April 25, 1933. A. LINHARES 1,906,167

ELECTRICALLY OPERATED TYPEWRITER

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Fig. 1.

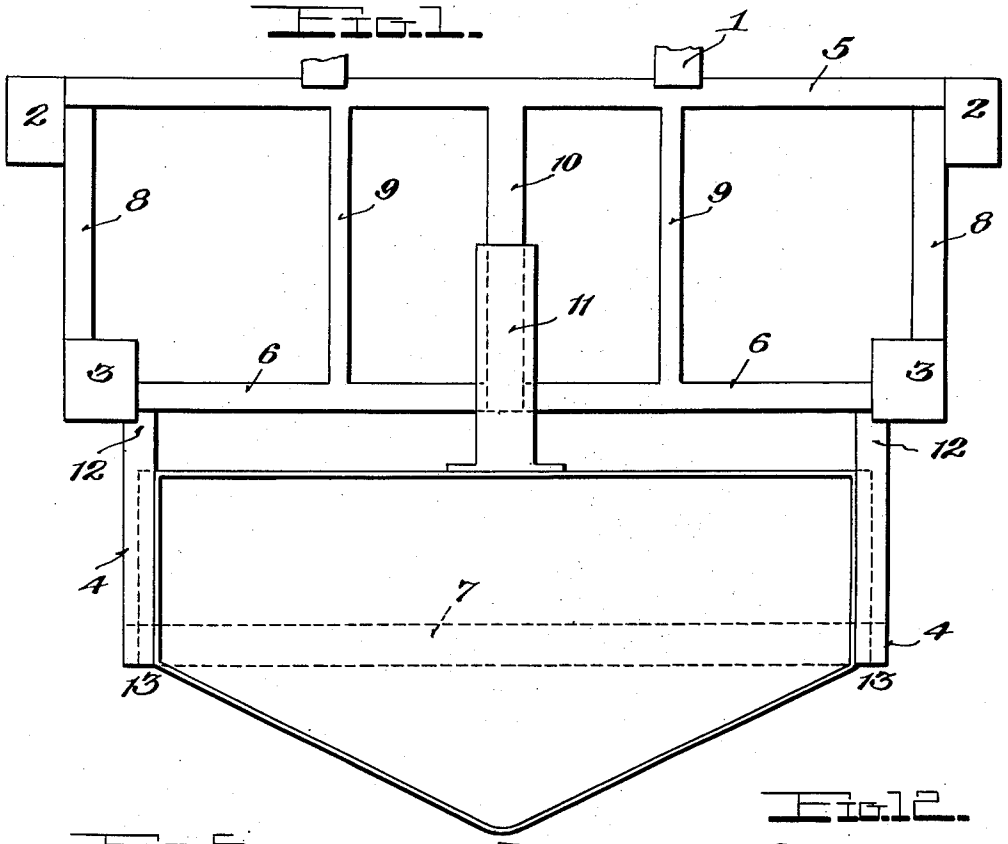


Fig. 12.

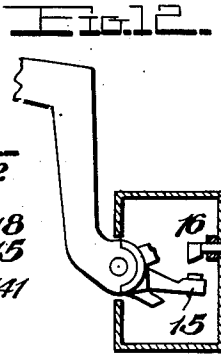


Fig. 5.

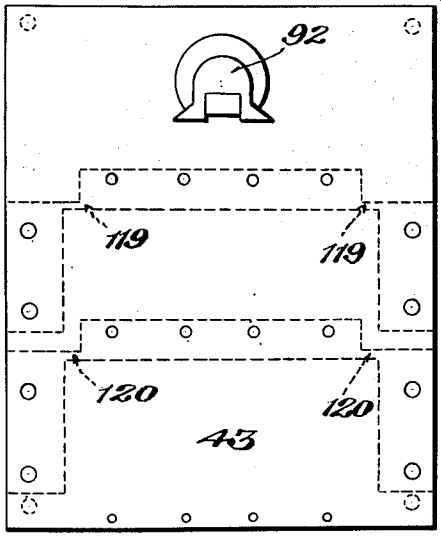


Fig. 11.

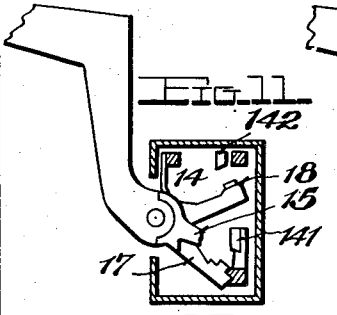
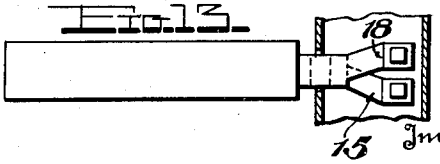


Fig. 13.



Inventor

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Attorney

April 25, 1933. A. LINHARES 1,906,167

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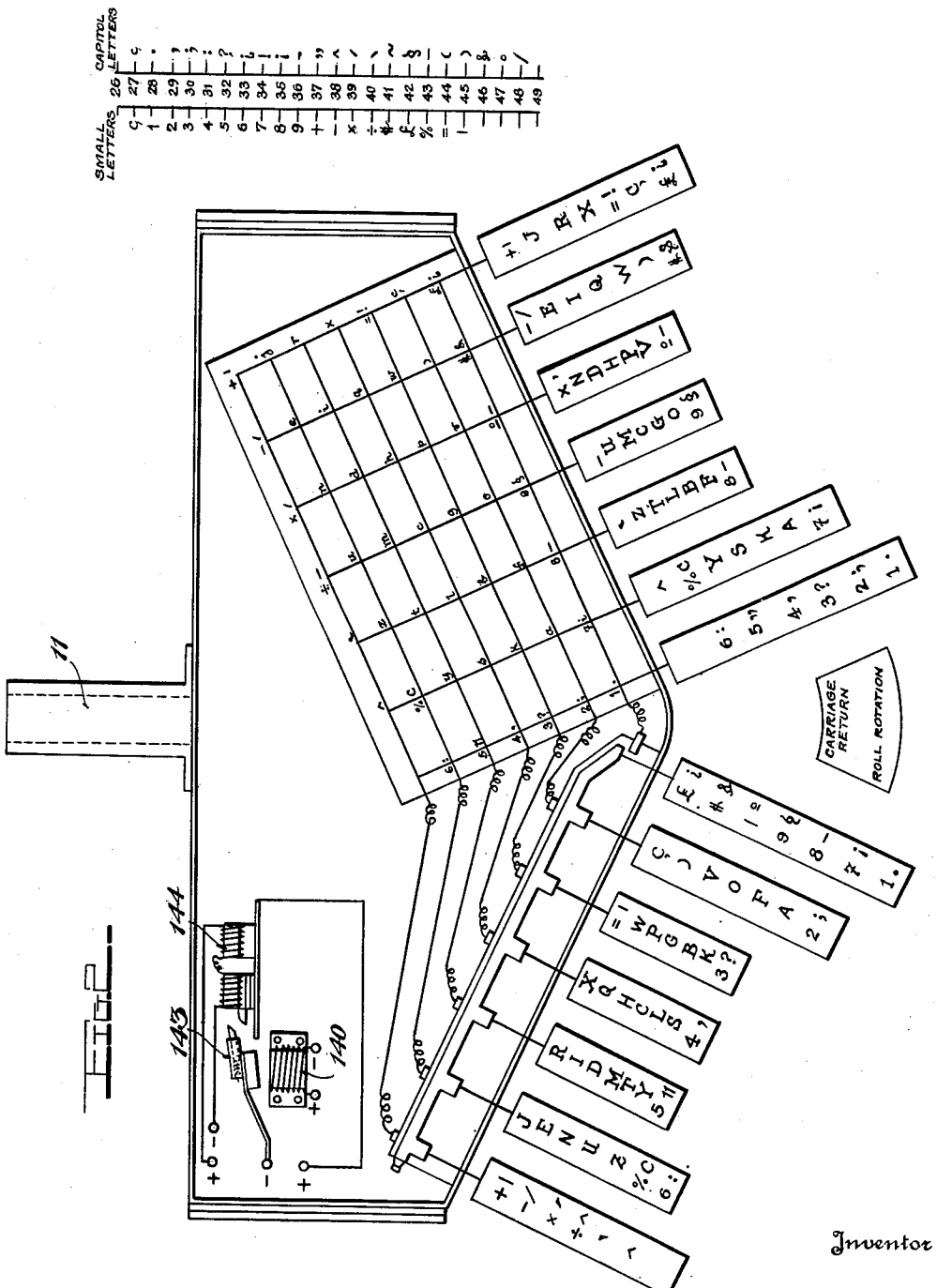


FIG. 2

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April 25, 1933. A. LINHARES 1,906,167

ELECTRICALLY OPERATED TYPEWRITER

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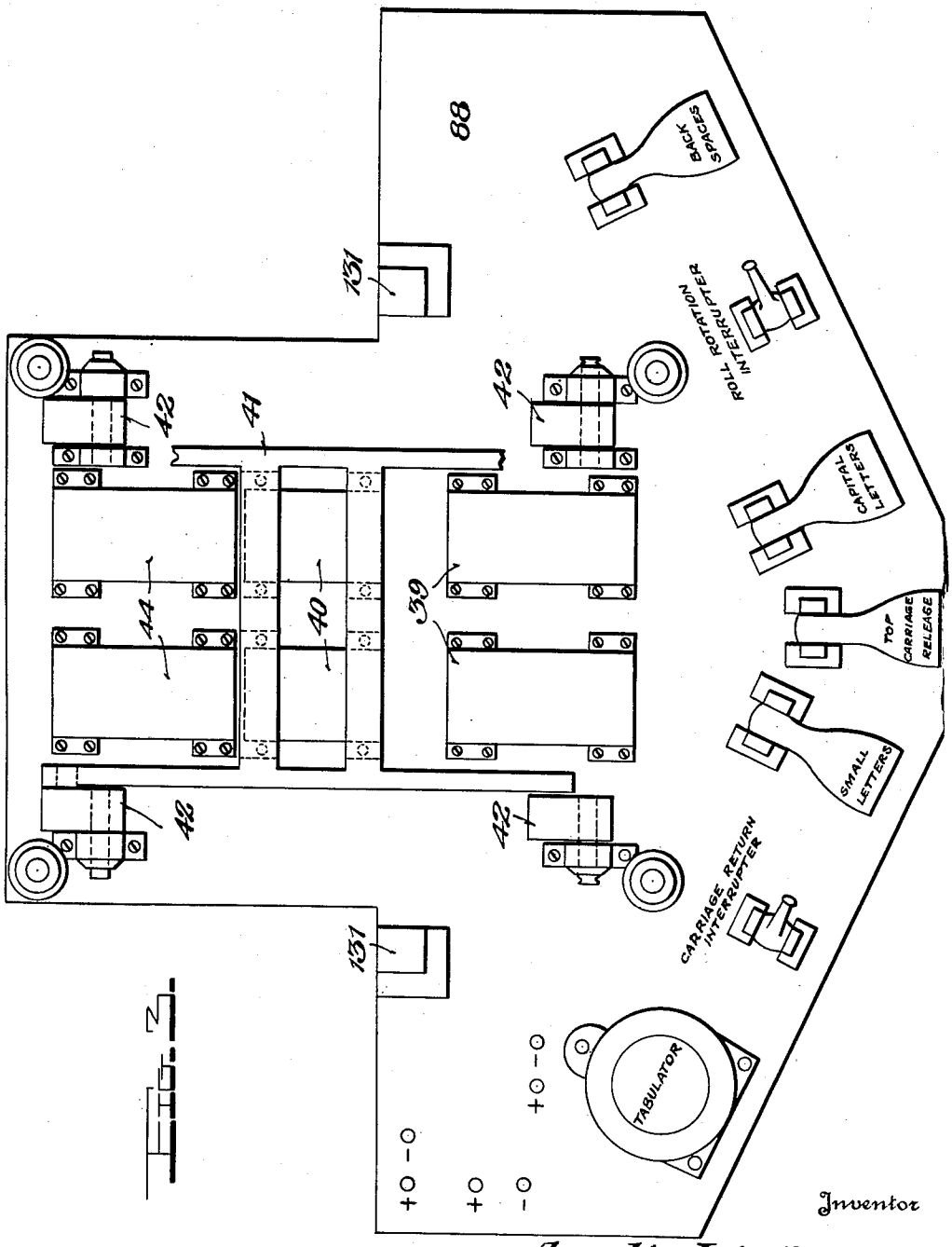


