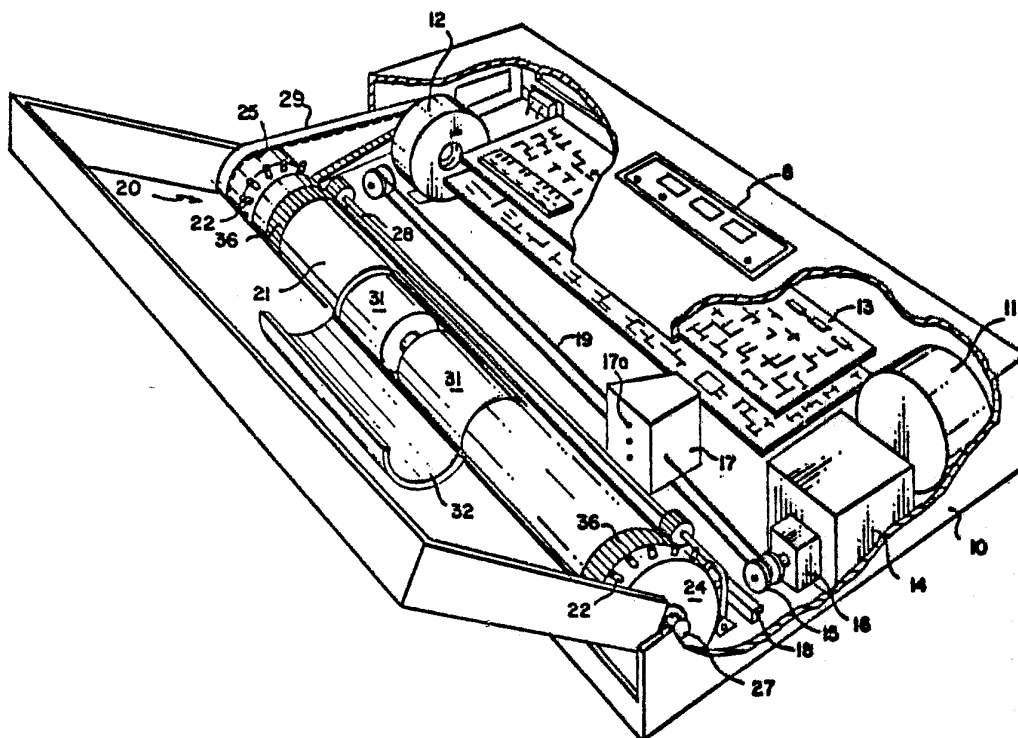
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(54) Title: COMPACT BATTERY-POWERED PRINTER



(57) Abstract

A portion of print medium transport system of an electrically operable printer is constructed to house battery power sources. This construction enables size reduction of the printer. Disclosed embodiments include housing cylindrical batteries in a printer platen and housing batteries of other configurations in sheet guide structure of the printer.

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COMPACT BATTERY-POWERED PRINTERThe Technical Field

The present invention relates to battery-powered printing apparatus, and more particularly to a space-economizing construction for such apparatus.

The Background Art

As devices such as personal computers and word processors have become more numerous and smaller, there has arisen a concurrent desire to provide smaller output printers for those devices. Such output printers use various printing technologies, e.g. impression or dot matrix impacting, thermal dye transferring and ink jet printing such as piezo-electric or thermal drop on demand devices. A common requirement for output printers using the above or other printing technologies is an electrical power source.

U.S. Patent 3,344,899 points out that it is highly advantageous for such data transferring machines to be "portable", implying that the machines desirably incorporate their own source of electrical power. However, even with the improvements that have been incorporated into small batteries, the power requirements for operating such output printers necessitates either: (i) the dedication of considerable volume within a printer housing or (ii) the approach of using a separate portable power supply. Neither of these alternatives is attractive from the viewpoint of the consumer who wishes maximum capability with the minimum baggage.

The Invention

Thus an important purpose of the present invention is to provide improved configurations which contribute significantly toward enhanced compactness in a battery-operable printer. The invention is

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advantageous from the viewpoint of providing the user a more readily portable output printer, e.g. easily fitting within a portion of a briefcase. The invention also is advantageous in providing adequate
5 power for such a printer in reliably operable construction. Further, the present invention provides a conveniently located battery housing and an easily effected mode of battery installation.

The above and other objects are accomplished,
10 in accord with the present invention by providing in a printer of the kind having electrically powered printing components and a print medium transport means, such as a feeding and/or guiding member, an improved power supply construction that comprises a
15 battery housing formed within such transport means, terminals couplable to batteries inserted in such housing and circuit means connecting those terminals to electrically operated components of the output printer.

20 The Drawing Description

The subsequent description of preferred embodiments is set forth with reference to the attached drawings wherein:

Figure 1 is a perspective view of printer
25 apparatus incorporating one preferred embodiment of the present invention;

Figure 2 is a cross-sectional view of a portion of the apparatus shown in Figure 1.

