United States Patent [19]

Kawano et al.

[11] **3,827,543**

[45] **Aug. 6, 1974**

[54] **TYPEWRITING MECHANISM FOR A TYPEWRITER MACHINE**

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[52] **U.S. Cl.** **197/55,** 335/272

[51] **Int. Cl.** **B41j 1/32**

[58] **Field of Search** 197/55, 18, 52, 16; 335/272

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Primary Examiner—Robert E. Pulfrey
Assistant Examiner—R. T. Rader
Attorney, Agent, or Firm—Maleson, Kimmelman and Ratner

[57] **ABSTRACT**

A typewriting mechanism for a typewriter machine in which mechanism a swingable hammer bracket supporting a typewheel having a number of types formed on the surface of the typewheel, is driven by a single rotary magnet without being disconnected from a type-character selecting mechanism so that the typewheel strikes against the platen and a type-character on the surface of the typewheel is printed on the typewriter paper around the platen. The single rotary magnet also actuates a locking mechanism of the typewheel and a lever for driving an ink ribbon feed mechanism.

8 Claims, 23 Drawing Figures

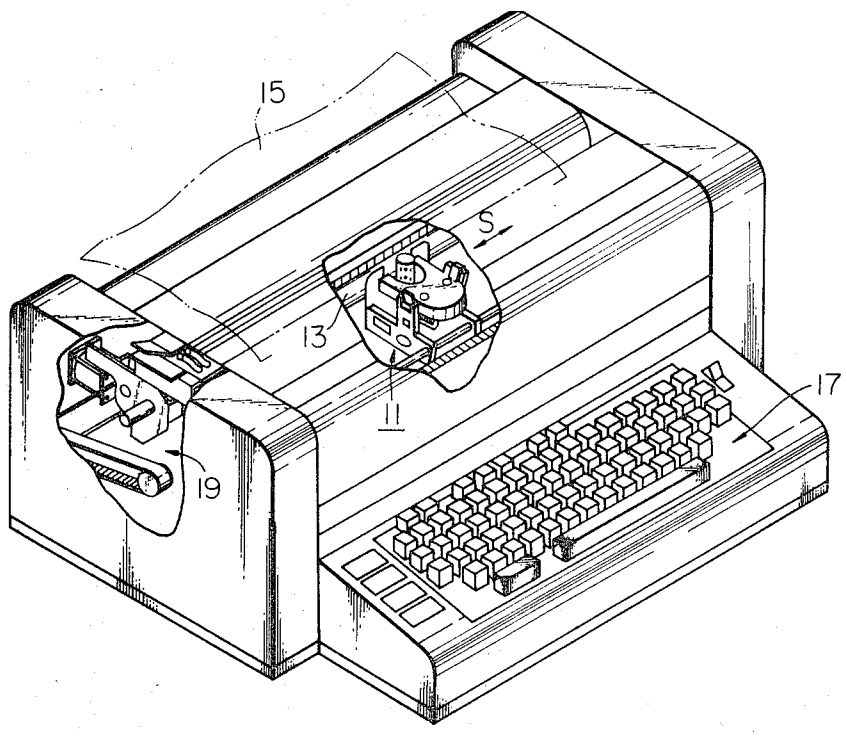


Fig. 1

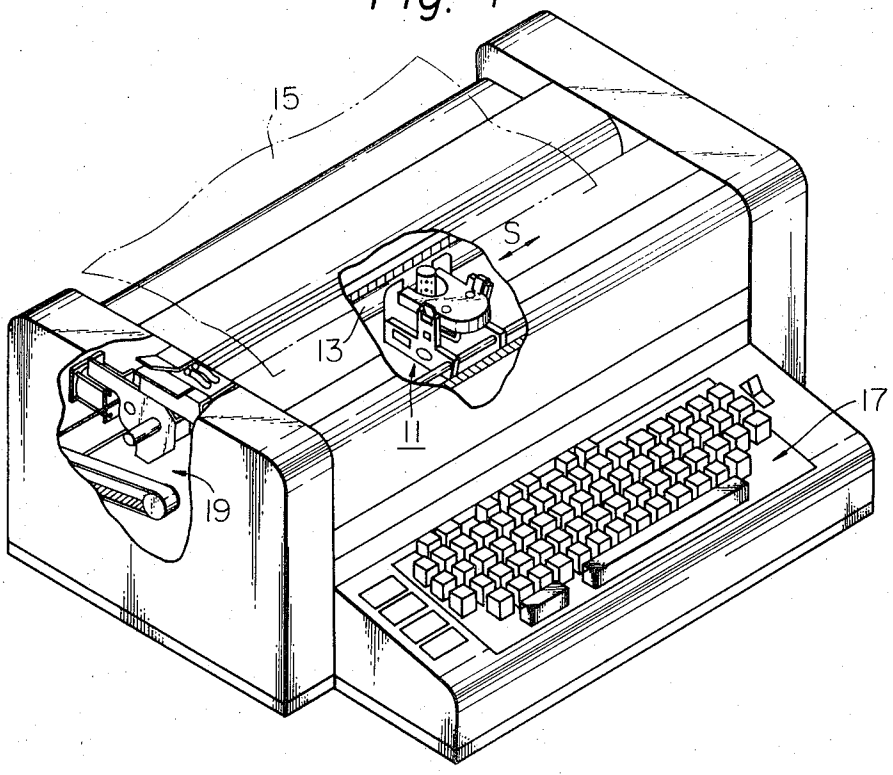

15
S
13
11
17
19

Fig. 2

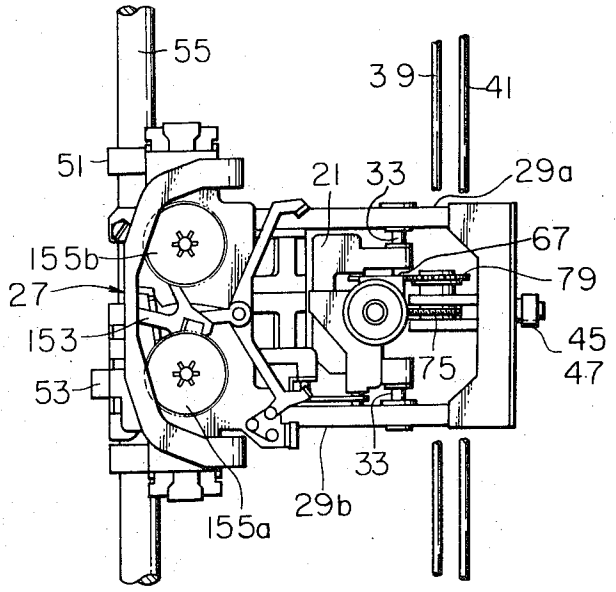

55
39
41
51
21
33
29a
67
155b
79
27
153
45
47
75
53
33
29b
155a

Fig. 3

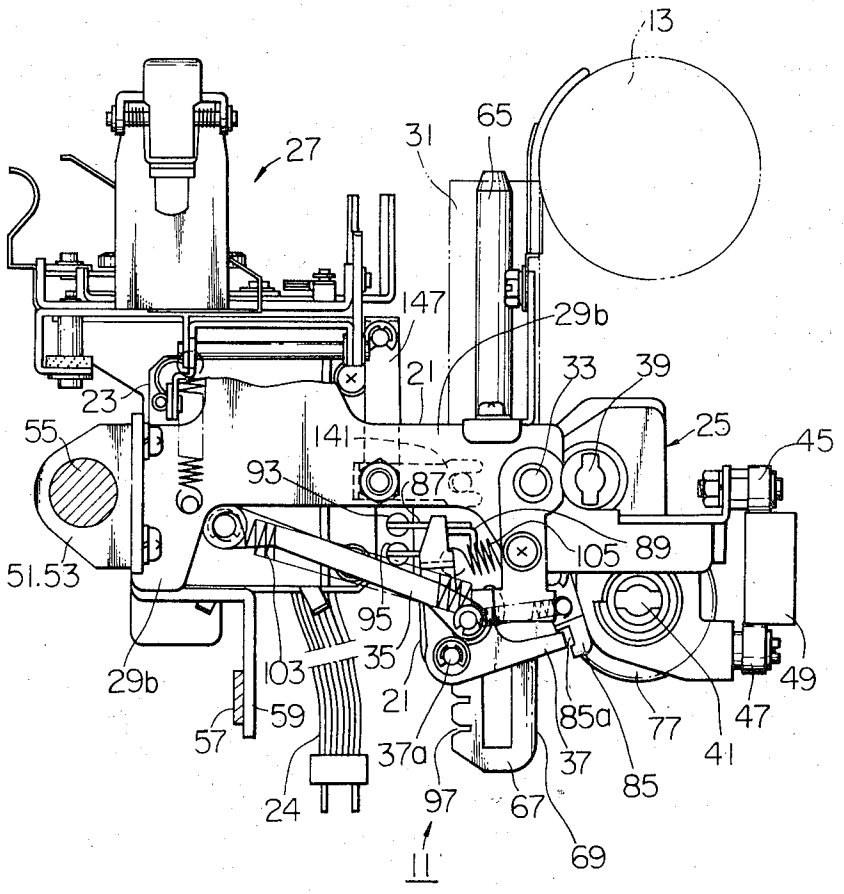

13
65
31
27
147
29b
21
33
39
23
25
45
55
141
93
87a
105
89
51.53
95
35
103
21
85a
77
47
49
29b
59
57
37a
37
41
24
97
67
85
69
11