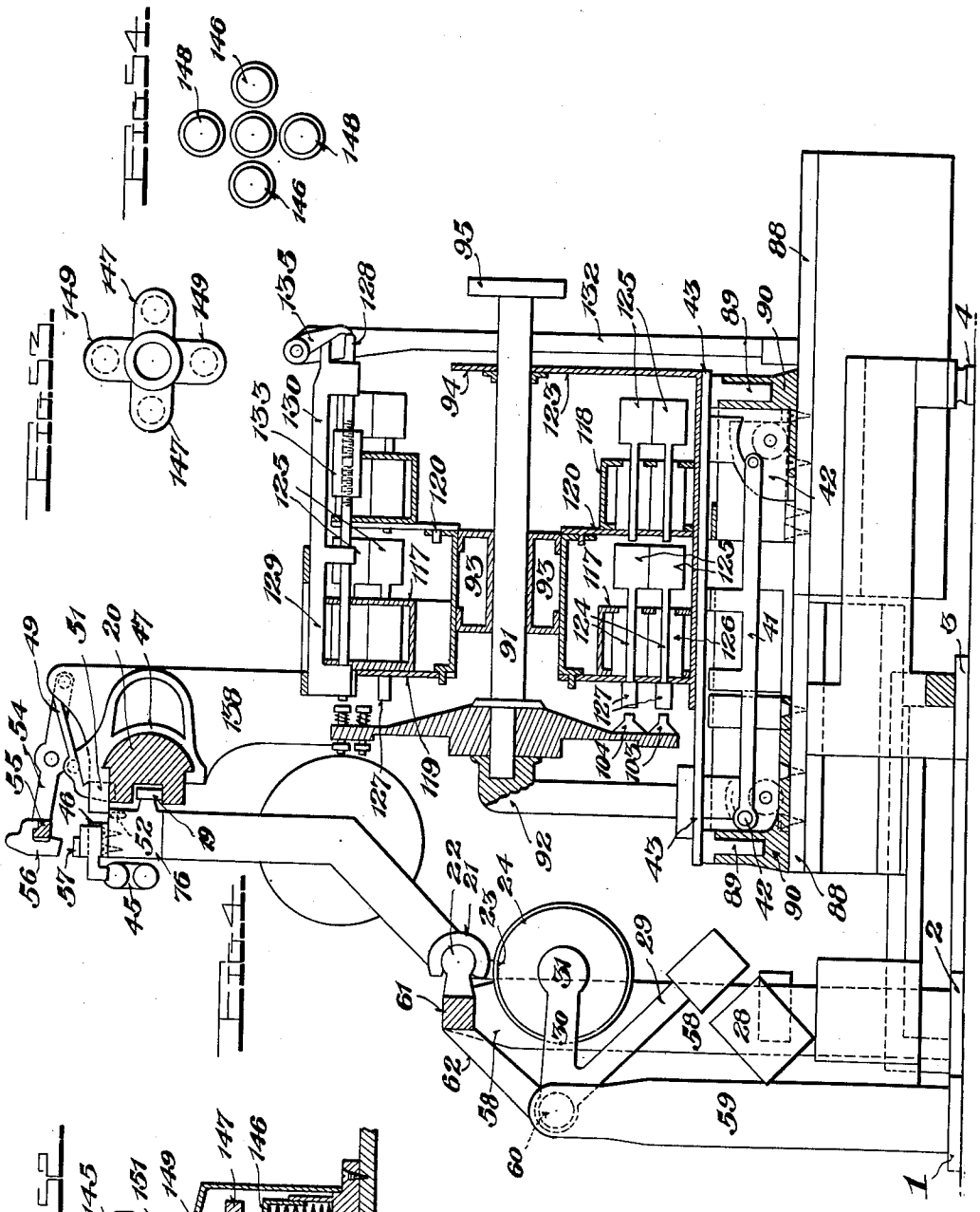
FIG. 2.

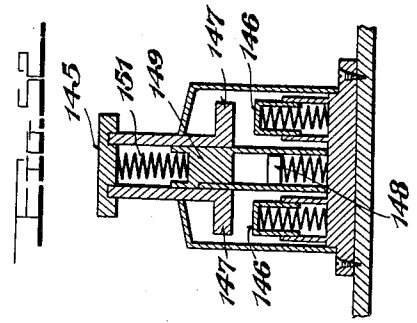
Inventor
Aurelio Linhares,
By Emil Bönnelycke
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April 25, 1933. A. LINHARES 1,906,167

ELECTRICALLY OPERATED TYPEWRITER

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Inventor
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Fig. 6.

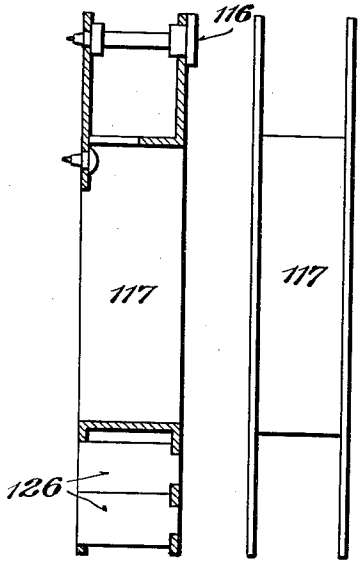


Fig. 9.

Fig. 7.

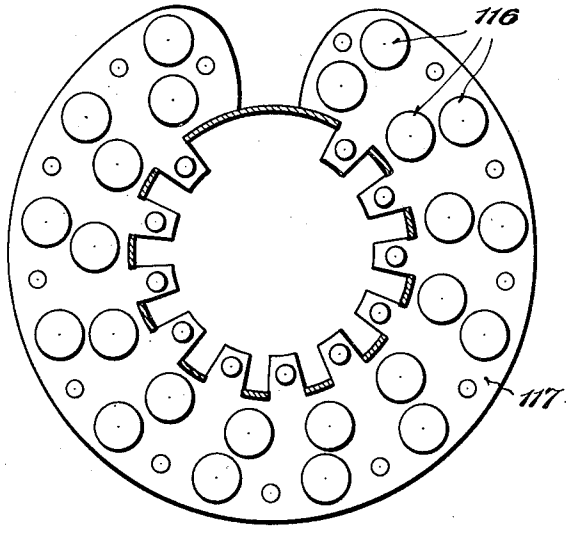


Fig. 10.

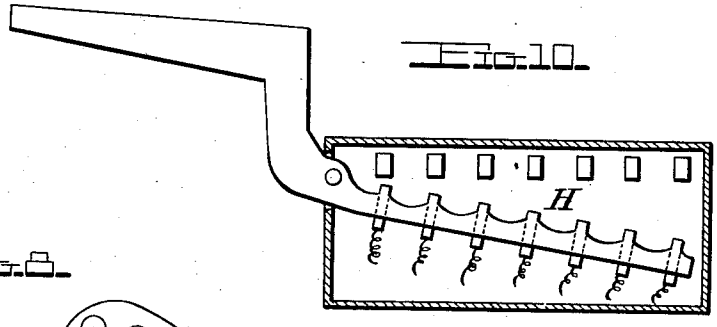
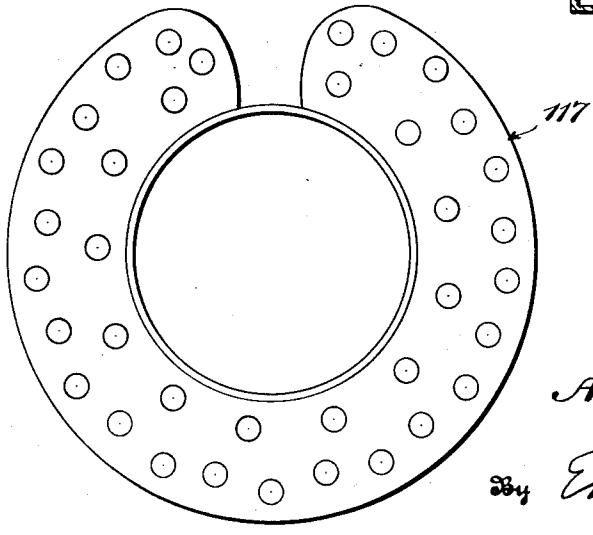


Fig. 8.



Inventor
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By Emil Bönnelycke
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April 25, 1933. A. LINHARES 1,906,167

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Fig. 14.

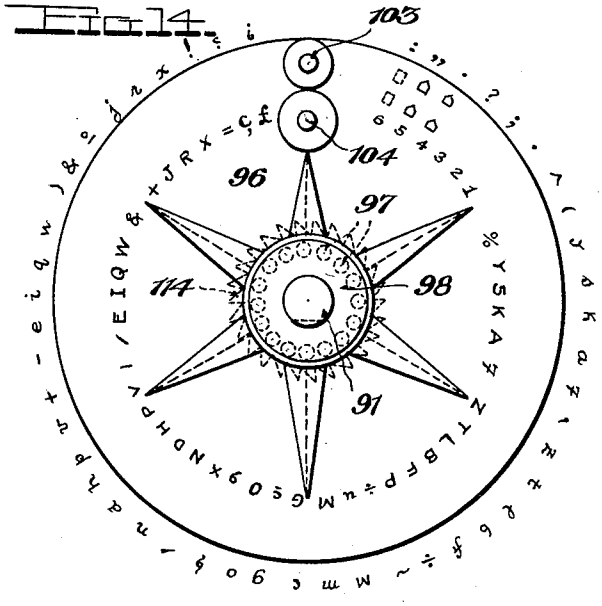


Fig. 15.

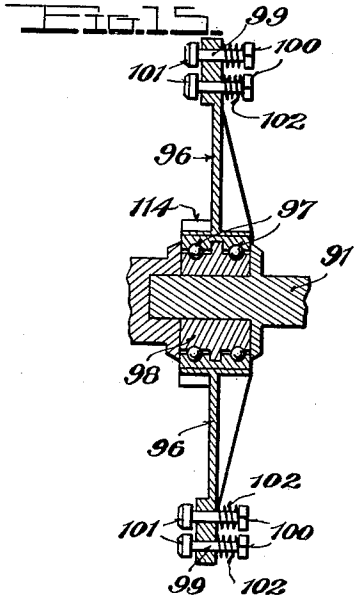


Fig. 17.