Figure 3 is a cross-sectional view similar to
30 Figure 2, but showing an alternative embodiment of the present invention;

Figure 4 is a cross-sectional view similar to Figure 2, but showing an alternative embodiment of the present invention;

35 Figure 5 is a cross-sectional view similar to Figure 2, but showing an alternative embodiment of the present invention;

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Figure 6 is a partial perspective view showing an alternative embodiment of the present invention;

Figure 7 is a cross-sectional view similar to Figure 2, but showing an alternative embodiment of the present invention;

Figure 9 is a partial perspective view showing another embodiment of the present invention;

Figure 10 is a cross-sectional view of a portion of the Figure 9 embodiment;

Figure 11 is a perspective view of another embodiment of the invention; and

Figure 12 is a cross-sectional view of a portion of the Figure 11 embodiment.

15 The Description of Embodiments

In general, the exemplary printer embodiment shown in Figure 1 comprises a main housing 10 within which are mounted print head motor 11, platen motor 12, and printing and drive control circuit boards 13. The motor 11 is coupled via a gear reduction drive (shown generally as 14) to a cable drive spindle 15 housed in journal 16. Rotation of motor 11 traverses print head assembly 17 along its support bar 18 by virtue of its coupling to one strand of endless drive cable 19. Motor 12 is coupled to the print media transport system 20 by gear means, e.g. a gear train or geared drive belt 29. The transport system 20 is described in greater detail below, however, in general it functions to move print medium, e.g. paper, past the transversing printing path of the print head 17. Thus, under control of circuits 13, print sheet portions are sequentially indexed and the print head traverses across the indexed portion to effect printing, e.g. by ejected ink drops, selective thermal heating or by impact printing. That is, the ink jet print head 17 (with ejection orifices 17a) is only

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exemplary of various printing technologies with which the present invention is useful.

Referring now to Figure 2, as well as Figure 1, it can be seen that the printer of this embodiment of the invention comprises a rotatable platen 21 having thereon sprocket teeth 22 which are constructed for advancing tractor-fed paper types. The ends 23 of the platen are coupled to end plates 24, one of which has a drive gear 25 adapted to mesh with gear means 29. Both end plates 24 have bearing surfaces 26 adapted to support the platen for rotation on the journal surface 27a of shaft 27. A bail assembly 28 is mounted within the printer to engage friction surfaces 36 of the platen in a known manner.

In the embodiment of the present invention shown in Figures 1 and 2, the transport system 20 is constructed to house a source of battery power for operating the printer. Specifically, platen 21 is formed as a hollow shell adapted to move around a plurality of cylindrical batteries 31, e.g. five nickel-cadmium "C" size batteries, connected in series. As shown in Figure 1, the platen 21 comprises an access door 32, which is openable for insertion of the individual batteries and is hinged internally of the platen so as to present a smooth cylindrical surface when closed. After insertion through door 32, the front and rear batteries of the series are moved into supporting engagement with complementary shaped end caps 33, here formed as integral portions of journal shafts 27. As shown in Figure 2, both end caps contain contact springs 34 which are adapted to make electrical connection with the terminals of inserted batteries and which are coupled to the power distribution system 35 for the printer. From system 35 electrical energy is supplied via portions of control panels 13 to motors 11 and 12, print head 17

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and other electrically energized portions of the printer, e.g. execution panel 8, detection and interface electronics of the printer.

In operation of the printer shown in Figures 1 and 2, the batteries 31 do not rotate with the platen 21. This is advantageous from the viewpoints of minimizing drive energy and eliminating the necessity of brush contacts. Also, the approach of stationary batteries decreases the momentum of the platen, which is particularly useful in achieving accurate indexing of the platen, and thus the print medium. Thus, rotation of the platen will advance edge-perforated paper print medium via sprockets 22 or individual sheets via the pinching engagement between the roller of bail 28 and the opposing platen surface, which can have a rubber surfacing shown at 36 in Figure 1.

Figure 3 discloses an advantageous modification of the previously described embodiment wherein the support caps 33 are joined by an arcuate support shelf 37 that extends between the lower sectors of the caps within the bottom of the platen 21. In this embodiment, all batteries nest in the shelf 37 to prevent rubbing between inserted batteries and the rotating platen 21.

Figure 4 illustrates another embodiment of the present invention wherein non-rubbing support of the batteries is effected by cooperation of end caps 33 and a battery package which retains the series connected batteries in a "stick" format 31a by encapsulating wall member 39. Such multi-battery packages are commercially available, e.g. the "Power Stick" battery from General Electric Company. In this embodiment coil spring 34a forms the electrical contact at one end of the battery stick to facilitate battery insertion into end caps 33. Also, the battery

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access door 32 of the platen 21 is elongated from the size shown in Figure 1 so that the battery stick can be compressed against spring 34a and then released to engage the terminal 34 in the opposite end cap 33.

- 5 Figure 5 shows another preferred embodiment wherein the batteries remain stationary during print media advance. In this construction the battery stick 31a, described with respect to Figure 4, itself forms a platen over which print media is advanced.
- 10 Tractor-fed paper advance is again effected by the rotation of sprocket 22; however, ordinary sheet feed is effected by means of a drive 41 coupled to the roller 42 of the bail system 28. In the Figure 5 construction, the battery stick 31a is retained in a
- 15 stationary operative relation with contacts 34 by magnetic couplings 43.