Fig. 4

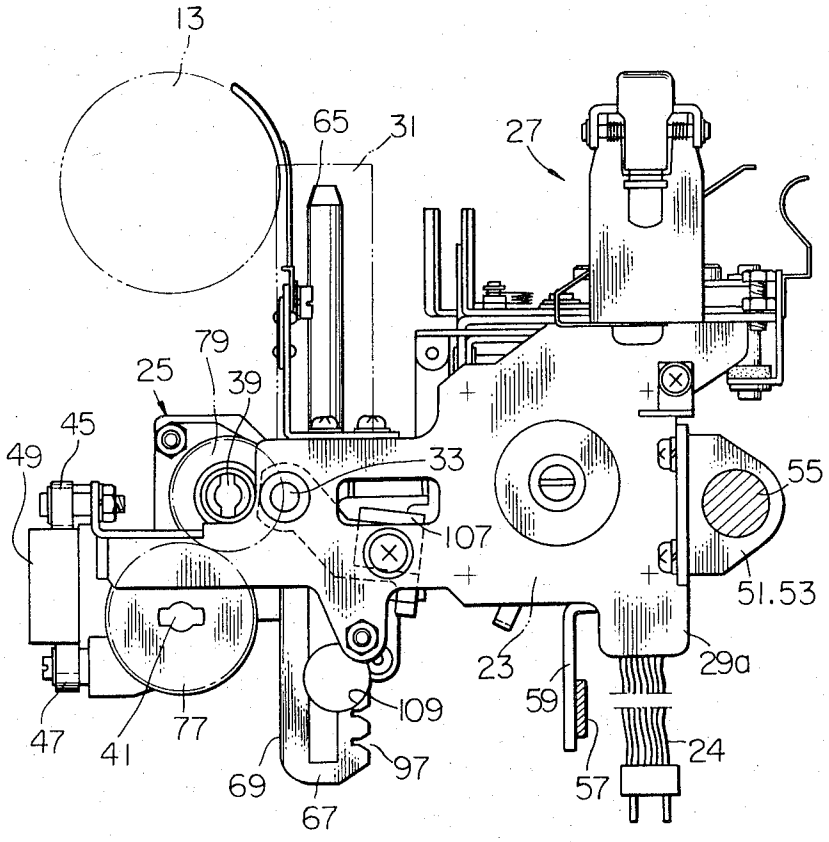

13
65
31
27
79
25
39
45
49
33
107
55
51.53
23
29a
59
109
24
47
41
77
69
97
57
67

Fig. 5

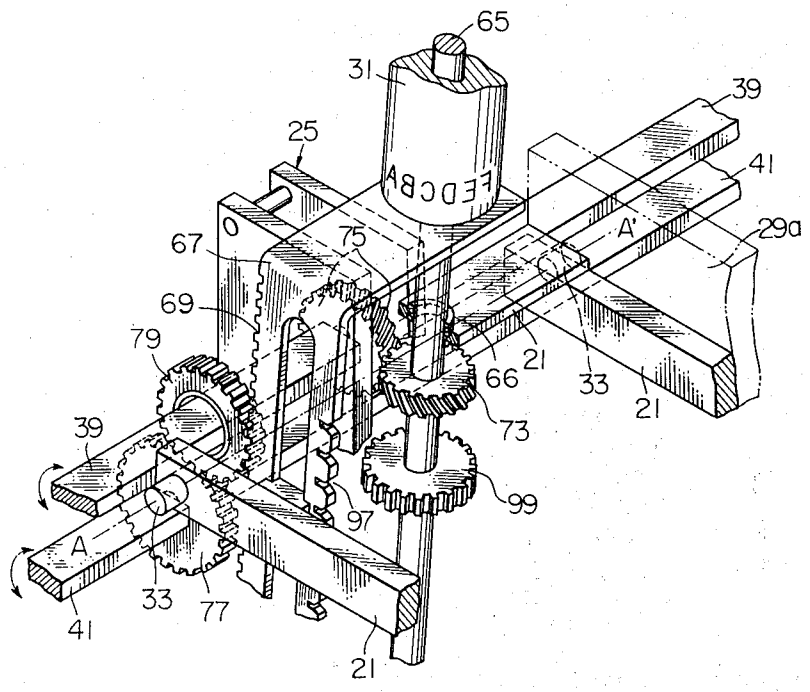

65
31
39
25
41
FEDCBA
A'
29a
67
75
69
79
21
66
33
21
73
39
99
97
A
33
77
41
21

Fig. 6

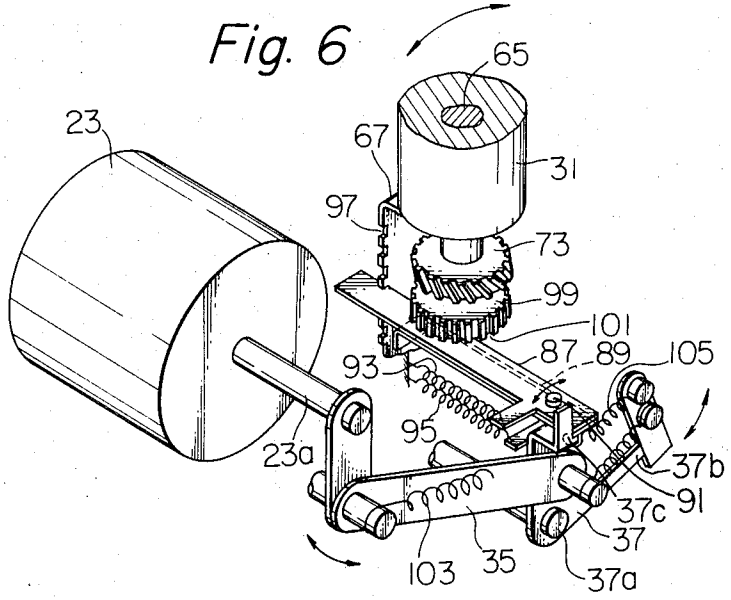

65
23
67
31
97
73
99
101
87
89
105
93
95
23a
37b
91
37c
37
103
35
37a

Fig. 7

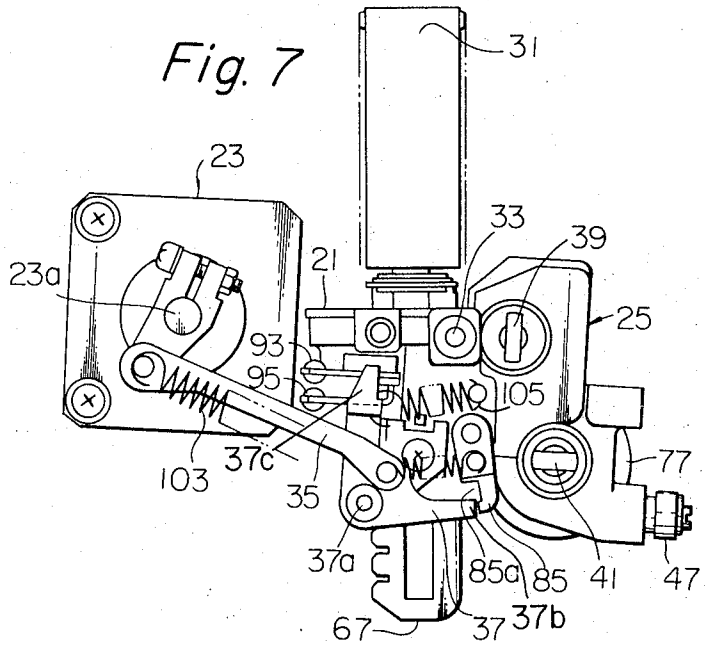

31
23
33
39
23a
21
25
93
95
105
37c
77
103
35
37a
85a
85
41
47
67
37
37b

Fig. 8

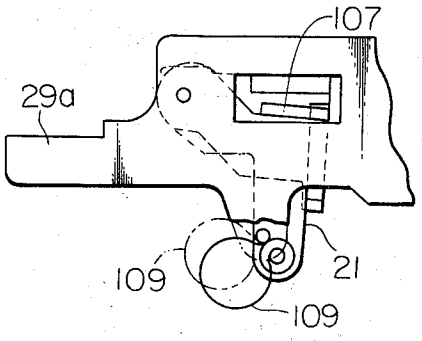


Fig. 9a