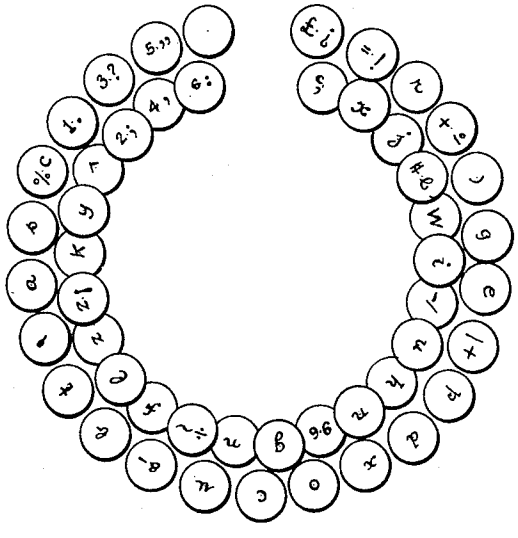
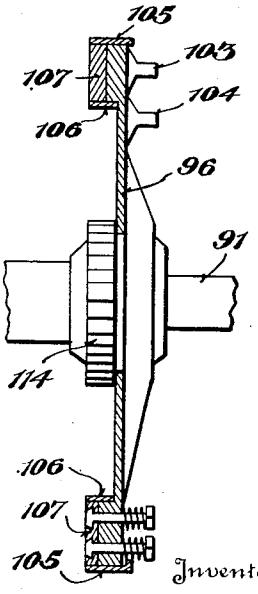


Fig. 16.



Inventor

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By Emil Bömelzhee

Attorney

April 25, 1933. A. LINHARES 1,906,167

ELECTRICALLY OPERATED TYPEWRITER

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Fig. 15.

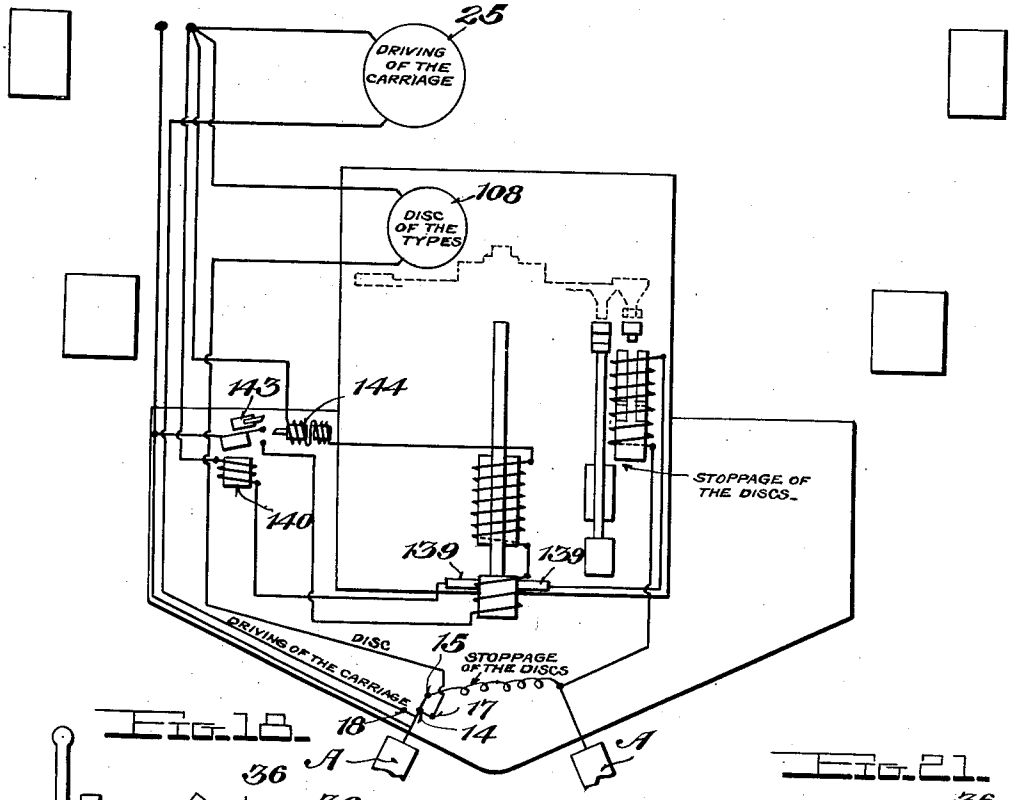


Fig. 18.

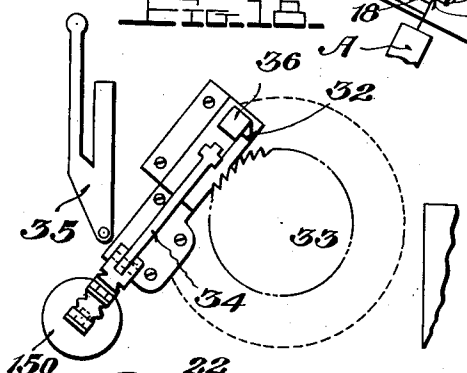


Fig. 22.

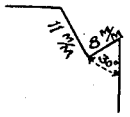


Fig. 20.

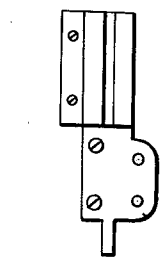
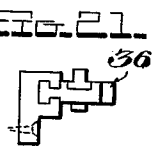


Fig. 21.



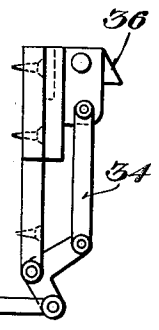
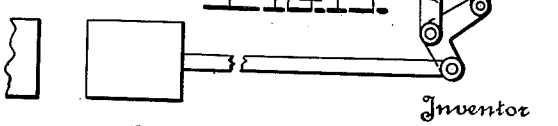


Fig. 19.



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Aurelio Linhares,

By Emil Bönnelycke

Attorney

April 25, 1933. A. LINHARES 1,906,167

ELECTRICALLY OPERATED TYPEWRITER

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Fig. 23.

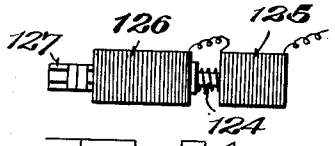


Fig. 24.

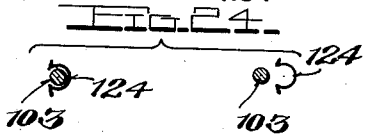


Fig. 25.

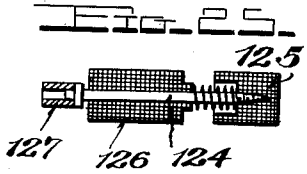


Fig. 26.

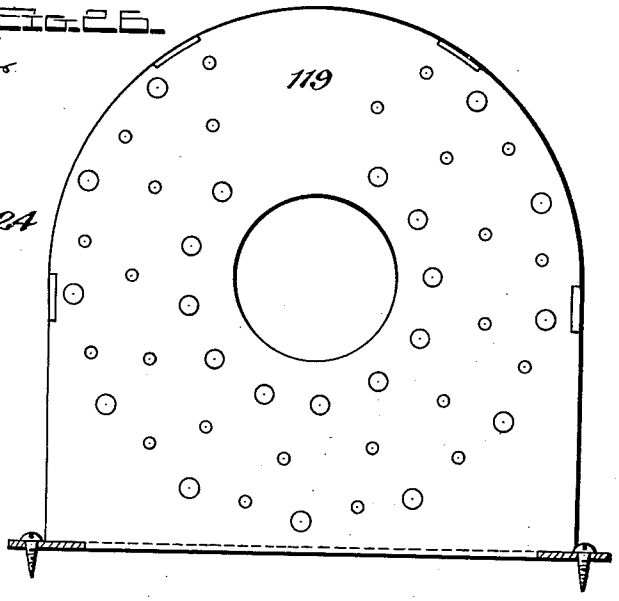


Fig. 27.

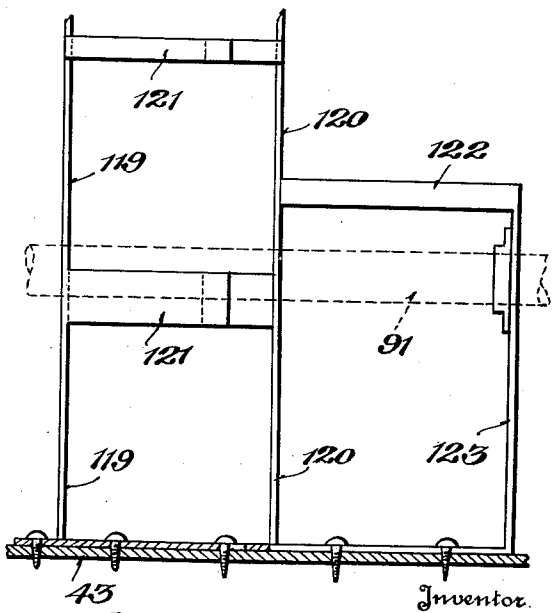
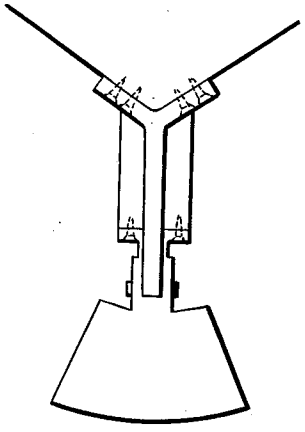


Fig. 51.



Inventor.

Aurelio Linhares,

By Emil Bönnelycke

Attorney

April 25, 1933. A. LINHARES 1,906,167

ELECTRICALLY OPERATED TYPEWRITER

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Fig. 28.

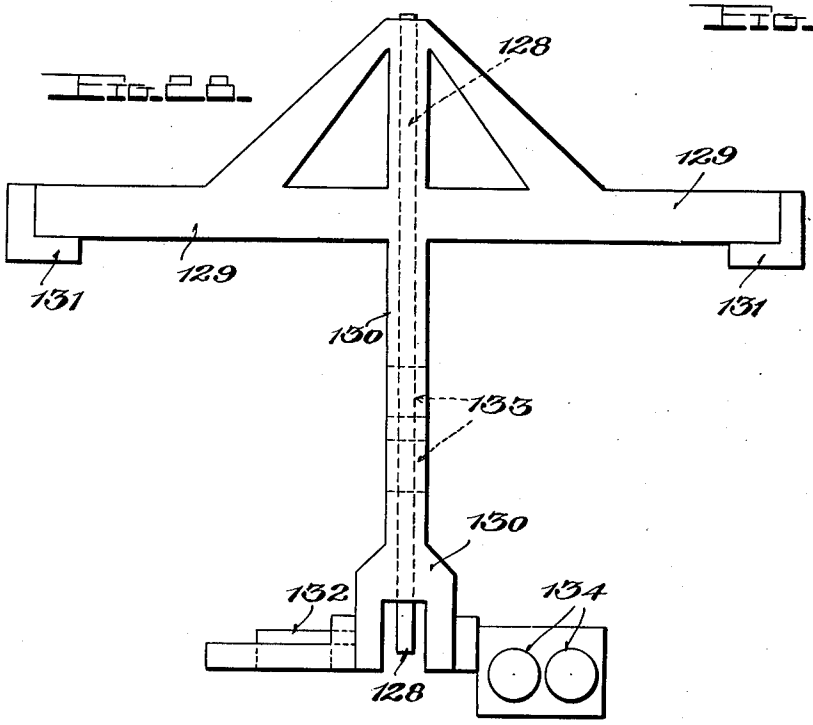


Fig. 29.

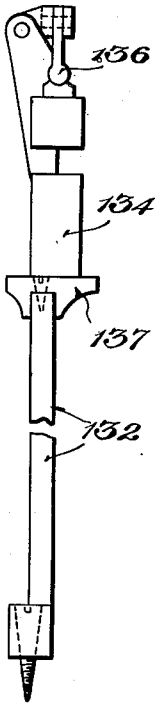


Fig. 30.