- Figure 6 illustrates another embodiment of the invention in which the bail assembly 28' is rotated to effect print medium advance. In this
- 20 embodiment the battery housing 46 forms guide means having a guide surface 47 that directs the print medium into and out of the printing zone. The rollers 42 are driven via shaft 48 by drive gear 49, which can be coupled to the gear means 29 of the printer. The
- 25 guide surface 47 is preferably coated with a low friction material. Thus, neither the batteries nor housing 46 rotate during operation. The member 46 can be a battery casing itself and, as shown, the battery configuration need not be cylindrical.

- 30 Figures 7 and 8 illustrate embodiments of the present invention wherein batteries rotate with the media transport system. In the Figure 7 embodiment, the platen 51 is configured to support the batteries for rotation therewith, i.e., the separate support
- 35 structure of Figures 2 and 3 has been eliminated. Instead, end caps 53 are constructed to support spring

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contacts 54 in brushing connection with the terminals of batteries 31 during rotation of the platen 51.

In the Figure 8 embodiment, a battery stick 31a itself forms the rotative platen of the printer.

5 In this embodiment end plates 64 have flanges 64a which are adapted to support the battery stick and to communicate rotative drive thereto. The stationary end caps 63 are again constructed to support spring contacts 68 in brushing electrical connection with the
10 end terminals of the battery stick 31a.

Figures 9 and 10 show another embodiment of the invention wherein a plurality of individual batteries or a battery stick can be inserted into a rotatable platen from the side of the printer housing
15 70. Thus, a cap 71 is adapted to interfit with an opening 72 of the housing 70, for example by screw threads 73. Electrical connection of inserted batteries to power distribution system 35 is made by means of battery spring 74, which is coupled to
20 contact ring 75 on cap 71. When cap 71 is in the interfitting engagement, ring 75 electrically connects to contact washer 76, which in turn is coupled to system 35. Platen-housing 78 is mounted at one end in bearing 79 and coupled at its other end to rotary
25 drive, not shown.

Figures 11 and 12 disclose another embodiment of the present invention wherein a battery-stick platen 81 is removable from the printer, e.g. by means of a bottom access door 82. As shown in Figure 12,
30 tractor feed wheel 83 has a resilient seating recess 84 adapted to be secured on the end of battery stick 81. A coupling key portion 85 of feed wheel is adapted to interfit with drive gear 87, and the other end 86 of portion 85 is forced into electrical contact
35 with the terminal of battery stick 81. The opposite end of battery stick 81 is similarly fitted with a

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tractor wheel 83', which has a bearing shaft adapted to seat in a bearing recess of the printer wall. When the battery stick with its fitted tractor feed wheels is inserted through the opening provided by door 82, 5 the keyed portion 85 of wheel 83 interfits with a slot of gear 87. A spring/contact 88 urges gear outwardly from its bearing 89 in the printer wall. The spring is electrically coupled to an electrically conductive central portion of gear 86, which interfits with keyed 10 portion 85, and to an electrical lead to power distribution system 35. A dielectric ring 90 is adhered to the wall around bearing recess 89 to prevent grounding of spring. After insertion of the battery stick unit into the printer, the unit is rotatable by 15 printer drive means coupled to gear 87 and power is supplied by means of the above-described connections from conductive portions 85 and 86 of the tractor wheel. It will be appreciated that the same structural configurations can be used to removably 20 mount a cylindrical housing for separate batteries, rather than a battery stick. In such an arrangement the platen wheels can form caps on the cylindrical battery housing.

Industrial Effect

25 From the foregoing it can be appreciated that the present invention provides significant technical advantage from the viewpoints of providing a more compact battery operable printer, wherein the batteries are also conveniently and reliably housed.

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The Claims:

1. In portable printer apparatus of the kind having printing component(s) that are operated electrically and transport means for guiding and/or
5 feeding a print medium through the operative print path of said apparatus, an improved construction for battery power supply comprising:
 - (a) a battery housing formed at least partially in said transport means;
 - 10 (b) electrical terminal means couplable to batteries inserted in said housing; and
 - (c) circuit means coupling said terminal means to said electrically operated printing component(s).
- 15 2. The invention defined in claim 1 wherein said transport means comprises a hollow roller.
3. The invention defined in claim 2 wherein said roller forms a print platen of said printer apparatus.
- 20 4. The invention defined in claim 2 or 3 wherein said roller is constructed to house a plurality of cylindrical batteries in an end-to-end relation.
5. The invention defined in claim 2 or 3
25 wherein said roller is rotatably mounted in said printer apparatus and wherein said battery housing includes end members, with respect to which said roller rotates, that are constructed to support portions of inserted batteries in electrical non-rotating
30 connection with said terminals.
6. In portable printer apparatus of the kind having printing component(s) that are operated electrically and transport means for guiding and/or
35 feeding a print medium through the operative print path of said apparatus, an improved construction for battery power supply comprising:

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(a) battery means forming at least a portion of said transport means;

(b) electrical terminal means couplable to said battery means; and

5 (c) circuit means coupling said terminal means to said electrically operated printing component(s).

7. The invention defined in claim 6 wherein said battery means comprise at least a portion of a
10 transport roller.

8. The invention defined in claim 7 wherein said roller forms a print platen of said printer apparatus.

9. The invention defined in claim 7 or 8
15 wherein said roller comprises a plurality of cylindrical batteries in an end-to-end relation.