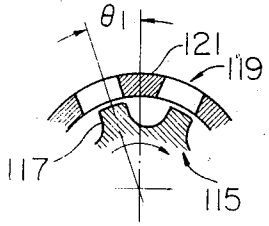


Fig. 9b

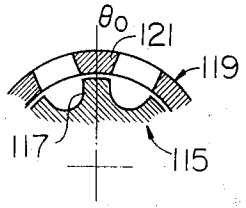
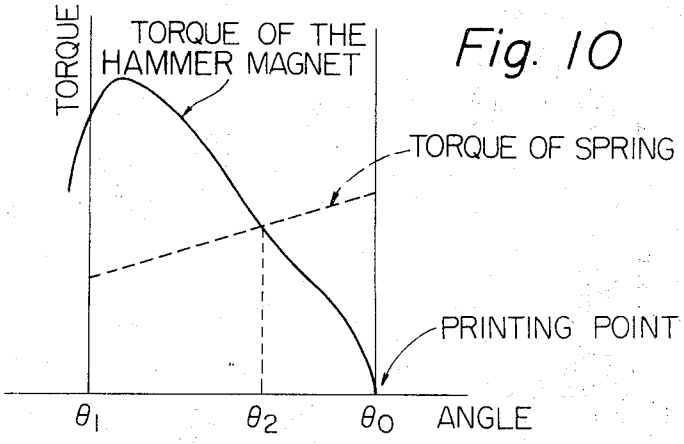


Fig. 10



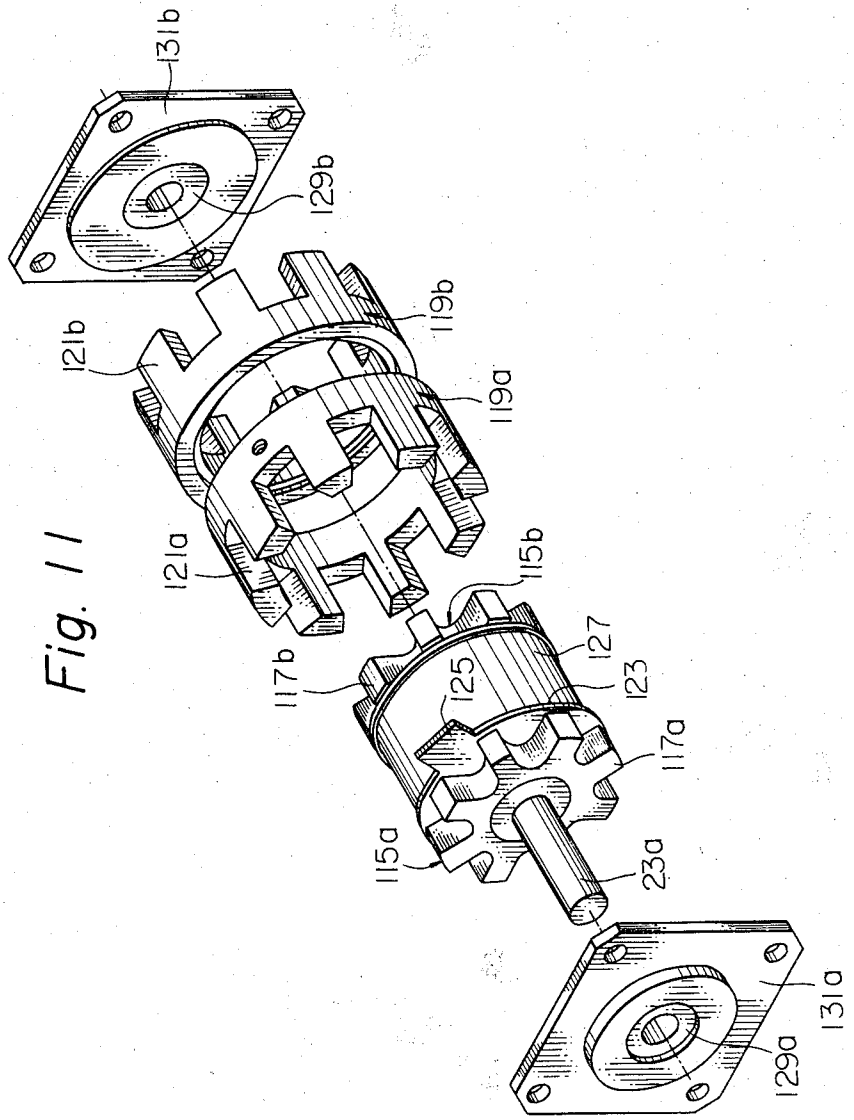

131b
129b
119b
121b
119a
121a
115b
127
125
123
117b
117a
115a
23a
131a
129a

Fig. 11

Fig. 12a

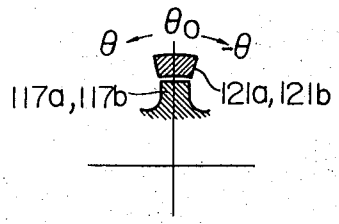


Fig. 12b

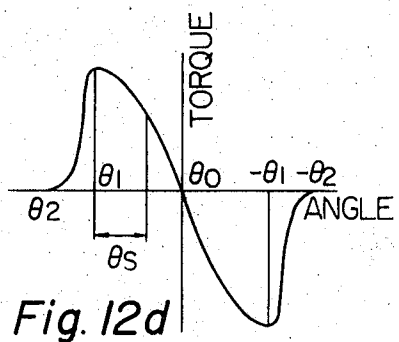


Fig. 12c

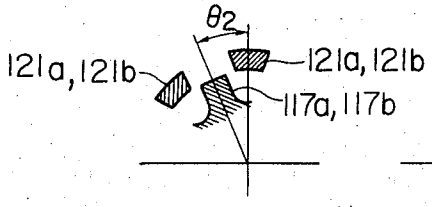


Fig. 12d

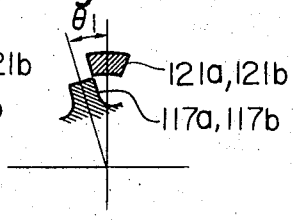


Fig. 13a

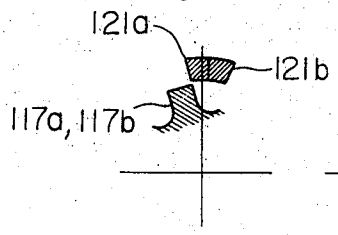
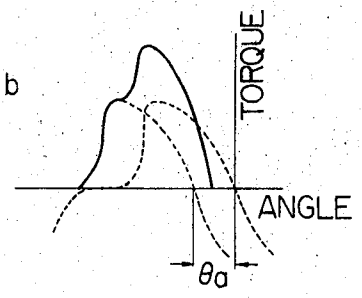