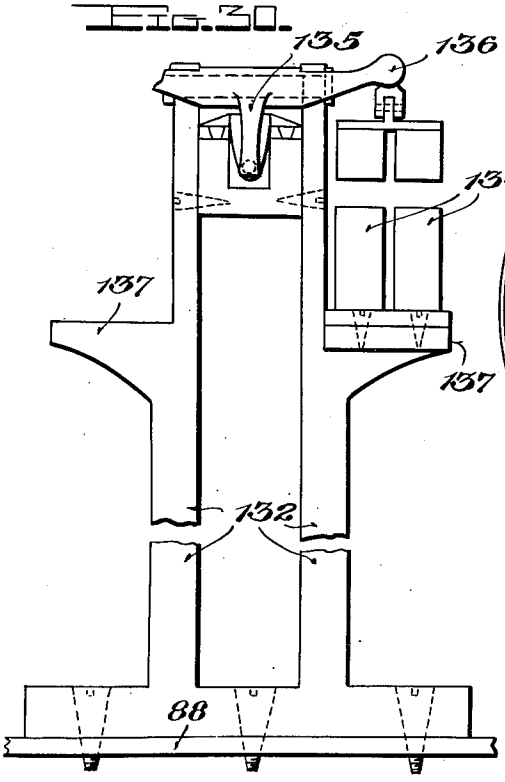
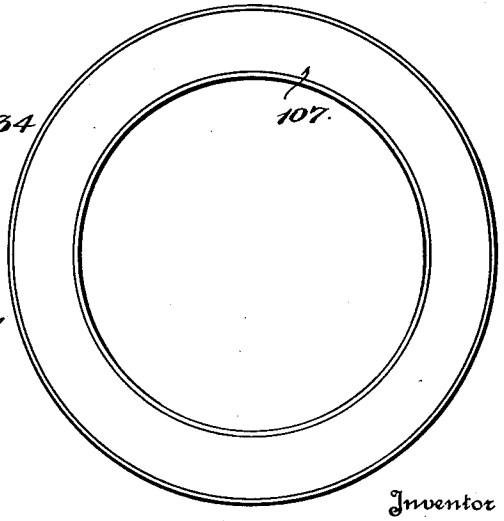


Fig. 31.



Inventor

Aurelio Linhares,

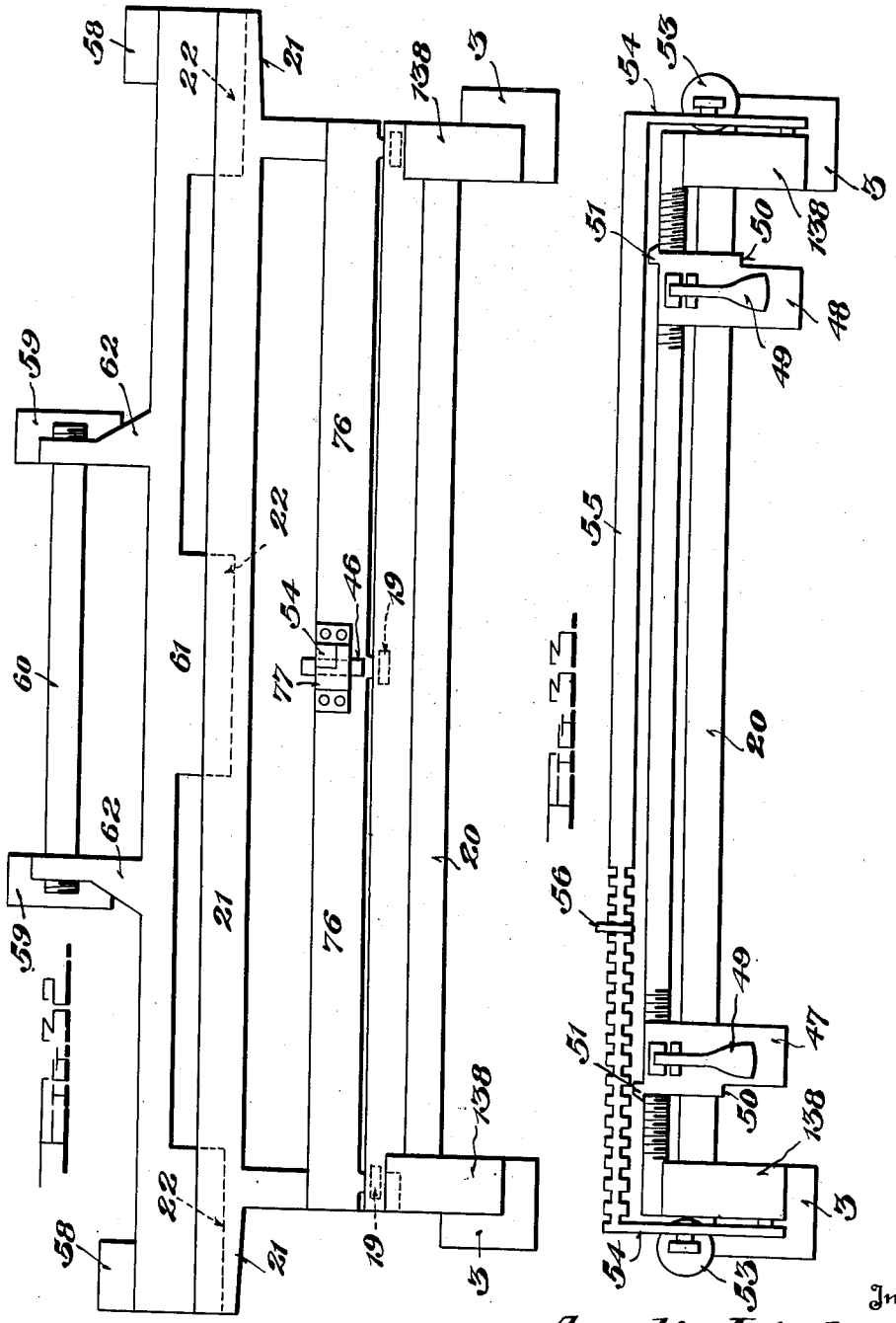
By Emil Bönnelycke

Attorney

April 25, 1933. A. LINHARES 1,906,167

ELECTRICALLY OPERATED TYPEWRITER

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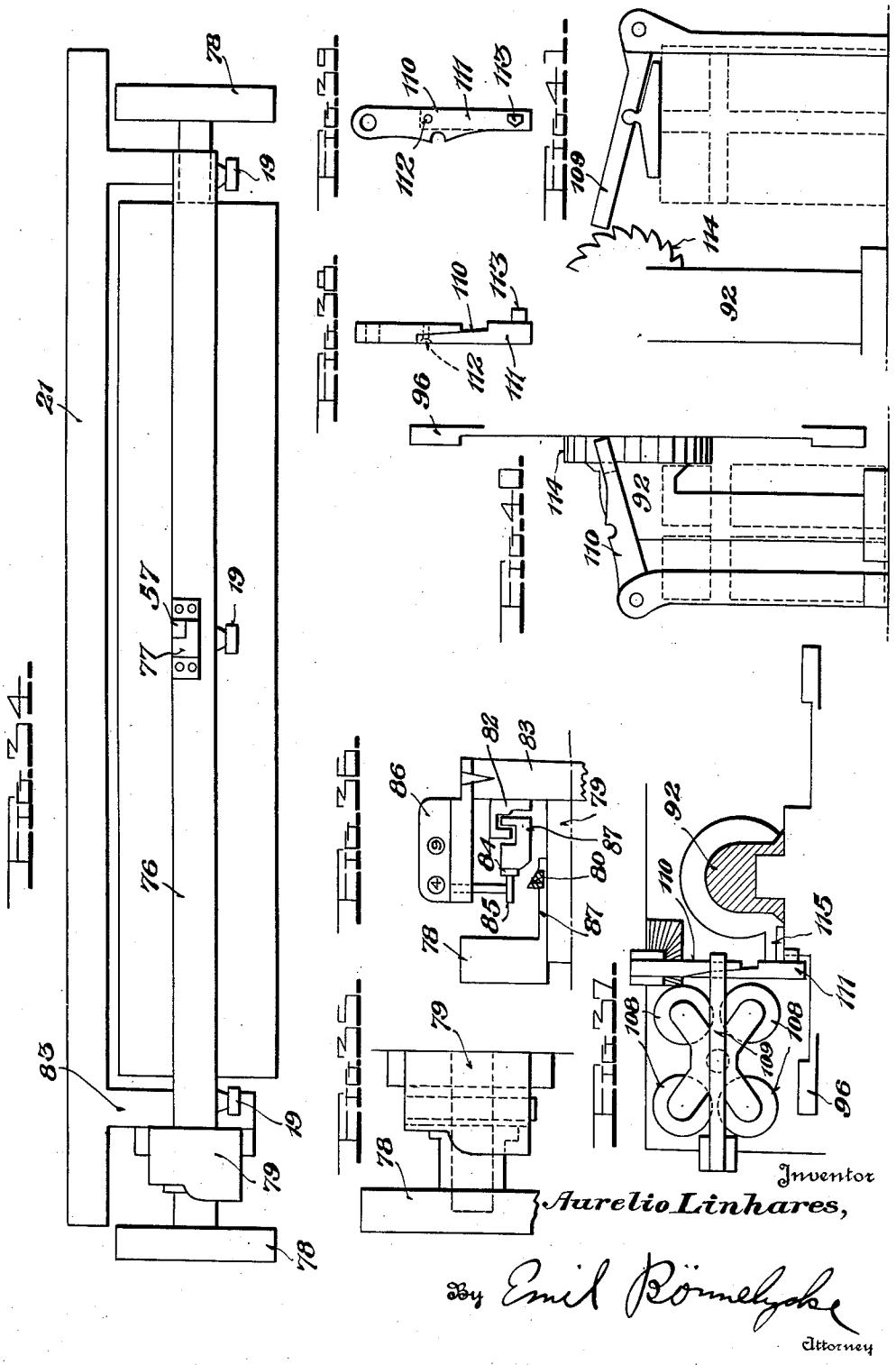


Inventor
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April 25, 1933. A. LINHARES 1,906,167

ELECTRICALLY OPERATED TYPEWRITER

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ELECTRICALLY OPERATED TYPEWRITER

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Fig. 42.

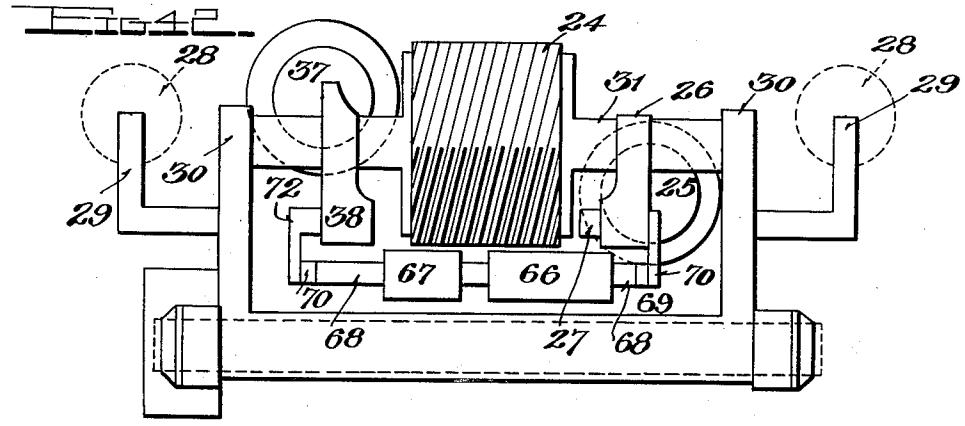


Fig. 43.