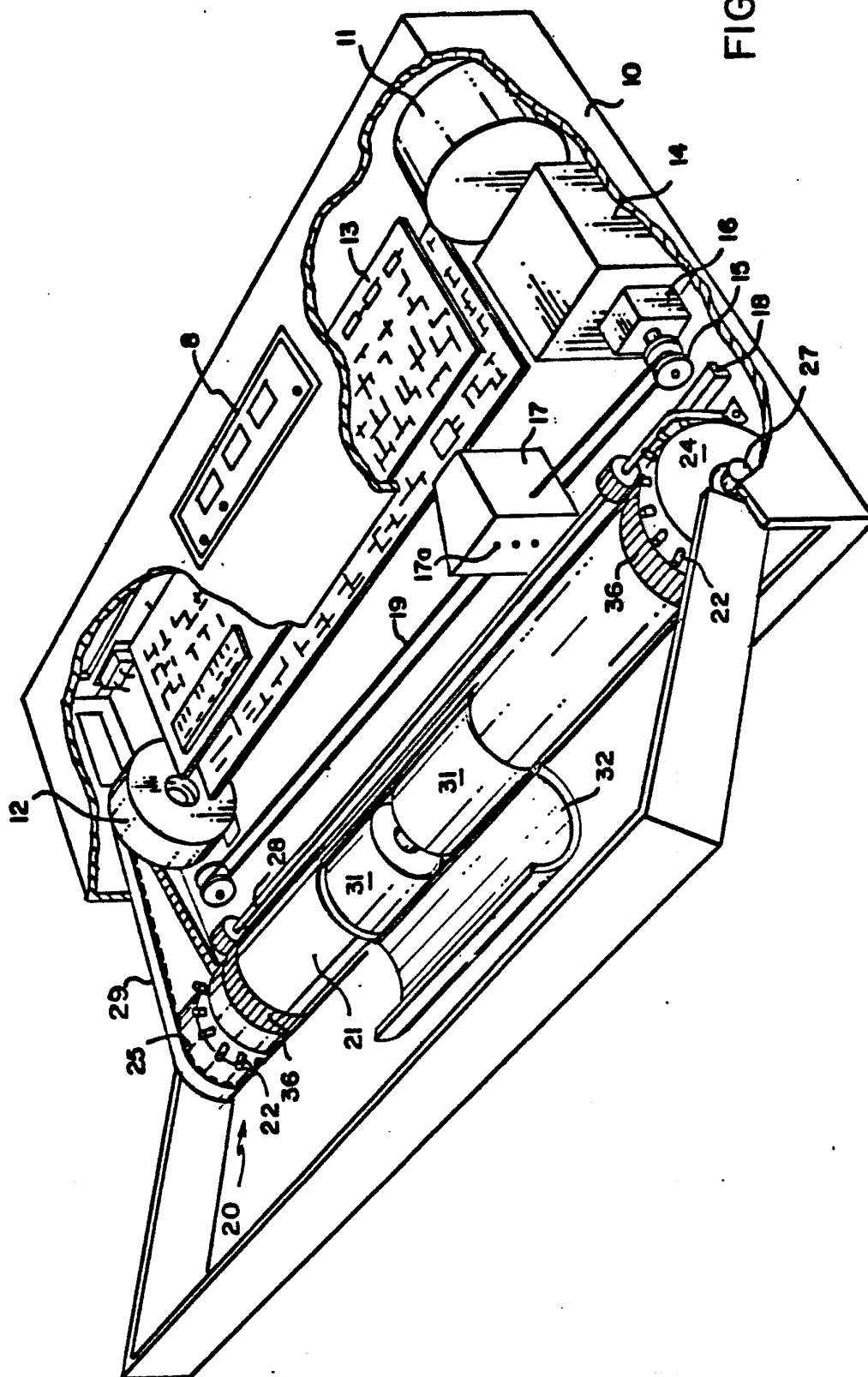
10. The invention defined in claim 7 or 8 wherein said roller is rotatably mounted in said printer apparatus and wherein said terminal means are
20 constructed to contact portions of said battery means during rotation of said battery means.