Fig. 13b



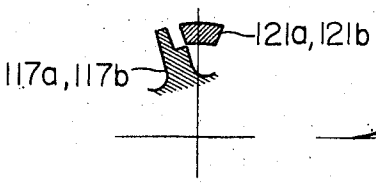


Fig. 14a

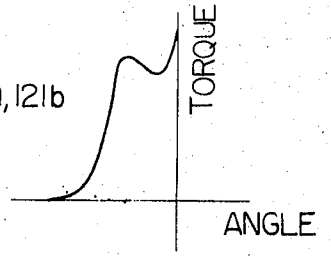


Fig. 14b

Fig. 15

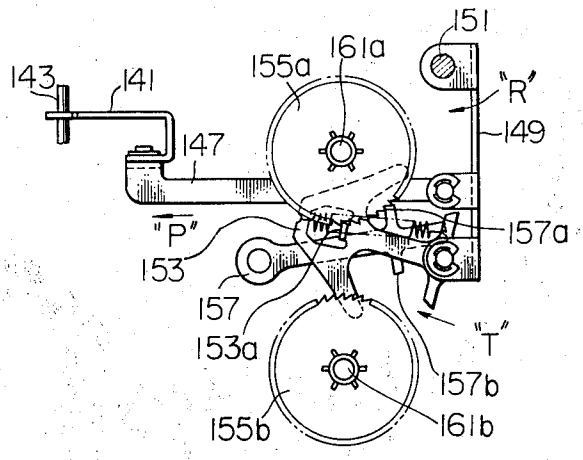

151
161a
155a
143
141
"R"
149
147
157a
"P"
153
157
153a
"T"
157b
155b
161b

Fig. 16

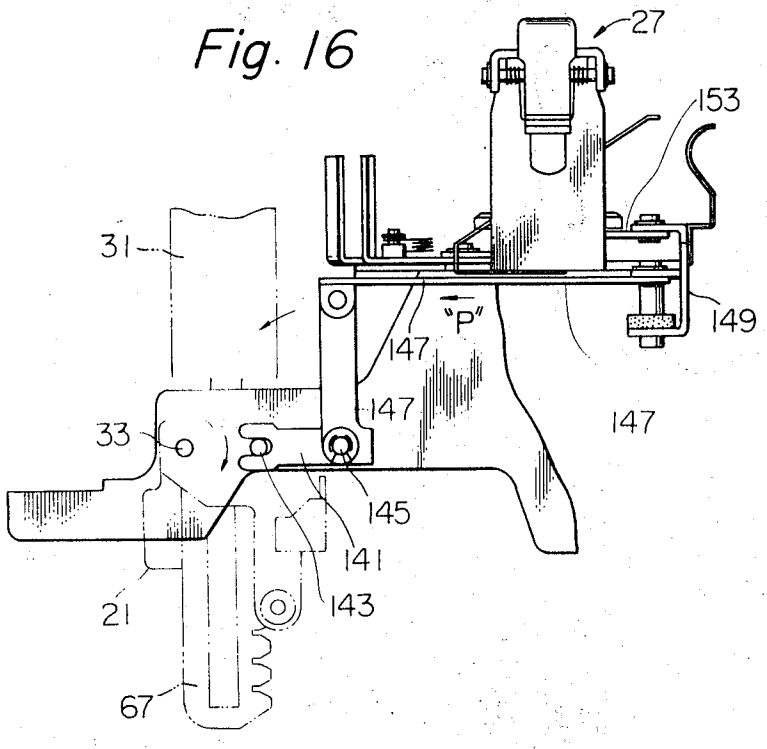
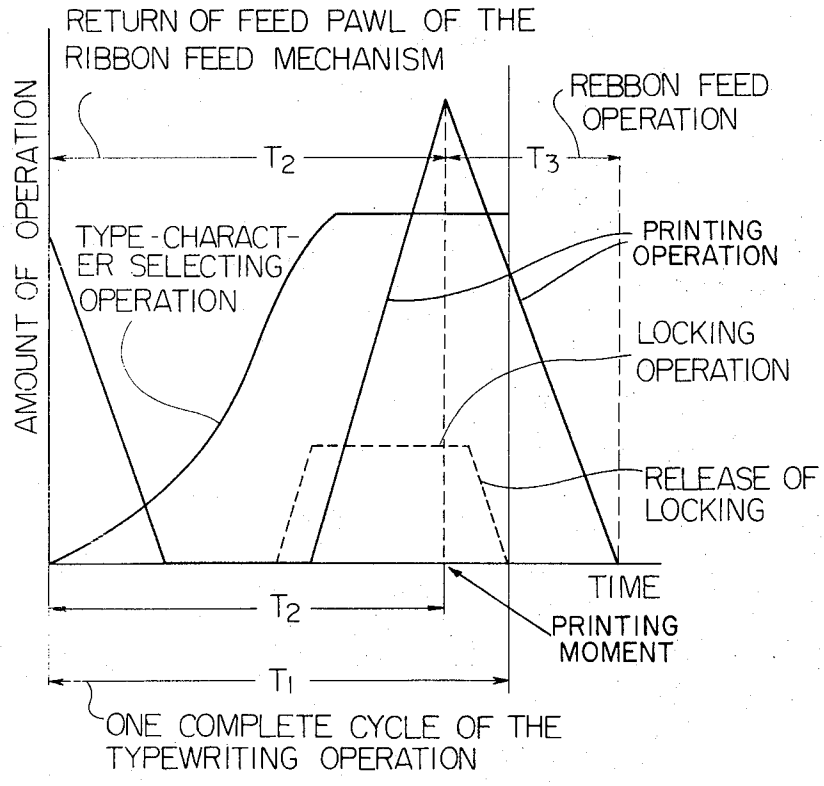

27
153
31
"P"
149
147
147
147
33
145
141
143
21
67

Fig. 17


RETURN OF FEED PAWL OF THE RIBBON FEED MECHANISM
REBBON FEED OPERATION
AMOUNT OF OPERATION
T2
T3
TYPE-CHARACTER SELECTING OPERATION
PRINTING OPERATION
LOCKING OPERATION
RELEASE OF LOCKING
TIME
T2
PRINTING MOMENT
T1
ONE COMPLETE CYCLE OF THE TYPEWRITING OPERATION

TYPEWRITING MECHANISM FOR A TYPEWRITER MACHINE

The present invention relates to a typewriting mechanism for a typewriter machine e.g., a lineprinter and a teleprinter, and more particularly relates to a typewriting mechanism in which one of the types on the surface of the typewheel is selected through the vertical and rotatary motions of the typewheel and then, the printing of the selected type is carried out by the swinging motion of a hammer bracket supporting the typewheel.

In some conventional typewriting mechanisms of a typewriter machine employing a system such as a typewheel or type cylinder having types formed on the surface thereof, directly strikes against the platen, the printing motion of the typewheel is produced through the operation of cams mounted on a hammer shaft driven through a clutch mechanism and the restoring motion of the typewheel after completion of the printing of a type-character is carried out by a restoring spring, or alternatively the printing motion is produced by a spring force and the restoring motion is carried out through the operation of a cam mechanism.

However, these conventional mechanisms are accompanied by such drawbacks that not only is the top speed of the typewriting operation restricted but also, the typewriting mechanism is very complicated and is accompanied by high production cost and extremely high operation noise.

In some other conventional typewriting mechansisms, the printing motion of the typewheel is produced by an absorption type magnet such as a plunger type magnet.