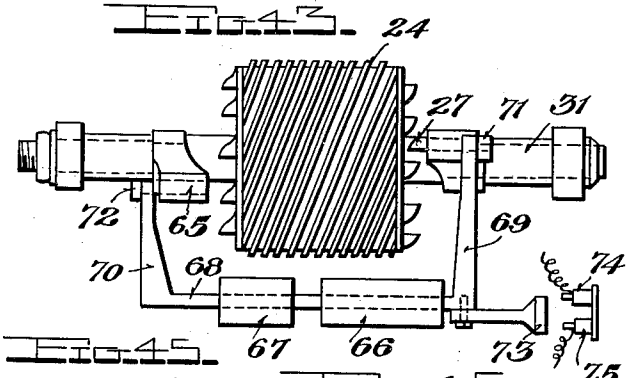


Fig. 44.

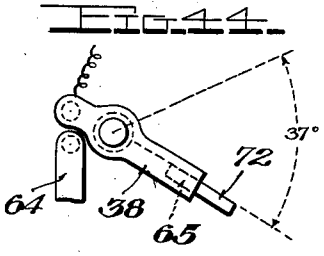


Fig. 48.

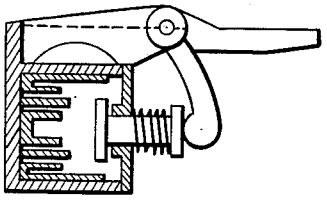


Fig. 45.

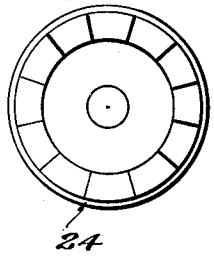


Fig. 46.

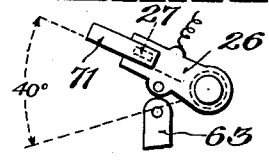


Fig. 47.

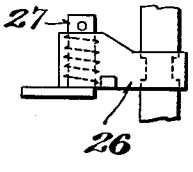


Fig. 49.

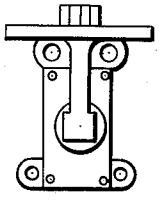
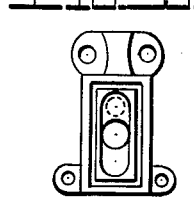


Fig. 50.



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April 25, 1933. A. LINHARES 1,906,167

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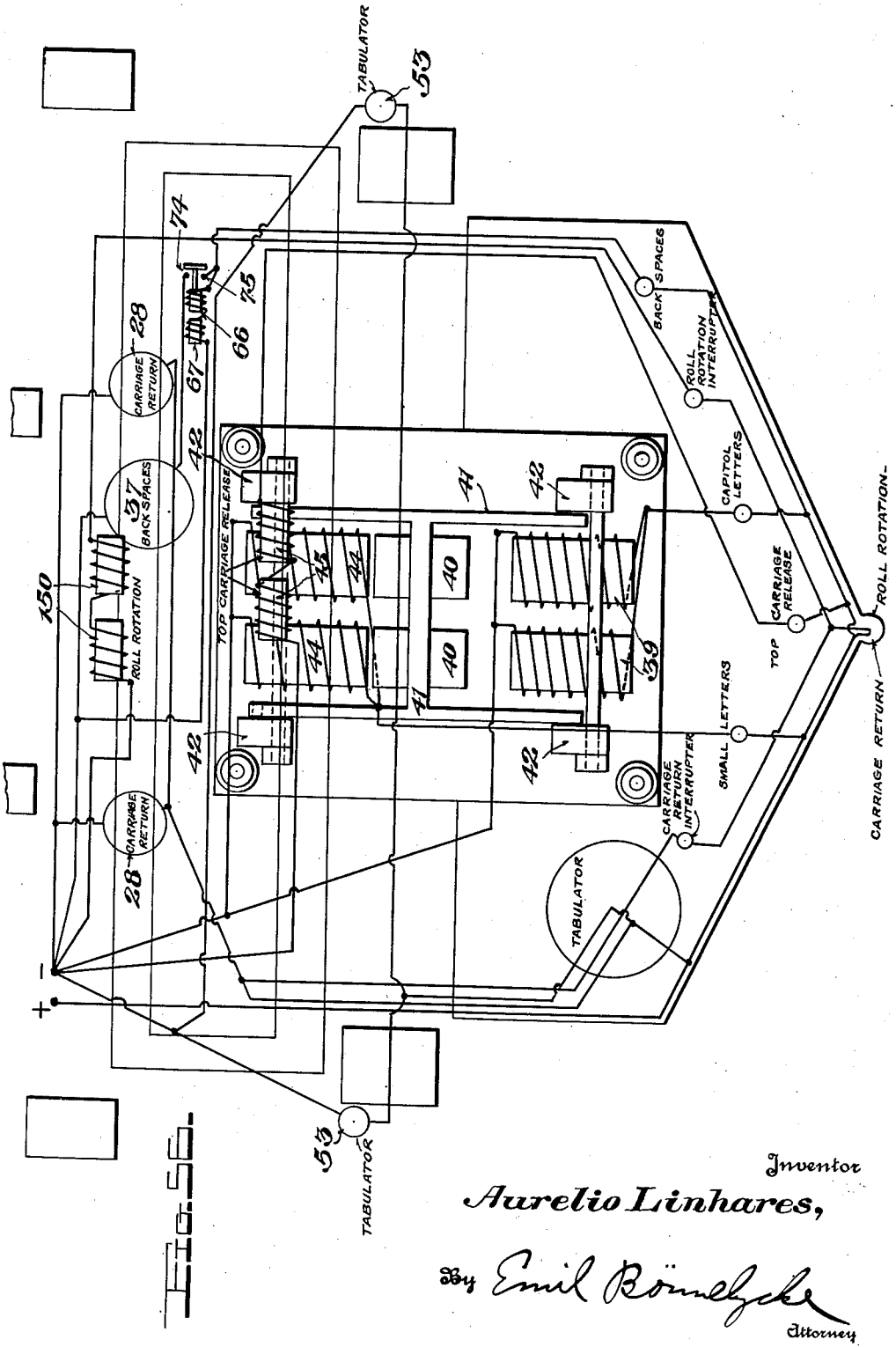


Fig. 56.

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Aurelio Linhares,
By Emil Bönnhycke
Attorney

Patented Apr. 25, 1933

1,906,167

UNITED STATES PATENT OFFICE

AURELIO LINHARES, OF RIO DE JANEIRO, BRAZIL

ELECTRICALLY OPERATED TYPEWRITER

Application filed September 7, 1928, Serial No 304,533, and in Brazil March 15, 1928.

The present invention refers to typewriting machines or typewriters.

The main object of the invention is to provide a typewriter which is entirely electrically controlled from the key board (excepting only what concerns "tabulating", in which case the operation is partly electrical and partly manual), in a form to be described hereinafter.

Other objects of the invention will become apparent as the description proceeds, with reference to the accompanying drawings.

In my novel electrically operated typewriter, the operation of all parts or elements is effected through the means of electricity or springs, the only exception to this being in what concerns "tabulating", in which case the direct manual effort of the typist has to be called into action; all the other operations are effected through the mere control of electric contacts.

Another advantage of the typewriter of my present invention is the elimination of the annoying noise resulting from the striking of the types against the roll of the present day typewriters. In my improved typewriter this is obtained as a consequence of the printing process, which is not based upon the kinetic energy with which the types strike against the roll, but upon the pressure exerted by the printing needle against the heads of the types to press the latter against the paper.

The use of electricity as the driving power will probably render it possible to attain greater speed of work which is further enhanced by the novel keyboard of the invention which employs only fourteen keys, instead of the forty two or more keys of prior machines. It is further to be noted that said fourteen keys result practically in only seven, since each of the hands acts only on this number simultaneously, so that the keyboard may be considered as consisting of seven groups of duplicated keys, each duplicated key being operated simultaneously by both the left and the right hand.

This means a considerable reduction of both mental and physical work, this latter not only on account of the lesser number of keys and the lesser effort required to operate the same, but also on account of the easier arrangement of all the keys in one plane, as well as by said keys being elongated in a manner similar to ordinary piano keys.

This commodity and rapidity of work are further enhanced by the fact that the other operations are electrically performed, having their respective keys within easy reach of the typist's fingers. Thus the operations of carriage return, top carriage release, rotation of the roll, advancement of the carriage, back spacing, capital letter printing and small letter printing are controlled from electric switching contrivances arranged within easy reach and which operate at a slight pressure of the finger, thus minimizing muscular effort and time. These results are attained through a novel combination of electromagnets and electric contacts and circuits.

It is also an advantage to have this original feature of having the operation of all of said auxiliary mechanisms of the machine electrically operated and easily controlled, the direct expenditure of manual effort being limited to tabulation alone.

It is also an important and remarkable fact to be noted, that the present invention renders is possible to operate several typewriting machines simultaneously from a single keyboard, it being only necessary therefore to connect said several typewriting machines in parallel connection relatively to said single controlling keyboard.

The invention is illustrated by way of example in the accompanying drawings, in which:—

Fig. 1 is an upper plan view, showing the supporting base of the machine and the box containing the electric bus bars;

Fig. 2 is a diagrammatic view of the box containing the bus bars, showing the keyboard and the arrangement of the bars, and showing at the right a key to the printing symbols;

Fig. 3 is an upper view of the cover plate of the box containing the bus bars, showing the parts attached thereto;

Fig. 4 is a front to rear section of the machine;

Fig. 5 is an upper view of the plate on which is mounted the printing group;

Fig. 6 is a section of the rear reel mounting the electromagnets of the printing group;

Fig. 7 is a view of the rear face of said reel;

Fig. 8 is a view of the front face of the same;

Fig. 9 is a side view of the same reel;

Fig. 10 shows one of the right hand key levers and its respective system of electric contacts;

Figs. 11, 12 and 13 are detail views of the left hand key levers;

Fig. 14 is a front view of the disc carrying the printing types, showing the arrangement therein of the different symbols, letters, figures and the like;

Figs. 15 and 16 are sectional views of the disc of Fig. 14;

Fig. 17 shows a projection of the electromagnets of the printing group upon the plane of the disc of Fig. 14;

Figs. 18, 19, 20 and 21 are detail views of the devices for the automatic rotation of the roll;

Fig. 22 is a diagrammatic view showing the relation of the movements of the bell crank of Fig. 19;

Fig. 23 shows one of the electromagnets of the printing group;

Fig. 24 shows relative positions of the catch of the electromagnet of Fig. 23 and the projecting pin or finger of the disc of Fig. 14;

Fig. 25 shows a section through the electromagnet of Fig. 23, showing the return spring of the catch;

Fig. 26 shows the mounting plate for the rear reel of the electromagnets of the printing group;

Fig. 27 is a front to rear section through the mounting system of the reels, showing the mounting plates;

Fig. 28 is an upper view of the support of the printing needle;

Fig. 29 is a side detail view of the front column of the assembly of Fig. 28;

Fig. 30 is a front view of the front columns of Fig. 28;

Fig 31 is a view of the circular printing ribbon;

Fig. 32 is a fragmentary upper rear view of the machine, showing also the carriage;

Fig. 33 is a detail of Fig. 32, including further the tabulating devices;

Fig. 34 is an upper view of the carriage with the roll;

Figs. 35 and 36 are detail views of the end attachments of the roll;

Figs. 37, 38, 39, 40 and 41 are detail views of the actuating mechanism of the disc of the types;

Fig. 42 is an upper view of the assembly of the mechanism serving to effect the advancement and back spacing movements of the carriage;

Fig. 43 is a front view of the drum of Fig. 42, with the corresponding devices for normal advancement and back spacing movement;

Figs. 44, 45, 46 and 47 show details of the assembly of Figs. 42 and 43;

Figs. 48, 49, 50 and 51 are detail views of the switching contacts of the key "carriage return-roll rotation";

Figs. 52, 53 and 54 are detail views of the switching contacts of the tabulation key;

Fig. 55 is a diagrammatic view showing the electric circuits relating to the advancement of the carriage, actuation of the disc of the types, stop of the disc of the types, and the printing needle;

Fig. 56 is a diagrammatic view showing the electric circuits relating to the back spacing movements of the carriage, capital letters top carriage release, "carriage return-roll rotation", small letters, and the tabulator.