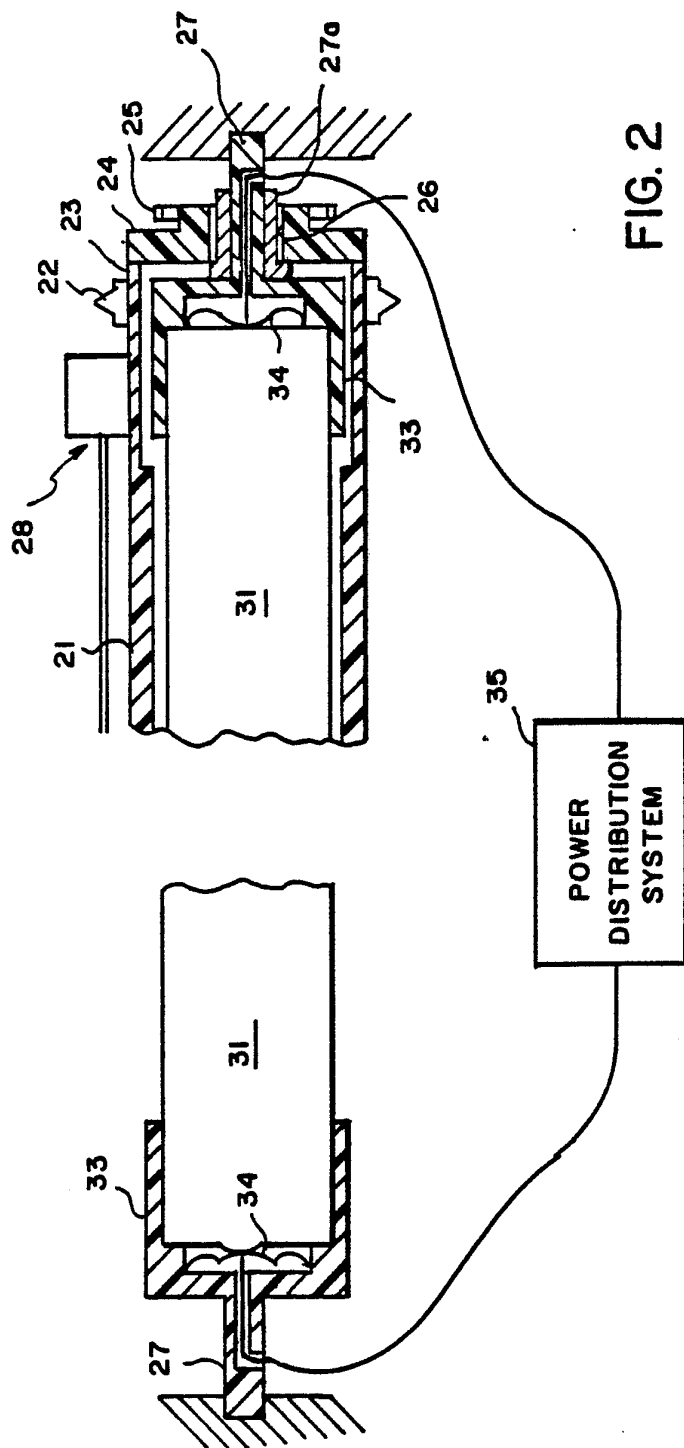
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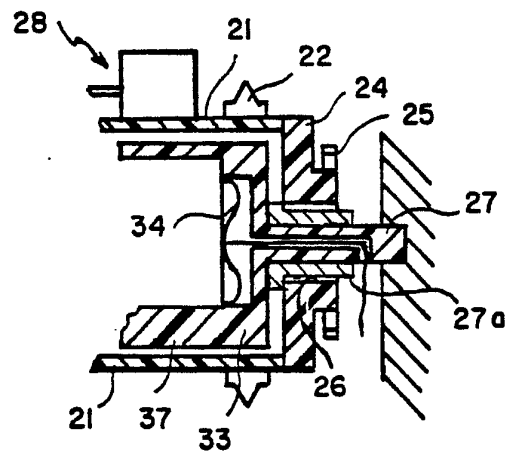