In this mechanism, there are the advantages that the arrangement of the mechanism is relatively simple and control of the hammering action can be easily carried out. However, there are such serious drawbacks that the restoring action of the magnet takes a long time due to its poor stroke to torque characteristics and also, the initial torque of the magnet is very small and as a result, high-speed typewriting operation, now in great demand, can not be achieved.

Furthermore in this mechanism, not only does the change of excitation time of the magnet produce change of printing pressure but also, simultaneous employment of a particular free-flight mechanism is required to form a free-flight region in the printing motion of the typewheel and moreover, impact sound produced by the absorbing motion of the plunger magnet, adds undesirable noise to the sound of the printing operation.

Therefore an object of the present invention is to eliminate the above-mentioned drawbacks of the conventional typewriting mechanism of a typewriter machine.

Another object of the present invention is to provide a typewriting mechanism for a typewriter machine which can achieve high-speed typewriting operation.

A further object of the present invention is to provide a typewriting mechanism of a typewriter machine which can reduce operating noise.

Another object of the present invention is to provide a high-speed typewriting mechanism for a typewriter machine whereby the typewriting operation sequence including locking operation of the typewheel after completion of a type-character selection, printing operation, and ribbon feeding operation can be continuously carried out by employing a single driving source.

A still further object of the present invention is to provide a rotary type magnet which can be used for said driving source of the typewriting mechanism of a typewriter machine.

The foregoing and other objects, features and advantages of the present invention will be apparent from the ensuing description with reference to the accompanying drawings illustrating a preferred embodiment of the present invention wherein:

FIG. **1** is an outside view of the typewriter machine employing a type carrier provided with the typewriting mechanism of the present invention;

FIG. **2** is a plan view of the type carrier provided with the typewriting mechanism of the present invention;

FIGS. **3** and **4** are opposite side views of FIG. **2**;

FIG. **5** is a schematically perspective view of the mechanism for selecting a type-character;

FIG. **6** is a schematically perspective view for illustrating the mechanism for locking the typewheel;

FIG. **7** is a schematical side view for illustrating the printing operation of the typewriting mechanism of the present invention;

FIG. **8** is a partial view illustrating the operation of the toggle spring employed in the typewriting mechanism of the present invention;

FIG. **9** is a schematic view illustrating the positional relationship between the rotor and stator of the rotary magnet used in the typewriting mechanism of the present invention;

FIG. **10** is a diagram showing the torque characteristics curve of the rotary magnet according to FIG. **9**;

FIG. **11** is a disassembled perspective view of an example of the rotary magnet;

FIG. **12***a*, *b*, *c* and *d* are diagrams illustrating the positional relationship of the rotor and stator of the rotary magnet and the torque characteristic curves;

FIG. **13***a* and *b* are diagrams illustrating another positional relationship of the rotor and stator of the rotary magnet and the torque characteristics curve;

FIG. **14***a* and *b* are diagrams illustrating still another positional relationship of the rotor and stator of the rotary magnet and the torque characteristics;

FIG. **15** is a partial plan view illustrating the mechanism for feeding an ink ribbon;

FIG. **16** is a partial side view of FIG. **15**;

FIG. **17** is a diagram illustrating the operation sequence carried out by the typewriting mechanism of the present invention.

FIG. **1** is an outside view of a typewriter machine provided with a type carrier **11** having a typewriting mechanism according to the present invention.

The type carrier **11** carries out carriage spacing movement in the directions shown by the arrow "S" along a conventional platen **13** when the carrier **11** is required for typewriting operation through an ink ribbon (not shown) on a typewriting paper **15** borne on the platen **13**.

Reference numeral **17** shows a keyboard carrying thereon a number of keys, tabulation bar and a space bar, etc.

Reference numeral **19** shows a part of the driving mechanism of the platen **13** and other parts.

Referring to FIG. **2** to FIG. **4** illustrating a detailed assembly of the type carrier **11**, there is shown a ham-

mer bracket **21** supporting a type wheel **31,** a rotary type hammer magnet **23,** a gear box **25,** a ribbon feed-mechanism **27** and carrier frames **29***a*, **29***b* arranged at the opposite sides of the bracket **21.**

The box-like hammer bracket **21** is swingably assembled to the carrier frame **29***a*, **29***b* via pivots **33,** and also, the hammer bracket **11** is combined with a shaft **23***a* of a hammer magnet **23** by means of a lever arm **35** via a locking lever **37** and as a result, according to the rotary action of the output shaft **23***a* of hammer magnet **23** upon being energized via an electrical lead **24,** the hammer bracket **21** performs the printing operation as later described in detail.

At the rear portion of hammer bracket **21,** the gear box **25** is arranged stationary with respect to carrier frames **29***a*, **29***b* and through the gear box **25,** shafts **39** and **41** are disposed for selecting a required type-character from a number of type-characters formed on the surface of a typewheel **31,** that is, the rotation of respective shafts **39** and **41** causes a later described type-character selecting operation so that the required character on the typewheel **31** is located at a selected position where the character can be printed.

At the rear most frames **29***a* and **29***b*, a pair of roller members **45, 47** are disposed so as to be able to slide along a stationary guide rail **49.**

Also, at the foremost frames **29***a*, **29***b*, a pair of guide bushes **51, 53** are disposed through which a stationary guide shaft **55** transversely extends.

The guide rail **49** and the guide shaft **55** allow the type carrier **11** to shift in to and fro transverse directions along them.

A spacing belt **57** is fixed to a bracket member **59** rigidly combined with frames **29***a*, **29***b* so that the type carrier **11** is shifted to an arbitrarily selected printing position by shifting forces in the to and fro transverse directions given via the belt **57.**

The ribbon feed-mechanism **27** is disposed at an upper portion of frames **29***a*, **29***b* of type carrier **11** so as to provide a feeding force to carry out the ink ribbon feed operation.

Now the operation of the typewriting mechanism according to the present invention will be described in more detail in accordance with the operation sequence from the selection of a certain type to the completion of the typing of that type.

FIG. **5** schematically illustrates the mechanism for selecting a type character to be printed from a number of type characters arranged on the surface of typewheel **31** in the vertical and circumferential directions.

A shaft **65** rotatably mounted on hammer bracket **21** via a bearing **66** and supporting typewheel **31** which is slidably mounted on the shaft **65** operates as a type character selection shaft in the circumferential direction which may be called "circumferential typewheel selection shaft."

Numeral **67** is a rack member having rack gear teeth **69** formed at the front edge thereof and vertically slidably mounted on hammer bracket **21** while being rotatably associated with typewheel **31.** This rack member **67** operates as a type-character selection element in the vertical direction.

Numeral **73** is a spiral gear rigidly fixed to the lower portion of circumferential typewheel selection shaft **65.** The elongated shaft **39** transmits the action of the circumferential type-character selection to the typewheel **3** from the outside and also, the elongated shaft **41** transmits the other action of the vertical type-character selection to the typewheel **31** from the outside. Shafts **39** and **41** have rectangular shaped cross-sections. Numeral **75** is a spiral gear housed in the gear box **25** and rigidly mounted on shaft **39** so that the spiral gear **75** together with shaft **39** are capable of sliding in accordance with the carriage spacing movement of hammer bracket **21.** Numeral **77** is a spur gear fixedly mounted on shaft **41** so that spur gear **77** together with shaft **41** are capable of sliding also in accordance with the carriage spacing movement of hammer bracket **21.** Numeral **79** is an idler gear concentrically and rotatably mounted on a flange (not shown) of spiral gear **75** while being in a meshing engagement with spur gear **77** and rack gear teeth **69** of rack member **69.** That is gear **79** receives its driving force from gear **77.**

As will be understood from the foregoing and later description, hammer bracket **21** is capable of swinging about pivots **33** with respect to carrier frames **29***a* and **29***b* (not shown) so as to carry out the printing operation. A line A–A′ passing through the center of pivots **33** in the axis of the above-mentioned swinging movement of hammer bracket **21.**

According to one of features of the present invention, spiral gear **75** and idler gear **79** keep a meshing engagement with spiral gear **73** and rack gear teeth **69** of rack member **67** respectively on the line A–A′. In other words, the respective meshing points always lie on the line A–A′ about which hammer bracket **21** swings to carry out the printing action.