Referring to Fig. 1, the typewriter of the present invention is supported on a base consisting of four pairs of feet 1—1, 2—2, 3—3, 4—4, respectively connected by the longitudinal bars 5, 6, 7 and the transverse bars 8—8 9—9 and 10. Fig. 1 shows also at the front a large box in which are encased the contact arms of the keys and which is supported on the central guide 11 and side guides 12—12, the latter being provided at their free ends 13—13 with sliding clamps which hold the box fast, once the same is adjusted in position. These sliding clamps are not shown in the figure.

For the sake of clearness, the typewriter of the present invention will be divided for description into three main headings, namely, 1 control; 2 printing; 3 actuation of carriage and roll.

Control.—Under this heading, I shall take up the keyboard with its attachments and the devices auxiliary thereto.

A novel feature of my invention is the utilization of the principle of the intersection of the lines of two different groups of lines—in the case of my present invention, the intersection of seven lines of one group with seven lines of another group, so as to determine forty nine distinct points which are intended to be used to determine corresponding electrical contact points.

Fig. 2 shows seven elongated keys to the left and seven others to the right, each of which is provided with its respective contact actuating arm. The left hand keys, when pressed down, transmit the electric current to the stationary bus bars, as shown by the figure, these bus bars corresponding to one of the groups of lines mentioned above. The right hand keys, when pressed down, make contact through their contact arms with said stationary bus bars, said contact arms of said

right hand keys corresponding to the other group of the above mentioned groups of lines. The relative positions of the fixed bus bars, which receive current from the left hand keys, and the contact arms of the right hand keys can be seen from Fig. 10.

The printing of any one letter is effected by pressing down simultaneously the corresponding key for each hand.

To illustrate, suppose it is desired to print the letter "H".

By depressing the left hand key bearing the letter H, the positive current brought in by bar 14, Figs. 11 and 12, passes to the three arms of the lever, and through arm 15 passes on to the fixed bus bar to which the corresponding contact 16 is connected through a suitable conductor. The right hand key bearing the letter H is also simultaneously depressed. The contact arm of this key touches on every one of the fixed bus bars; however, out of its seven insulated contacts, Fig. 10, the only one to receive current will be the one touching the excited bar previously mentioned. This current is sent to the electromagnet of the letter H in the printing group.

All other letters, figures and like symbols are likewise determined.

Through arm 17 of the contact arm of the depressed left hand key, the current is sent to the electromagnet of the disc carrying the types, imparting to the same a quick rotary motion, as seen from the circuit diagram of Fig. 55.

Through arm 18 of the same lever the current is sent to the electromagnet of the actuating mechanism for driving the carriage. The leftmost key of the left hand set of keys, is not provided with a like set of contacts, and therefore does not actuate the carriage, this leftmost key being the one bearing the accentuation marks. In this way, by depressing one of the left hand keys, current is sent to one of the fixed bus bars, and simultaneously for actuation of the carriage and quick rotation of the disc carrying the types. The mechanisms used for actuation of the carriage and rotation of the disc will be explained hereinafter with further details.

Means auxiliary to the control.—The central key "carriage return-roll rotation", which, as seen from Fig. 51, is a mere circuit interrupter, serves when depressed, to send current simultaneously to the electromagnet which effects the return of the carriage and to the electromagnet which effects rotation of the roll, whereby upon depressing said central key, the carriage will be automatically returned to the initial position in the stroke and the roll will be automatically rotated so as to advance one or two spaces, as desired. For a better understanding of the operation of the several mechanisms, the actuation or driving of the carriage will first be studied.

Fig. 4 shows how the carriage is supported from above and below. From above, it is supported by means of the rollers 19 which run in a slot cut in bar 20, and at its lower part the carriage is supported by means of the cylindrical, hollow split bar 21 mounted on a plurality of supporting elements 22 which have the part that engages with said hollow bar 21 properly shaped to suit the curvature of said hollow of said bar 21; these parts can also be seen from Fig. 32. To the lower portion of hollow bar 21 is attached a rack 23 which is acted upon by a worm 24, Figs. 4, 42 and 43. When a current is sent to excite the electromagnet 25, Fig. 42, this magnet pulls down lever 26, the tooth 27 of which acts on the teeth of the drum or worm 24, causing the latter to rotate through an angle of 30°, which in turn causes the rack, and therefore the carriage to advance through the space corresponding to one letter. As the carriage moves forward, it winds a coil spring (not shown) located at the right. This coil spring is similar to the ones usually employed with the carriages of ordinary typewriters, but has an inverse function, since the same opposes the advancement of the carriage, instead of effecting such advancement, as is usual. This coil spring serves to cause the carriage to automatically return to the initial position of the stroke, when the rack is released from the worm.

The worm is made to release the rack when the key "carriage return-roll rotation" is depressed, since this will cause the excitation of electromagnets 28—28, Figs. 4 and 42, which attract their armatures causing the double armed lever 29—29, which carries axle 31 on which the worm is mounted, to move down, thus moving said worm away from the rack, which leaves the carriage free and subjected to the action of the coil spring (not shown), which latter causes the carriage to automatically return to the starting point, as already indicated. As soon as said magnets 28—28 lose their excitation, a sufficiently powerful spring (not shown) brings said double armed lever back to its normal position, thus causing the worm again to engage the rack.

This is the way in which are performed the actuation or driving of the carriage and the return of the same to its starting position.

The current for the rotation of the roll is conducted to the electromagnet 150 of the respective mechanism by naked conductors being received through brushes conveniently mounted on said hollow bar 21, said mechanism being also mounted on the upper part of said carriage hollow bar 21. The

armature of this magnet, as it moves, carries along the system of levers indicated in Figs. 18 and 19, causing tooth 32 to rotate the toothed wheel 33 which is fixed to the axle of the roll, thus causing the latter to rotate.

The stroke of lever 34 is adjustable for one or two spaces, according as the graduated lever 35 allows it to run freely, or locks the same through its tooth 36, when pulled to its forward position.

Both the circuits—carriage return-and-rotation of the roll have manual circuit interrupters as indicated in Fig. 3, to cut out said circuits from automatic operation whenever desired.

Fig. 3 shows the cover plate for the box that contains the electric bus bars.

On this plate is mounted the control key for "back space," acting as a mere circuit interrupter which, when depressed, sends current to a suitable electromagnet associated therewith.

This said electromagnet is shown at 37, Fig. 42, and, when the interrupter key is depressed, this magnet acts on lever 38, which, through the tooth 65, causes the worm to rotate in a reverse direction as compared to its rotation for the advancement of the carriage and through the same angle as for said advancement, whereby the carriage is caused to move back through the space corresponding to one letter.

Next on this said cover plate, comes the manual circuit interrupter for cutting out the automatic rotation of the roll.

Next comes the control key for "capital letters", which, when depressed, sends current to the electromagnet 39—39, Fig. 3, which attract their armatures 40—40, the latter dragging along with the levers 41—41, Fig. 4, which cause cams 42—42 to rotate, whereby to raise plate 43, Fig. 4, on which is mounted the printing group. The reason for this raising of said plate 43 and printing group thereon will be explained further down, under "printing".

Next comes the control key for "small letters", which, when depressed, sends current to the electromagnets 44—44, whereby armatures 40—40, rods 41—41 and cams 42—42 will be caused to move in a reverse direction as when said control key for capital letters is operated, thus causing said plate 43 to be lowered.

Next comes the control key for "top carriage release", which is intended to release the carriage when the same has come to the end of its normal stroke, in order to allow the printing of a few additional letters or like symbols whenever desired. This key, when depressed, sends current to the electromagnet 45, Fig. 4, which causes tooth 46 to be retracted (as shown in the figure).

For a clear understanding of how this operation is performed, I will first explain how the stroke of the carriage is limited.

The riders 47 and 48, Fig. 33, are capable of running over the bar 20, so as to be set at any desired position, which is indicated on a graduated metal strip attached to the face of said bar 20 by an arrow head at 50 (said graduated strip and arrow head being not shown in the figure). In the normal or released position of lever 49 of the riders, the latter are locked, respectively, against a rack such as shown at the left hand portion of the figure only, the locking being automatically effected under the action of a spring; by depressing lever 49, the rider is unlocked, so as to allow it to be moved to the desired position on bar 20. Once the riders are locked in position, the stops 51—51 lock the carriage against further advancement whenever tooth 46, Fig. 32, strikes against one of said stops. In such position, if the top carriage release key is operated, tooth 46, Fig. 4, is retracted, setting free sliding detent 52 which slides up so as to prevent said tooth from returning to the position for engaging the stop when said key is released. As the carriage is advanced for the printing of an additional letter, said detent 52 is made to pass under said stop 51, and therefore will not continue to hold tooth 46 in its retracted position, which tooth will then return to its normal position as the carriage is advanced beyond the normal limit of the stroke. As the carriage is returned to within the limits of the stroke, the tooth 46 touches against and is slightly pushed back by the outer face of stop 51 which is suitably bevelled for the purpose, during which time detent 52 will be kept under stop 51; as soon as the stop is passed by, the tooth will completely return to its normal or unretracted position, being again ready to lock the carriage against the stop.

Next on this said cover plate comes the manual circuit interrupter for "carriage return", already explained.

Next comes the "tabulator" control, details of which can be seen from Figs. 52, 53 and 54, and which is a circuit interrupter controlling two circuits, as explained below.

Before pressing down the tabulator key, it will be necessary to hold the carriage with the right hand, the reason for this being that the carriage will then be free to be thrown back to the beginning of the stroke under the action of its coil spring, as will be apparent from what follows. The carriage will have to be actuated by hand for tabulation, as already stated.

By depressing the "tabulator" key until a first resistance to its advancement is felt, current is sent to the electromagnets 53—53, Fig. 33, which pull down lever arms 54—54 (shown also in Fig. 4) which force down bar 55. In a rack on this bar 55 a rider 56, Figs. 4 and 33, is adjusted to the desired

position, and serves as a stop against which a detent 57 will be made to contact, as explained below.

By continuing to depress the "tabulator" key until a second and last resistance to its advancement is felt, current is sent to the electromagnets 28, Fig. 4, which release the carriage's rack 23 from the worm 24, as already explained. The carriage will then be free to fly back under the action of its coil spring, and, as previously stated, must at this time be held with the right hand, with which said carriage is pushed against said coil spring until said detent 57 contacts against said rider or stop 56 which has previously been set in the desired position. When the "tabulator" key is released, the worm 24 comes again into gear with the rack 23 so as to lock the carriage, and the electromagnets 53—53 lose their excitation, thus allowing the bar 55 to be forced up under the action of suitable springs (not shown in the figure). To the face of this bar 55 there is attached a graduated strip, for the purpose of indication in setting the riders 56 in the desired positions.

The utilization and mode of operation of the keyboard which I have just described under this head—Control—are important features and, to the best of my knowledge, they have not been proposed heretofore in connection with typewriting machines.

Printing.—The printing group comprehends three different parts:—the disc which carries the types, with its actuating system; the group of electromagnets intended for locking the disc; the printing needle.