FIG. 3

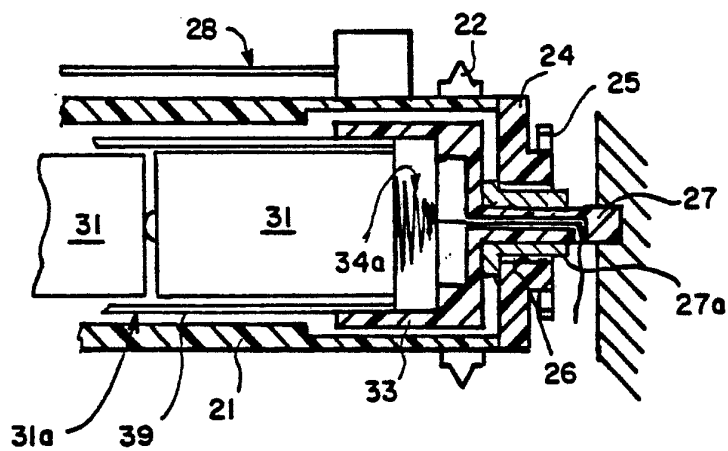


FIG. 4

SUBSTITUTE SHEET

FIG. 5

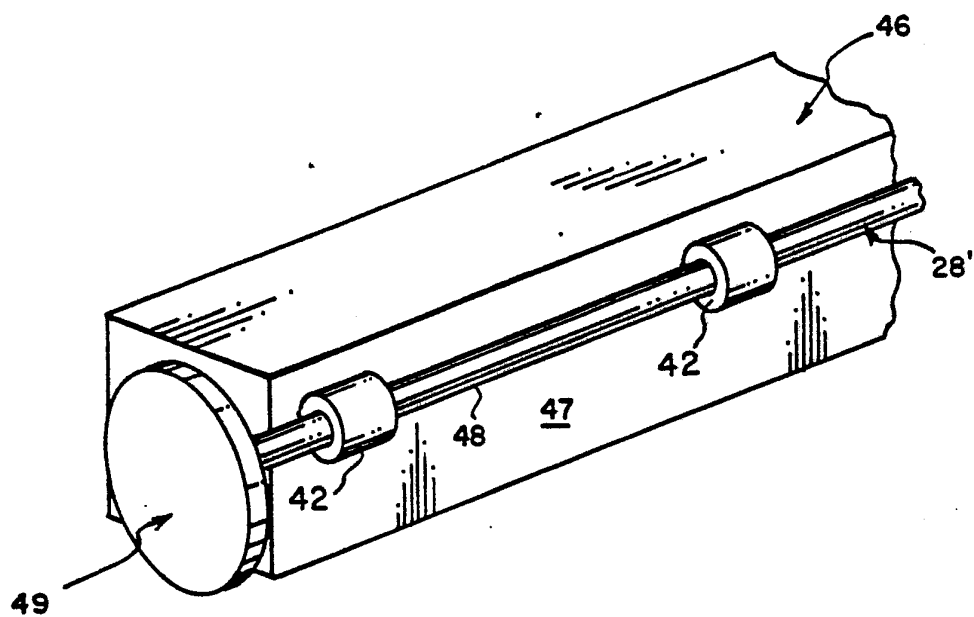
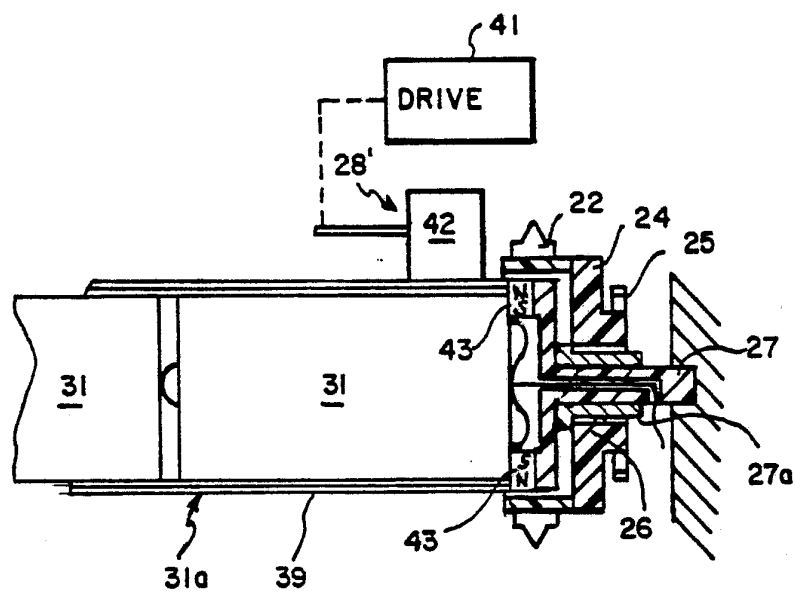