In this case, a suitable amount of backlash may be provided at the respective meshing points so that interference between respective gears may be avoided when hammer bracket **21** starts to swing for carrying out the printing action.

In the above arrangement of a type-character selection mechanism, when a signal which commands the selection of a certain type-character, is given to both shafts **39** and **41,** both shafts **39** and **41** rotate to the preselected amount of rotation required for selecting the certain type-character on typewheel **31** and the rotational movement of shaft **39** is transmitted to shaft **65** through the meshing engagement of spiral gears **75** and **73** so as to effectuate the circumferential typewheel selection while the rotational movement of shaft **41** is simultaneously transmitted to rack member **65** through the meshing engagement of gears **77** and **79** and rack gear teeth **69** so as to effectuate the vertical typewheel selection. That is to say, typewheel **31** is positioned to a predetermined printing position where a selected type on the surface thereof can be printed on a typewriter paper (not shown) upon swinging of hammer bracket **21** about pivots **33.**

According to the above arrangement wherein the meshing points of the gears for transmitting the type-character selecting action always correctly lie on the axis about which hammer bracket **21** swings to carry out the printing action, it is not necessary to disengage the type-character selecting mechanism from hammer bracket **21** supporting typewheel **31** every time hammer bracket **21** carries out the printing action so that the printing action of hammer bracket **21** can be continuously carried out after completion of the type-character selecting operation without any interruption and this fact results in the high-speed typewriting operation capability of the typewriting mechanism of the present invention.

Now referring to FIG. 6, a mechanism for locking typewheel 31 after completion of the circumferential and the vertical type-character selection, is schematically and perspectively shown.

As is seen from FIG. 3, this locking mechanism is arranged at the lower portion of swingable hammer bracket 21 of the type carrier 11.

In FIG. 6, immediately before completion of the type-character selecting operation, hammer magnet 23 is energized to rotate output shaft 23*a* in the clockwise direction against the force of a spring 103 and as a result locking lever 37 starts to rotate in the counterclockwise direction about shaft 37*a* and against the force of a spring 105 via lever arm 35 and engages with a notch 85*a* of a trigger lever 85 at its one end 37*b*. And at this moment, the other end 37*c* of locking lever 37 is disconnected from an engagement with a vertical locking lever 87 and a rotational locking lever 89 so that both locking levers 87 and 89 are rotated about a vertical shaft 91 in the clockwise direction due to the forces of respective springs 93 and 95.

As a result of this, locking levers 87 and 85 simultaneously engage with one of the locking grooves 97 formed at the rear edge of rack member 67 and one of the locking teeth 101 of a locking wheel 99 fixed at the lower end of shaft 65 of typewheel 31 respectively as shown in FIG. 6, and typewheel 31 is then put into a locked state so that a certain selected type thereon can be correctly printed by the swinging movement thereof.

It should be understood from FIG. 6 that at the moment when the typewriting operation is completed and hammer magnet 23 is deenergized, the forces of the springs 103 and 105 cause locking lever 37 to rotate in the clockwise direction so that the end 37*c* of locking lever 37 returns to re-engage with both vertical and rotational locking levers 87 and 89 while causing a counterclockwise rotation of levers 87 and 87 about shaft 91, and as a result, the locking of typewheel 31 is released and the next type-character selecting operation starts.

Here again considering the locked state of typewheel 31 while referring to FIG. 7, energized hammer magnet 23 continues to pull locking lever 37 via lever arm 35 against springs 103 and 105 until the end 37*b* of locking lever 37 contacts the upper edge of notch 85*a* of trigger lever 85 and the counterclockwise rotation of locking lever 37 is restricted momentarily by trigger lever 85.

However, further pulling force of hammer magnet 23 applied to locking lever 37 via lever arm 35 causes hammer bracket 21 to start its swinging action about pivots 33 fixed to carrier frames 29*a*, 29*b* (not shown in FIG. 7) from an initial position away from platen 13 (not shown in FIG. 7).

As soon as the swinging action of hammer bracket 21 starts, hammer magnet 23 is deenergized, and therefore, the torque thereof applied to output shaft 23*a* is reduced. However, at this moment due to the inertia of swinging hammer bracket 21, the printing operation of hammer bracket 21 is positively achieved, that is to say, typewheel 31 strikes against the typewriter paper 15 around platen 13 through the ink ribbon similar to the conventional manner so that the selected type-chamber is printed on the paper 15.

When typewheel 31 strikes against platen 13 through paper 15, sudden stoppage of the swinging action of hammer bracket 21 produces inertial rotation of output shaft 23*a* which maintains locking lever 37 in the pulled state by lever arm 35 and as a result, locking of typewheel 31 is kept during the printing action of hammer bracket 21.

When the inertial rotation of output shaft 23*a* of hammer magnet 23 is exhausted, the forces of springs 103 and 105 act to release the locking of typewheel 31 as previously explained and simultaneously, act to bring back hammer bracket 21 to the initial position where hammer bracket 21 contacts a stopper 107 fixedly attached to the inner side of carrier frame 29*a* as shown in FIG. 4.

Thus, the printing operation of hammer bracket 21 is completed.

Here it should be noted in FIGS. 3 and 8 that a toggle spring 109 bridged between carrier frame 29*a* and hammer bracket 21 has its neutral point at the preselected position which is five-sixths the distance from the initial position of hammer bracket 21 to platen 13.

Therefore, when hammer bracket 21 is swung exceeding the neutral position, toggle spring 109 forces hammer bracket 21 to further swing toward platen 13, and until hammer bracket 21 reaches the neutral position, toggle spring 109 applies the spring force to hammer bracket 21 so as to restrict the swinging action of hammer bracket 21. That is to say, toggle spring 109 always resists the occurrence of both swinging and returning actions of hammer bracket 21, so that both locking and release of locking of typewheel 31 are accomplished before the occurrence of movement of hammer bracket 21.

Now, a brief description of the rotary type hammer magnet 23 will be given with reference to FIG. 9 and FIG. 10.

FIG. 9 illustrates the positional relationship between the stator and the rotor of the rotary magnet 23.

In the structure of hammer magnet 23, a rotor 115 fixedly mounted on output shaft 23*a* (FIG. 6) and having equi-angularly spaced poles 117 rotates with respect to a stationary stator 119 which has poles arranged at the same pitch as poles 117 of rotor 115.

In the non-operating state, poles 117 of rotor 115 are positioned so as to be staggered from poles 121 of stator 119 by an angle θ_1 as shown in FIG. 9(a_1).

In this state, when stator 119 is energized, the attractive force acting between stator 119 and rotor 115 produces maximum torque which makes rotor 115 rotate with output shaft 23*a*, and when rotor 115 rotates until poles 117 are aligned with poles 121 of stator 119 (position θ_0 of FIG. 9(a_2) refers to), the torque of output shafts 23*a* or rotor 115 is extinguished.

FIG. 10 indicates the torque characteristics curve of rotary hammer magnet 23 with respect to the difference of angle of stagger between rotor 115 and stator 119.

In the case where this hammer magnet 23 is employed for driving the typewriter mechanism of the present invention, the arrangement is such that at an angular position η_1 of FIG. 10, the printing action of typewheel 31 starts, and at an angular position θ_0 of FIG. 10, the printing of a type is completed.

In FIG. 10, a dotted line indicates a torque characteristics curve of spring 103 which resists the rotation of rotor 115 and output shaft 23*a*.

According to the foregoing, it will be understood that at the initial state of printing action of typewheel **31**, hammer magnet **23** applies a large torque to typewheel **31** so as to effectively accelerate the swinging action of typewheel **31**, but according to the progress of the swinging action of typewheel **31**, the torque of hammer magnet **23** becomes small while the torque of the resisting spring **103** becomes large and as a result, the printing action of typewheel **31** is carried out merely by its inertial swinging action so that printing of a type is performed by a momentary contact only of typewheel **31** with platen **13**. Therefore, clear and uniform printing of a type can be achieved because no vibrating action of typewheel **31** occurs due to the small contact pressure between typewheel **31** and platen **13**. That is to say, double printing action of typewheel **31** can be completely avoided.