Its mode of operation, in a general way, is as follows:—whenever the keyboard is operated for the printing of any one letter, the disc carrying the types is actuated with a rapid rotary motion, while at the same time the catch carrying stem of the electromagnet corresponding to said letter is advanced so as to lock the disc in the position corresponding to said letter; the printing needle then advances, pressing the type against the roll, thus causing said selected letter to be printed.

I shall now describe the several parts in detail.

The disc and its actuating system, as well as the group of electromagnets intended for locking the disc, are mounted on plate 43, Fig. 4, which, as previously stated, can be made to move up and down. The purpose of this up and down movement of plate 43 and system mounted thereon is to allow the printing of capital and small letters, as desired. This up and down movement of plate 43 is secured through a system of electromagnets mounted on plate 88, which, as previously stated, serves as a cover plate for said large box that contains the electric bus bars, Figs. 3 and 4. This system of electromagnets comprehends magnets 39—39 and 44—44, fixed on said plate 88, and their respective armatures 40—40 which are fixed to the rods 41—41, which latter are attached to the cams 42—42 which are thus made to act on the under face of said plate 43. For printing capital letters, the current is sent, through the operation of the key for "capital letters", to the electromagnets 39—39, which attract their armatures 40—40, which latter, through rods 41—41, cause the cams 42—42 to rotate, thus raising said plate 43. This plate 43 is guided in its up and down movement by four guide legs 89—89 which move in the hollow columns 90—90 mounted on said large plate 88. When the key for "small letters" is depressed, current is sent to the electromagnets 44—44, which attract armatures 40—40, which causes the two pairs of cams 42—42 to be rotated in a sense contrary to that explained above for the case of capital letters, whereby said plate 43 and system mounted thereon will be allowed to move down by their own weight. The electric circuits for the electromagnets 39—39 and 44—44 are shown in Fig. 56.

The disc 96 which carries the types is shown in front view in Fig. 14 and in side views in Figs. 15 and 16. In Fig. 4, said disc is shown in its assembled position in the machine, mounted on axle 91 one end of which rests on a column 92 mounted on said plate 43, said axle 91 being further supported on supports 93 and 94. By pulling out axle 91 by means of knob 95, the disc 96 will be freed from the said axle, and the disc may then be removed for substitution of the circular printing ribbon or for the purpose of cleaning the types. Disc 96 rotates on a ball bearing, as seen at 97, Fig. 15, which is arranged over a sleeve 98 fixed to axle 91. The types are mounted on the disc 96, arranged in two concentric series close to the rim of the disc, and traverse the disc in suitable seats therein. The types arranged in the external series are those for printing the small letters and the accents, the types arranged in the internal series being those for printing the capital letters and the numerals. Fig. 14 indicates the arrangement of the types on the disc, as well as a few of the holes for seating the types. The types, as seen from Fig. 15, consist of a stem 99, head 100 and the type proper 101, and are provided with a spiral spring 102 for forcing the types back into normal position as soon as the same are freed from the pressing action of the printing needle. The disc 96 is further provided on its front face with two projecting pins or fingers 103 and 104, which, by engaging the catch of the electromagnet intended for locking the disc and which has been advanced, locks the disc in the correct position for the printing of the corresponding letter. Fig. 31 shows the circular printing ribbon 107, which is held on to the disc

96 by means of fasteners 105 and 106, as indicated in Fig. 16.

I shall now explain how the disc 96 carrying the types is actuated or driven with a rapid rotary motion.

The actuation of disc 96, Figs. 37, 38, 39, 40 and 41, is performed by means of the four electromagnets 108, which receive current whenever the keyboard is operated for the printing of any one letter. The armatures of these electromagnets are attached to the middle point of lever arm 109; the displacement or stroke of these armatures is preferably of the order of, say, three millimeters, so that the free end of lever arm 109 will be moved through six millimeters. The free end of said lever arm 109 acts on the middle point of lever arm 110, which latter is arranged perpendicularly to lever arm 109, so that the free end 111 of lever arm 110 will be moved through twelve millimeters. Fig. 38 shows the lever arm 110 with its free end 111, which latter is a mere extension pivoted with a spring action at 112 to said lever arm 110 in such a way as to allow said extension 111 to move sidewise for a purpose explained below. This extension 111 is provided with a tooth 113 which, when the above mentioned system of levers is abruptly pulled down by said magnets 108, acts on one of the teeth of the toothed wheel 114 which is fixed to the disc 96, thus imparting to this said disc an abrupt and rapid rotary motion. When said extension 111 has moved through half its total final displacement, the same is pushed sidewise by a stop 115 fixed to the head of column 92, so as to prevent the tooth from locking or hindering the rotary motion of the disc. When the current is cut off from the electromagnets and the levers are thereby set free, they return to their initial position, forced back by springs not shown in the figures, said tooth 113 rubbing against the toothed wheel without moving the latter, as said toothed wheel will by this time be locked by the catch of some one of the electromagnets intended for locking the disc, as explained below.

I shall next describe the group of electromagnets intended for locking the disc which carries the types.

These electromagnets are 48 in number, each magnet corresponding to a letter or like symbol, and are arranged in two groups of 24 magnets each mounted on the aluminium reels 117 and 118, respectively. One of these said reels is shown in side view in Fig. 9.

On each reel, the 24 electromagnets are arranged in two concentric series of 12 magnets each, as seen from holes 116, Fig. 7, which figure shows the rear face of reel 117. The projections of the 48 electromagnets upon the plane of the disc which carries the types would be such as shown in Fig. 17. Fig. 4 shows the arrangement of reels 117 and 118 as assembled in position in the machine, with the electromagnets mounted thereon. The reels 117 and 118 are mounted on the vertical plates 119 and 120 respectively, of which one is shown in front view in Fig. 26 and both in side view in Fig. 27. These plates 119 and 120 are mounted on said plate 43, as shown in Figs. 4, 5 and 27. The plates 119 and 120 are connected together by bars 121—121, for rigidity of the whole, this whole being reinforced in rigidity by its connection through bar 122 to the column 123 which offers a bearing for the axle 91 of disc 96. Said plates 119 and 120 are suitably perforated to let pass the catch carrying stems of the electromagnets for locking the disc. These electromagnets comprehend a core 126, armature 125 and a stem 124 which terminates in a catch 127, and are provided with a spiral spring located between the core and the armature for returning the stem to initial position, as shown in Fig. 23 and in section in Fig. 25. Fig. 25 shows the core perforated so as to allow the stem 124 to traverse the same and move therein. The catch 127 consists of a small piece of laminated steel bent into a U shape so as to form a springy mouth or jaw, and is attached to the free end of the stem 124. The opening of the U is directed so as to catch on the stop finger 103 (or 104) of disc 96, when the stem is advanced and the disc is rapidly rotated. The opening of the U is slightly less than the diameter of the stop finger, so as to enable said catch 127 to exert a spring action on said stop finger, in order to prevent the disc from jumping back once the stop finger is caught by the catch. Fig. 24 shows to the right the stop finger before entering the catch, and to the left said stop finger caught into the said catch. The cores of the electromagnets are fixed to the inside of the reels, for which purpose the front faces of said reels are made removable, being fixed to the rear faces by means of bolts, as shown in Fig. 6.

I shall next describe the system of the printing needle.

The system of the printing needle is independent of the up and down movement of plate 43 and system mounted thereon.

The printing needle 128 is mounted on the arched piece 129 and its extension 130. The arched piece 129 is supported on the legs 131 which rest on the large plate 88 that serves as a cover for the box containing the electric bus bars, and the forward end of extension 130 rests on columns 132 which rest on said plate 88. The needle, when pushed forward, travels through a space of four millimeters, pressing the type that happens to be in front of it against the roll. Between the free end of the needle and the type, there is a space of two millimeters, it being then obvious that the type will travel through a space of two millimeters. The needle 128 is divided into

two sections, being adjustable in length by means of the nut 133 acting on the right and left handed threads formed on the adjacent ends of the sections of the needle. The needle is actuated by means of the four electromagnets 134 mounted in two symmetrical pairs on the shelves 137 of columns 132. The movement of the magnets 134 is communicated to the needle through a three armed lever, the magnets acting directly on the arms 136 of this said lever, the central arm 135 of which finally acts on the needle to move the same. The needle, when set free by the magnets, returns to normal position under the action of a spring not shown. Since the system of the needle is mounted on plate 88, the same will be independent of the up and down movement of the printing group which is mounted on plate 43, so that in front of the needle will be encountered for printing the types of the internal or the external series of disc 96, according as the keyboard is operated for the printing of capital or small letters. The piece 129 which supports the needle is formed into an arch just for the purpose of allowing said up and down movement of the printing group.

Actuation of carriage and roll.—I have already indicated how the carriage is supported and how it is driven.

By examining the details, it will be seen that the actuating system is mounted on two pairs of columns 58 and 59, Fig. 4, the feet 1—1 and 2—2, Fig. 1, of which form a part of the base frame. The columns 59—59 are connected together by axle 60 which supports the actuating system proper, as it is on this said axle that the double armed lever 29—29, 30—30 is mounted, the axle 31 of the worm 24 being carried on the forward ends of said arms 30—30, Figs. 4 and 42. On the forward ends of said arms 29—29 are mounted the armatures of the electromagnets 28—28 which are intended for effecting the return of the carriage. The columns 59—59 are connected to the bar 61 which connects together the columns 58—58, through the connecting arms 62—62, Fig. 32. To this bar 61 are soldered the supporting elements 22—22—22 which serve as the lower supporting means for the hollow bar 21 of the carriage. Figs. 42, 43, 44, 45, 46, 47 show details of the actuating system: they show the drum and worm 24 with its 12 lateral or end teeth; the levers 26 and 38 which receive the action of the electromagnets for advancement of the carriage and back spaces, respectively, through the links 63 and 64, respectively; and the teeth 27 and 65 of said levers 26 and 38, respectively.

The tooth 27 is normally in position to act on the drum of the worm when lever 26 is pulled down; as it is returned to normal position, it is forced into its seat by rubbing against the bevelled forward face of the next tooth of the drum 24 until said tooth is completely passed by, whereupon said tooth 27 again jumps off its seat under the action of the spring shown in Fig. 47.

The tooth 65 is normally held inside its seat, so as not to interfere with the rotary motion of the drum 24. When the key for "back spaces" is depressed, the current is sent to the small electromagnet 66—67 prior to the excitation of the electromagnet which operates the carriage for back spaces. The core 66 of this said small electromagnet is stationary, its movable armature 67 being fixed to the sliding axle 68 which slides in the inside of 66. The arms 69, and 70 attached to the ends of said axle 68 bear against the stops 71, 72 of the teeth 27, 65, so as to normally maintain tooth 65 within and tooth 27 off their respective seats. Through the excitation of magnet 66—67, said arm 69 forces tooth 27 into its seat and out of the position for acting on the drum, while said arm 70 sets free tooth 65 which is then driven off its seat and becomes ready to act on the teeth of the drum 24 when operated through the means of the electromagnet which drives the carriage for back spaces. As soon as the electromagnet 66—67 loses its excitation, the armature 67 returns to its initial position under the action of a spring not shown, dragging along said axle 68 (Fig. 43) and said arms 69 and 70. When said axle 68 is made to move by said magnet 66—67, it causes bridging contact 73 to be advanced, (Fig. 56) thereby closing at 74—75 the circuit of the electromagnet 37 which drives the carriage for back spaces.

The carriage is shown in side view in Fig. 4 and in top plan view in Figs. 32 and 34. These figures show the bar 76 which carries the rollers 19—19—19 and on the upper part of which is mounted the casing 77 within which moves the tooth 46 and to the top face of which is attached the detent 57. The electromagnets 45, for top carriage release, are shown in Fig. 4, but do not appear in Figs. 32 and 34.