FIG. 6

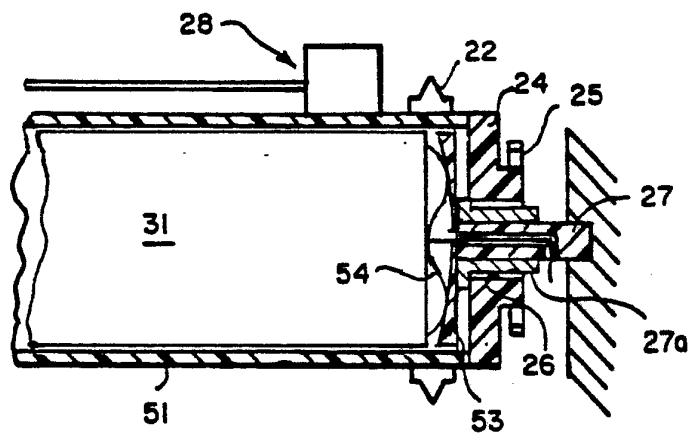


FIG. 7

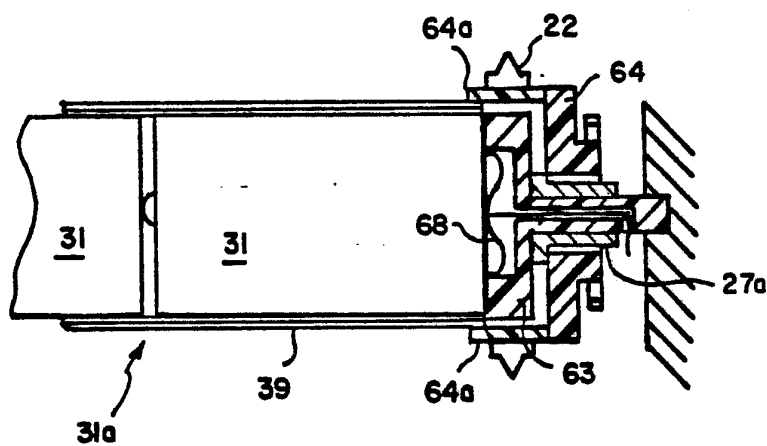


FIG. 8

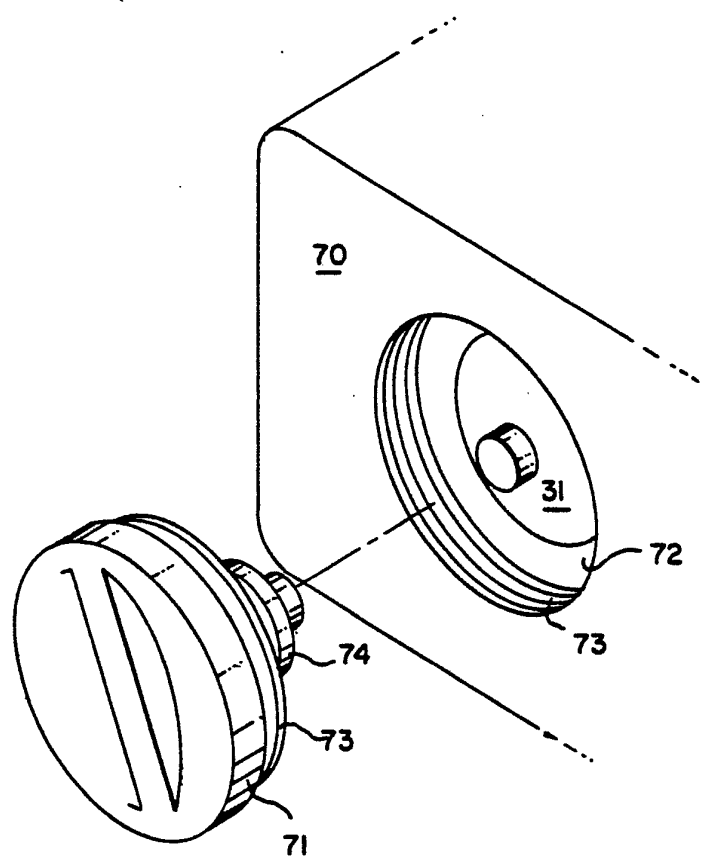
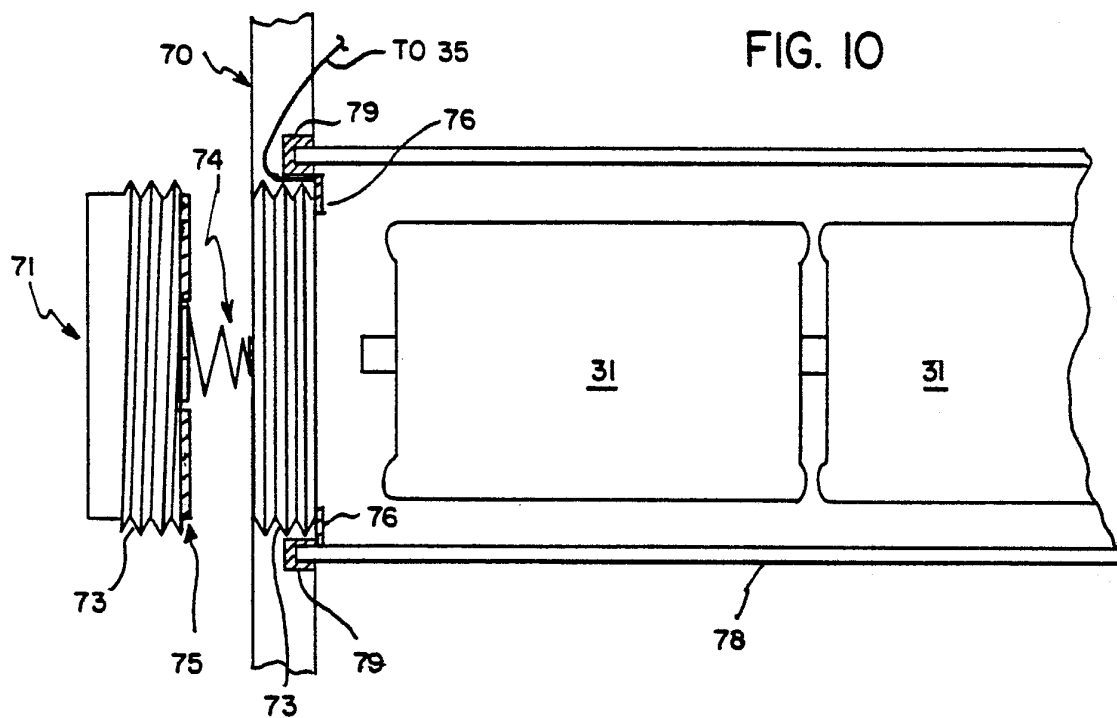