Also, it will be understood that by controlling the exciting current given to hammer magnet **23**, control of the printing torque applied to typewheel **31** is easily carried out.

Therefore, corresponding to the number of typewriter papers which must be printed at the same time, the above contact pressure between typewheel **31** and platen **13** can be suitably and easily controlled.

Further, it will be understood that according to the employment of rotary hammer magnet **23**, impact occurs only when typewheel **31** strikes against platen **13** and also, when hammer bracket **21** returns to stopper **107** (FIG. **4**) and as a result, noise of the typewriting mechanism is extremely reduced compared with the conventional mechanism wherein heavy hammering action is used for producing printing pressure.

Further, it will be understood from FIG. **10** that as the torque of hammer magnet **23** is almost zero, return of typewheel **31** due to the torque of spring **103** starts immediately after completion of printing of a type so that the whole typewriting operation can be carried out at high-speed.

Now, further detailed description with respect to the rotary type hammer magnet will be hereinafter mentioned referring to an example thereof shown in FIG. **11** to FIG. **14**.

In FIG. **11**, shaft **23***a* is made of magnetic material, and rotors **115***a*, **115***b* having a plurality of poles **117***a*, **117***b*, are fixedly mounted on shaft **23***a*. Numeral **123** is a bobbin made of non-magnetic material and is arranged on shaft **23***a* and between rotors **115***a*, **115***b* while keeping suitable gaps between bobbin **123** and these other elements. Numeral **127** is an excitation winding installed on the bobbin **123**. Numerals **119***a*, **119***b* are stators inserted over rotors **115***a*, **115***b*, and excitation windings **127** while keeping slight radial air gaps therebetween. These stators **119***a*, **119***b* are provided with poles **121***a*, **121***b* arranged at the same equiangular spaces as rotor-poles **117***a*, **117***b*. Numerals **129***a*, **129***b* are bearings supporting the opposite ends of shaft **23***a* so that shaft **23***a* can be rotated. Numerals **131***a*, **131***b* are bracket members for stationarily supporting the above-mentioned stators **119***a*, **119***b* as well as holding bearings **129***a*, **129***b* as shown in FIG. **11**.

Numeral **125** is a pawl provided for the above-mentioned bobbin **123** for restricting the rotation of bobbin **123**.

In the above arrangement of the hammer magnet **23**, when excitation current is applied to excitation windings **127**, magnetic flux through shaft **23***a*, rotors **115***a*, **115***b* and stators **119***a*, **119***b* is formed and as a result, magnetic attractive forces are produced between poles **117***a* and **121***a*, and between poles **117***b* and **121***b*, respectively.

These attractive forces produce a torque on rotors **115***a*, **115***b* and shaft **23***a* when poles of rotors **115***a*, **115***b* and poles of stators **119***a*, **119***b* are in a staggered relationship and as a result, shaft **23** rotates until the rotors and stators are aligned.

When the excitation is stopped, shaft **23***a* with rotors **115***a*, **115***b* is capable of returning to the initial state by a suitable means such as a spring.

Now, assuming that in the non-operating initial state, poles of rotors **115***a*, **115***b* are positioned between poles of stators **119***a*, **119***b* as shown in FIG. **12***c*, and in the operating state, poles of rotors **115***a*, **115***b* are magnetically attracted to poles of stators **119***a*, **119***b* as shown in FIG. **12***a*, the torque characteristics curve shown in FIG. **12***d* is obtained corresponding to angle of stagger between poles of rotors **115***a*, **115***b* and stators **119***a*, **119***b* in both angular directions as shown by angles θ and $-\theta$ in FIG. **12***a*.

In FIG. **12***d*, θ_1 and $-\theta_1$ indicate positions where the maximum torque is obtained from rotors **115***a*, **115***b*.

FIG. **12***c* indicates the positional relationship between rotors **115***a*, **115***b* and stators **119***a*, **119***b* when this maximum torque is obtained.

As is seen from FIG. **12***c*, the maximum torque can be obtained when poles **117***a*, **117***b* of rotors **115***a*, **115***b* depart from poles **121***a*, **121***b* of stators **119***a*, **119***b*.

The positions θ_2 and $-\theta_2$ of FIG. **12***d* indicate the second zero torque positions where poles **117***a*, **117***b* of rotors **115***a*, **115***b* are positioned in the middle of poles **121***a*, **121***b* of stators **119***a*, **119***b* as is seen from FIG. **12***c*.

In the torque characteristics shown in FIG. **12***d*, if the region θ_s only from the position θ_1 is used, the initial torque becomes maximum while the end torque becomes minimum.

Therefore, the initial maximum torque serves as an acceleration torque for shaft **23***a* and the end minimum torque serves to restrict the impacting action of shaft **23***a*.

Referring to FIG. **13***a*, *b*, another positional relationship between the rotors and stators of hammer magnet **23** and its torque characteristics curve are indicated.

In FIG. **13***a*, an example wherein stators **119***a* and **119***b* are staggered from each other by an angle θ_a is shown and in this case, the maximum torque obtained from shaft **23***a* may be reduced in value. However, an averaged torque characteristics curve can be obtained as shown in FIG. **13***b*. And it will be understood that if θ_a is suitably changed, any kind of torque characteristics curve can be obtained.

FIG. **14***a*, *b* indicates another case in which output shaft **23***a* of hammer magnet **23** has a large end torque, because the rotation of output shaft **23***a* is stopped by a suitable magnetic stop member provided over a portion of the respective poles of rotor **115***a* or **115***b*. That is to say, when the motion of shaft **23***a* is stopped by the stop member, magnetic attractive forces between rotors **115***a*, **115***b* and stators **119***a*, **119***b* produce the largest or maximum torque as shown in FIG. **14***b*.

In this case, the magnitude of the end torque can be suitably set by changing the number of stop members

which may be provided for all poles **117***a*, **117***b* of rotors **115***a*, **115***b* or for merely selected numbers of poles **117***a*, **117***b* of rotors **115***a*, **115***b*.

Of course, the stop members may be provided for poles **121***a*, **121***b* of the stators instead whereby the same effect as the foregoing can be expected.

Further, in the above arrangement of the rotary type magnet, sliding surfaces exist only in bearings **129***a*, **129***b* and as a result, the abrasion effect which exists in the conventional plunger type magnet, can be greatly reduced or eliminated.

Also, almost all elements such as rotors **115***a*, **115***b*, stators **119***a*, **119***b*, and a shaft **23***a*, are made of magnetic material, so that the leakage of magnetic flux produced by energizing of excitation windings **127** is very small and as a result, a magnetic driving source of superior efficiency can be obtained.

Now, the typewriting mechanism of the present invention will be again considered.

FIGS. **15** and **16** illustrate a mechanism for feeding an ink ribbon for the next typewriting operation after completion of printing of a certain type.

This mechanism is actuated by the swinging action of hammer bracket **21**.

In FIGS. **15** and **16**, when hammer bracket **21** carries out swinging action as described before, a feed arm **141** engaged with a pin **143** fixed to hammer bracket **21** is actuated to carry out a swinging action about an axis **145**, and this swinging action of feed arm **141** is transmitted to the ribbon feed mechanism **27** via a feed link **147**.

Feed link **141** is connected to the middle portion of a feed lever **149** which is rotatable about a vertical axis **151** disposed at one end of feed lever **149**, and therefore, movement of feed link **147** in the direction shown by an arrow "P" causes the swinging motion of feed lever **149** in the direction shown by an arrow "R" about axis **151**.

Then, the swinging action of feed lever **149** causes a feed pawl **153** rotatably attached to the other end of feed lever **149** to move in the direction shown by an arrow "T."