Figs. 35 and 36 show to the left the end attachment of the roll.

The part relative to the automatic rotation of the roll, which has already been explained, is indicated in Figs. 35 and 36, the end attachment of the roll being shown in detail in these said figures.

The knob 78 is mounted so as to slide along axle 79 of the roll, being, however, compelled to rotate with said axle. When this knob is pulled out as far as it can go, the same will be in the position for rotating the roll manually, the devices for the automatic rotation of the roll being then thrown out of engagement. When this knob 78 is pushed in as far as it can go, its circular spring 80, which has two free ends, exerts a pressure against the internal walls of piece 81, so as

to form practically a rigid system therewith. This said piece 81 is the one to the periphery of which is attached the toothed wheel 33, Fig. 18, which is acted upon by tooth 32 of the mechanism for the automatic rotation of the roll. This piece 81 is in the form of a ring which is held loosely in position by means of the circular piece 82 which is fixed to the arm 83 of the carriage. The piece 81 is provided in one side thereof with a bevel wheel 84 which drives the bevel wheel 85 of a revolution counter 86.

In this way, by pushing in knob 78 as far as it can go, said piece 81 and all the above mentioned elements connected therewith (the devices for the automatic rotation of the roll and the revolution counter) are made practically rigid with said axle 79 of the roll, and therefore with the roll itself, whereby the roll will be automatically rotated and its revolutions automatically counted.

The spring 80 is made up of two annular sections fixed by the center to the sleeve 87 of knob 78 and arranged into a lodging slot formed in said sleeve 87. When said knob is pushed in as far as it goes, said annular sections of spring 80 are forced into their lodging slot in the sleeve, the external surface of said sections acting on said piece 81 with sufficient friction to render the latter practically rigid with said sleeve 87, and therefore with the knob 78, axle 79 of the roll and the roll itself.

1. *Electric circuits.*—The electric circuits are eleven in number, and are diagrammatically shown in Figs. 55 and 56.

By depressing one of the left hand keys, current is sent directly to the three circuits for stopping of the disc which carries the types, actuation of this said disc, and actuation or driving of the carriage, while at the same time the interrupter for the printing circuit is indirectly closed.

2. *Stopping the disc.*—The current from the positive side of the source is brought to the box containing the contact actuating arms of the left hand keys, on to a longitudinal bar 14, Fig. 11, wherefrom it is communicated to the conducting portion of the contact actuating arms, passing to the three contact arms thereof. When one of said left hand keys is depressed and made to move down through an angle of 15°, the spring contact of arm 15 thereof contacts against contact 16, wherefrom the current is conveyed to the corresponding stationary bus bar contained in the box to the right. By depressing a corresponding key of the set of right hand keys and causing the same to move down through an angle of 10°, one of the insulated contacts of the contact actuating arm of said depressed right hand key (suppose it is the contact corresponding to the letter H, Fig. 10) receives the current, which will be conveyed to one of the 48 electromagnets of the printing group corresponding to the letter it is desired to print. The armature of this electromagnet will cause its catch carrying stem to be advanced, so that said catch will catch on the stop finger of the disc carrying the types, in such a way as to lock the said disc in the position proper for bringing said desired letter in front of the roll and the printing needle. The current then follows on to an internal ring which acts as a collector ring for these circuits and which is shown at 139 in Fig. 55, wherefrom it passes through the electromagnet 140 and passes on the negative side of the source. Said electromagnet 140, by attracting its armature, causes the printing circuit to be closed.

3. *Actuation of the disc.*—When the contact of contact arm 17, Fig. 11, contacts against contact 141, there is closed the circuit of the electromagnets 108 that operate the system of levers, Figs. 37, 40, 41 and 55, which, as already explained, act on the toothed wheel of the disc, thereby abruptly setting the same into rotary motion. The current then passes on to the negative side of the source.

When the contact of contact arm 18, Fig. 11, contacts against the contact 142, there is closed the circuit of the electromagnet 25, Figs. 4, 42 and 55, of the lever that moves the worm, causing the carriage to be advanced. The current then passes on to the negative side of the source. The leftmost key of the set of left hand keys is not provided with this contact arm, and therefore, when depressed, this said key will not cause the carriage to be advanced. The reason for this, is that this key corresponds, when working under the conditions for printing small letters, to the accentuation marks, which must be placed upon the letters. When it is desired to print the algebraic characters, while working under the conditions for printing small letters, it will be necessary, prior to printing the characters, to cause the carriage to be advanced by depressing singly any one other of the left hand keys. This said leftmost key prints only six characters in the position for small letters, and four characters in the position for capital letters.

4. *Printing.*—The circuit for the printing system is direct, not passing through the contact arms of the keys; it is, however, normally open. The current for this circuit comes from the positive side of the source to the armature of the electromagnet 140, Figs. 2 and 55, which is mounted within the large lower box. When the current that has traversed one of the electromagnets for locking the disc passes through magnet 140, the armature of the latter is attracted and locked through detent 143, thereby closing the circuit for the printing system, as already explained. The current is then conveyed to the electromagnets of the printing needle, which actu-

ate the latter in the way already explained, passing from said electromagnets on to the small electromagnet 144, which, by attracting its armature, releases said detent 143. As soon as the armature of magnet 140 is thus released, the same flies back to its off position under the action of a spring, thereby opening again the circuit for the printing system. From the small magnet 144 the current passes on to the negative side of the source.

The reason for this arrangement, is the necessity of slightly retarding the action of the printing needle, in order to allow sufficient time for the completion of the other phases of the operation—actuation of the disc and stoppage or locking of the same.

5. *Back spaces.*—By depressing the key for back spaces, which is in the form of a mere circuit interrupter, the current from the positive side of the source is made to pass through the electromagnet 66—67, Figs. 42, 43 and 56, for the purpose already explained, wherefrom the current passes on to the negative side of the source. As the armature 67 moves, it operates the bridging contact 73 to close at 74 and 75 the circuit of the electromagnet 37 which acts on the lever 38, thus causing the worm to rotate in a sense contrary to its rotation for the normal advancement of the carriage, whereby to cause the carriage to be moved back through the space corresponding to one letter, already explained. From contact 74 the current passes on to the negative side of the source.

6. *Capital letters.*—As has already been explained, when the key for capital letters—a mere circuit interrupter—is depressed, the current is sent to the electromagnets 39—39, Figs. 3 and 56, attracting their armatures 40—40 to raise the printing group. The current then passes on to the negative side of the source.

7. *Top carriage release.*—When this key is depressed, the current passes on to half naked conductor mounted on the rear portion of the fixed bar of the front position of the machine, where it is received by brushes and sent to the small electromagnet 45 fixed to front bar of the carriage, 76, Figs. 4 and 56. The armature of this magnet, as it moves, causes the tooth that locks the carriage to be retracted, in the way already explained. The current then passes on to a naked conductor mounted on the hollow bar of the carriage (which is the conductor that receives also the negative current of the circuit for automatic rotation of the roll), and then, received on brushes, passes on to the negative side of the source.

8. *Small letters.*—This circuit is similar to the one for capital letters, the current going, however, to the electromagnets 44—44. Figs. 3 and 56, to cause the printing group to be lowered, and then passing on to the negative side of the source.

9. *Tabulator.*—When this key is depressed, two circuits will be closed, as already explained. The first one of these two circuits is the one which sends the current from the positive side of the source to the two electromagnets located close to the forward columns of the machine, (53—53, Figs. 33 and 56). From these said magnets 53—53, the currents are received on a common return conductor which leads to the negative side of the source. The second one of these two circuits is one leading to the windings of the electromagnets 28—28 for return of the carriage, wherefrom the current passes on to the negative side of the source. The actuation of this part of the machine has already been explained.

10. *Carriage return.*—The key "carriage return-roll rotation", when depressed, sends the current from the positive side of the source simultaneously to the two circuits "carriage return" and "roll rotation." For the circuit for the return of the carriage, the current passes from the contact of this key to the manual circuit interrupter for this circuit, which manual circuit interrupter, if closed, lets pass the current to the two electromagnets that act on the double armed lever in order to lower the worm so as to release the same from the rack of the carriage, as already explained (armatures of electromagnets 28—28, lever arms 29—29 and 30—30, Figs. 4, 42 and 56). From said electromagnets the current passes on to the negative side of the source.

11. *Roll rotation.*—The other circuit closed by the key "carriage return-roll rotation" is the one that sends the current to the manual circuit interrupter for rotation of the roll, from where, if said manual circuit interrupter is closed, the current is conveyed to the electromagnet 150 mounted on the hollow bar of the carriage and the actuation of the lever system of which has already been explained (Figs. 18, 19, 20, 21, 22 and 56). The current is conveyed through fixed brushes to a naked conductor mounted on the hollow bar of the carriage, from which naked conductor it is led to the said electromagnet, from where it passes on to the same return conductor that receives the return current from the circuit for top carriage release, then passing on to the negative side of the source.

The manual circuit interrupter for the circuit "carriage return" is intended primarily to be used when it is desired to trace a vertical line on the paper, in which case the roll needs only to be rotated, while the carriage must remain stationary. This is possible, because the key that bears the vertical trace is the leftmost of the set of left hand keys, which, as has already been explained, does not actuate the carriage.

The manual circuit interrupter for the circuit "roll rotation" is intended to be used

when it is desired to rotate the roll manually at will, without keeping to normal spacing of the lines, while at the same time utilizing the automatic return of the carriage.

Figs. 52, 53 and 54 show the "tabulator" key, which is an interrupter controlling two circuits. By pressing button 145 down until a first resistance to its advancement is felt, the current is allowed to pass between contacts 146—146 through the bridging contact 147, thereby closing the circuit of electromagnets 53—53, Fig. 33. By continuing to press button 145 down until a second and last resistance to its advancement is felt, the current is allowed to pass between contacts 148—148 through the bridging contact 149 (which is not in electric contact with bridging contact 147), thereby closing the circuit of the electromagnets 28—28, Figs. 4 and 42, for the return of the carriage. When button 145 is released it returns automatically to normal position under the action of spring 151, thereby interrupting the above mentioned circuits.

I claim:

1. In an electrically operated typewriter, a keyboard for controlling the carriage and types, said keyboard comprising two sets of keys, each key of each set having a conductor attached thereto, the conductors of one set of keys crossing those of the other set at an angle, whereby a definite contact will be established whenever two keys, one of which belongs to each set, are actuated simultaneously, said contact being determined by the point of intersection of the two corresponding conductors, and a series of electromagnets controlled by the contacts thus established.

2. In an electrically operated typewriter, a keyboard for controlling the carriage and types, said keyboard comprising two sets of elongated keys, each key of each set having a conductor attached thereto, all the keys of the entire keyboard being arranged in substantially the same plane; the conductors of one set of keys crossing those of the other set at an angle, whereby a definite contact will be established whenever two keys, one of which belongs to each set, are actuated simultaneously, said contact being determined by the point of intersection of the two corresponding conductors, and a series of electromagnets controlled by the contacts thus established.

3. In an electrically operated typewriter, a keyboard for controlling the carriage and types, said keyboard comprising two sets of keys, each key of each set having a conductor attached thereto, each key having a plurality of characters thereon, no two keys of either set having the same pair of characters thereon, and all the keys of each set collectively embracing all the characters to be typed, the conductors of one set of keys crossing those of the other set at an angle, whereby a definite contact will be established whenever two keys, one of which belongs to each set, are actuated simultaneously, said contact being determined by the point of intersection of the two corresponding conductors, said contact being thus uniquely determined by the single character which appears in common on both said simultaneously actuated keys, and a series of electromagnets controlled by the contacts thus established.

AURELIO LINHARES.