FIG. 9

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FIG. 11

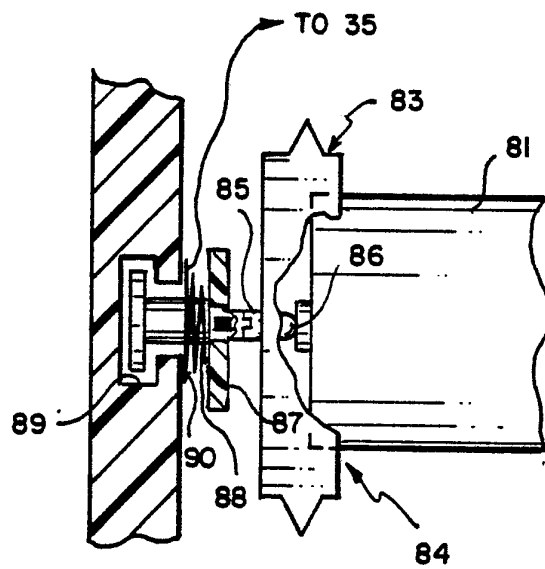
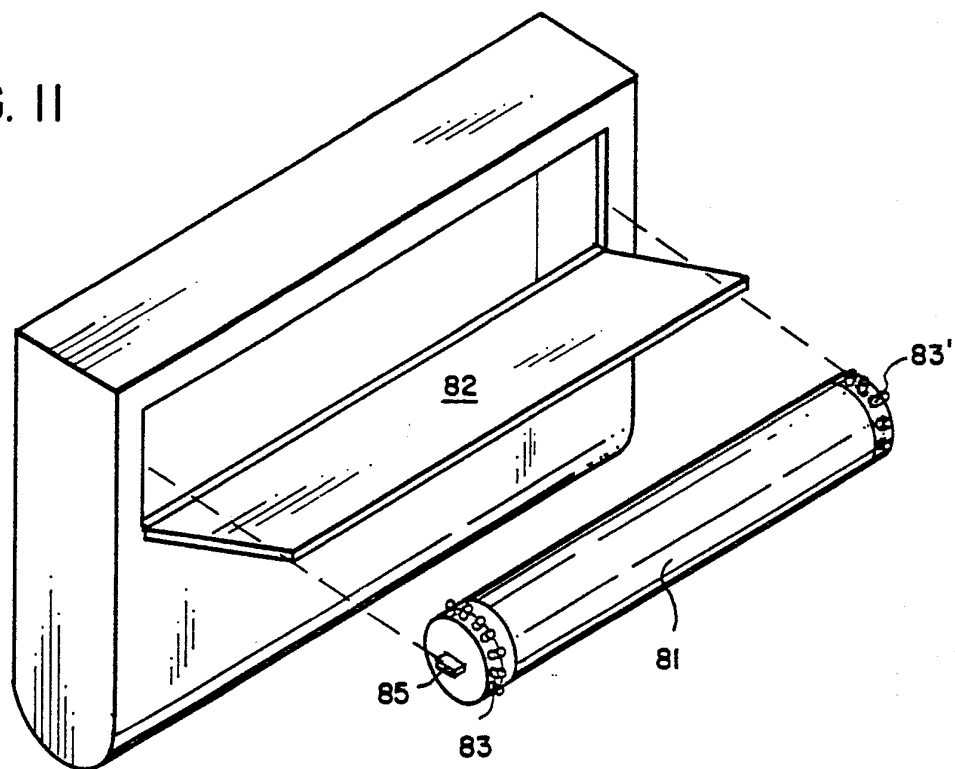


FIG. 12

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 87/00785

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁴ According to International Patent Classification (IPC) or to both National Classification and IPC IPC ⁴ : B 41 J 3/36; H 01 M 2/10																	
II. FIELDS SEARCHED Minimum Documentation Searched ⁷ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%; text-align: left; border-bottom: 1px solid black;">Classification System</th> <th style="width: 75%; text-align: left; border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px;">IPC⁴</td> <td style="padding: 5px;"> B 41 J H 01 M A 63 H </td> </tr> </table> Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸			Classification System	Classification Symbols	IPC ⁴	B 41 J H 01 M A 63 H											
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III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; text-align: left; border-bottom: 1px solid black;">Category ⁶</th> <th style="width: 60%; text-align: left; border-bottom: 1px solid black;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 30%; text-align: left; border-bottom: 1px solid black;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px;">A</td> <td style="padding: 5px;"> US, A, 3344899 (E.D. WANG) 3 October 1967 see column 2, line 62 - column 4, line 17; figure 1 cited in the application -- </td> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px; text-align: center;">1</td> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px;">Y</td> <td style="padding: 5px;"> GB, A, 2087800 (SHINSHU SEIKI K.K.) 3 June 1982 see page 2, lines 1-59; figure 1 -- </td> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px; text-align: center;">1, 6</td> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px;">Y</td> <td style="padding: 5px;"> US, A, 2703836 (C.H. MINOGUE) 8 March 1955 see the whole document </td> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px; text-align: center;">1, 6</td> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px;">A</td> <td style="padding: 5px;"> ----- </td> <td style="vertical-align: top; border-right: 1px solid black; padding: 5px; text-align: center;">2, 3</td> </tr> </table>			Category ⁶	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	US, A, 3344899 (E.D. WANG) 3 October 1967 see column 2, line 62 - column 4, line 17; figure 1 cited in the application --	1	Y	GB, A, 2087800 (SHINSHU SEIKI K.K.) 3 June 1982 see page 2, lines 1-59; figure 1 --	1, 6	Y	US, A, 2703836 (C.H. MINOGUE) 8 March 1955 see the whole document	1, 6	A	-----	2, 3
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Y	US, A, 2703836 (C.H. MINOGUE) 8 March 1955 see the whole document	1, 6															
A	-----	2, 3															
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IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="padding: 5px;">15th July 1987</td> <td style="padding: 5px; text-align: right;">12 AUG 1987</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">International Searching Authority</td> <td style="border-bottom: 1px solid black; padding: 5px;">Signature of Authorized Officer</td> </tr> <tr> <td style="padding: 5px; text-align: center;">EUROPEAN PATENT OFFICE</td> <td style="padding: 5px;">M. VAN MOL </td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	15th July 1987	12 AUG 1987	International Searching Authority	Signature of Authorized Officer	EUROPEAN PATENT OFFICE	M. VAN MOL							
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO.

PCT/US 87/00785 (SA 16867)

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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GB-A- 2087800	03/06/82	US-A- 4450454	22/05/84
US-A- 2703836		None	

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