As a result of this, an anchor-shaped feed pawl **153** drives one of the ratchet wheels **155***a* through engagement of a pawl **153***a* of feed pawl **153** and a ratchet of ratchet wheel **155***a* as shown in FIG. **15**.

A back stop lever **157** restricts the inertial rotation of ratchet wheel **155***a* through engagement of a stop pawl **157***a* and ratchet of ratchet wheel **155***a* as can be seen from FIG. **15**.

A spring **159** provides a spring force to effectuate positive engagement of feed pawl **153** and ratchet wheel **155***a* and also, of back stop lever **157** and ratchet wheel **155***a*.

The rotation of ratchet wheel **155***a* provides the ribbon feeding operation through spool **161***a* because a ribbon cartridge (not shown) which contains an ink ribbon, is mounted on both spools **161***a*, **161***b*.

That is, when one of the spools **161***a*, **161***b* rotates, the winding action of an ink ribbon is carried out within the cartridge.

When the ribbon feed operation caused by ratchet wheel **155***a* is completed, feed pawl **153** engages with ratchet wheel **155***b* through a reversing mechanism (not shown) and the ribbon feed operation caused by ratchet wheel **155***b* is carried out in the reverse direction of the foregoing.

In the above mechanism, the ribbon feed operation is carried out when hammer bracket **21** swings back to the initial position.

When hammer bracket **21** swings toward platen **13** to carry out a printing operation, feed pawl **153** of the ribbon feed mechanism **27** returns to its initial position.

FIG. **17** is a diagram schematically illustrating the operational sequence of the typewriting mechanism of the present invention, and the abscissa indicates time (T), and the ordinate indicates progress of the respective operations.

In the diagram of FIG. **1**, period T_1 represents one complete cycle of the typewriting operation from the type-character selection to the release of locking of the typewheel. In the period T_1, firstly, the type-character selecting operation is carried out and then, immediately before completion of the type-character selection, the locking operation of the typewheel starts and when the locking operation is completed, the printing operation starts and the printing of a type is completed at time T_2.

After completion of the printing operation, the ribbon feeding operation and the releasing operation of locking of the typewheel are carried out.

It will be understood from the foregoing and the diagram of FIG. **17** that as the locking of the typewheel is released immediately after completion of the printing operation, the next typewriting operation can start immediately and as a result, high-speed typewriting can be achieved according to the present invention.

Now it is to be understood that numerous variants and modifications of the typewriting mechanism of the typewriter machine can be effectuated within the scope and the spirit of the present invention.

What is claimed is:

1. A typewriting mechanism for a typewriter machine comprising bracket means capable of swinging about an axis toward the platen of the typewriter machine, a typewheel having a number of types on the surface thereof and rotatably and vertically movably supported by said bracket means,

said typewheel being capable of selecting one of said types through a type-character selecting mechanism having a gear meshing engagement,

rotary magnet means combined with said bracket means and actuating the swinging motion of said bracket means upon being electrically energized so that said typewheel strikes against said platen while carrying out printing of a type of said typewheel,

rotary magnet means comprising a rotatable shaft, rotor poles which are fixedly mounted on and equiangularly arranged around said rotatable shaft, stator poles equiangularly arranged around said rotor poles, and excitation windings provided for excitation of said stator poles and said rotor poles, and rotor poles, and

spring means for maintaining an initial position of said bracket means, said initial position of said bracket means being defined by a fixedly arranged stopper with which said bracket means comes into contact by the force of said spring means,

said rotary magnet means being associated with said bracket means in a manner so that when said bracket means stays in the initial position said rotor poles are positioned so as to be angularly staggered from said stator poles.

2. A typewriting mechanism for a typewriter machine as claimed in claim 1, wherein the center of swing of said bracket means and the points of contact of the pitch circles of respective meshed gears of said type-character selecting mechanism lie on the same line.

3. A typewriting mechanism for a typewriter machine as claimed in claim 1, further comprising link means driven by said rotary magnet means combined with said bracket means, said link means locking the rotational and vertical motion of said typewheel with respect to said bracket means whereby said selected type is positioned to be printed.

4. A typewriting mechanism for a typewriter machine as claimed in claim 1, further comprising lever means actuated by said bracket means through said swinging motion of said bracket means, said lever means including a feed pawl for driving an ink ribbon feed mechanism, said feed pawl engaging said feed mechanism to feed said ink ribbon when said bracket means swings back to an initial position and said feed pawl returning to its initial position when said bracket means swings so that said type wheel strikes against said platen.

5. A typewriting mechanism for a typewriter machine as claimed in claim 1, wherein said bracket means and said rotary magnet means are combined into carriage means which carries out carriage spacing motion along said platen during the typewriting operation.

6. A typewriting mechanism for a typewriter machine comprising:

bracket means capable of swinging about an axis toward the platen of the typewriter machine;

a typewheel having a number of types on the surface thereof and rotatably and vertically movably supported by a vertical shaft mounted on said bracket means;

type-character selecting means including gear meshing engagement for carrying out selection of one of said types of which is to be printed;

a rotary magnet having an output shaft rotated upon electrical energization of the rotary magnet;

means for actuating a swinging motion of said bracket means upon rotation of the output shaft of said rotary magnet so that said typewheel strikes against said platen while carrying out printing of a type of said typewheel, said actuating means comprising a first lever arm radially extending from said output shaft of said rotary magnet, a second lever arm having one end connected to the outermost end of said first lever arm and the other end associated with bracket means, and spring means for exerting restoring force on said second lever arm,

said rotary magnet and said bracket means being incorporated into a carriage means carrying out spacing motion along said platen during the typewriting operation;

said rotary magnet comprising rotor poles which are fixedly mounted on and equiangularly arranged around said output shaft, stator poles equiangularly arranged around said rotor poles, and excitation windings provided for excitation of said stator poles and said rotor poles; and

said spring means for maintaining an initial position of the bracket means, said initial position of said bracket means being defined by a fixedly arranged stopper with which the bracket means comes into contact by the force of the spring means;

said rotary magnet being associated with said bracket means in a manner so that when the bracket means stays in the initial position said rotor poles are positioned so as to be angularly staggered from said stator poles.

7. A typewriting mechanism for a typewriter machine as claimed in claim 6, wherein said type-character selecting means comprises:

a first rectangular traverse shaft rotated to transmit a circumferential type-character selecting motion to said typewheel;

a second rectangular transverse shaft rotated to transmit a vertical type-character selecting motion to said typewheel;

a first gear fixedly mounted on said first transverse shaft transversely sliding in accordance with said spacing movement of said bracket means;

a second gear fixedly mounted on said second transverse shaft transversely sliding in accordance with the spacing movement of said bracket means;

an idler gear freely rotatable on said first rectangular transverse shaft and being in meshing engagement with said second gear;

a third gear fixedly mounted on said vertical shaft and engaging with said first gear to cause said circumferential type-character selecting motion of said typewheel via said vertical shaft upon rotation of said first shaft;

a rack member having gear teeth formed at one vertical edge thereof and vertically slidably mounted on said bracket means while being rotatably associated with said typewheel, said rack gear teeth being in meshing engagement with said idler gear to cause said vertical type-character selecting motion of said typewheel upon rotation of said second shaft, and;

the points of contact of the pitch circles of said first and third gears and of said idler and rack gears lie on the center line of swinging motion of said bracket means.

8. A typewriting mechanism for a typewriter machine as claimed in claim 6, further comprising locking means for releasably locking said typewheel upon printing of said type to be printed comprising:

a member having vertically arranged teeth defining locking grooves between said adjacent teeth and vertically slidably mounted on said bracket means while being rotatably associated with said typewheel;

a locking gear fixed on said vertical shaft;

a first horizontal locking lever angularly movable on said bracket means and being engageable with one of said locking grooves of said member in an operated position thereof;

a second horizontal lever angularly movable on said bracket means and being engageable with said locking gear in an operated position thereof;

spring means for urging said first and second horizontal locking levers to initial positions thereof, and;

a third locking lever associated with said second lever arm to urge said first and second locking levers to the operated position from the initial positions in accordance with said electrical energization of said rotary magnet.

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