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COMPLETE SPECIFICATION

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Apparatus for use in Direct or Indirect Reproduction of a
Written Oriental Language

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We, MERGENTHALER LINOTYPE COMPANY, a Company organised under the laws of the State of New York, United States of America, of Park Avenue and Ryerson Street, Brooklyn, New York, United States of America, do hereby declare the nature of this invention (communicated by LIN YUTANG, of Chinese Nationality, of Rue Raffet, Paris 16 eme, France), and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to apparatus for use in reproducing characters or components of a written Oriental language such as the Chinese language which utilises symbols for written communications, and to devices for forming, selecting, and printing or reproducing such characters. The invention is particularly applicable to devices for printing Chinese characters, such as typewriters, teletypes and the like.

The symbols or characters used in writing the Chinese language consist of one or more components. Most of these characters consist of a left hand component forming a classifying component is not at the left hand ponent forming the phonetic of the word. In some of the characters, however, the classifying components is not at the left hand side of the character and the phonetic component is not in the right hand position. Also, many of the components may be used alone. Inasmuch as the components are not always in the same positions in the characters, a simple and logical classification of the characters has never been devised heretofore.

The Kang-Hsi dictionary lists about 43,000 Chinese characters. The arrangement of these characters in the dictionary in a great many instances is arbitrary and, as a result, a great deal of skill is required to use the dictionary and find the desired character and its meaning in the dictionary.

The modern dictionaries such as those used

in high schools and colleges contain between 10,000 and 15,000 Chinese characters. The classification of indexing of the characters still follows the Kang-Hsi system.

The Chinese telegraph code book which contains a sufficient number of words that may be needed in everyday correspondence contains about 9,000 Chinese characters.

The great number of characters required for correspondence or adequate written trans- mission of the Chinese language has made it difficult to provide practical devices, such as typewriters, printing telegraph and the like devices for printing or transmitting correspondence or news in the Chinese language.

The principal difficulty is that of providing enough types to print all of the characters required for modern Chinese and at the same time of providing a simple, quick and sure means for selecting the desired characters or components from so many thousands of types.

It has been proposed heretofore to use a drum having about 4,000 to 5,000 characters thereon and to arrange the drum so that any of these characters or components thereof can be brought into a desired printing position. In order to use the device, it is necessary to memorize the positions of the characters on the drum. Even exceptional individuals can only remember the positions of two or three thousand of the characters or their components, a number that is insufficient to permit the printing of coherent messages, news or other information, as indicated by the fact that at least 9,000 characters are provided for sending telegraphic messages. This device therefore cannot compete in speed with ordinary Chinese writing. Therefore, up to the present time, it has been usual to prepare and transmit messages in writing rather than by mechanical means. In the case of Chinese newspapers and books, it is necessary to set type manually from the many thousands of

[Price 2/8]

type characters from stacks occupying a whole room floor.

A more definite and concise classification of the characters making up the Chinese language is therefore required before a satisfactory typewriter or other keyboard operated printing or character-forming device could be produced. After many years of study, we have devised a classification system which reduces the written Chinese language to its fundamentals and permits the classification of the written symbols in a simple and accurate manner and which, in turn, permits typewriters and other character-forming or printing devices to be operated with little training and with a relatively small keyboard.

We have discovered that all Chinese characters or their components can be classified into smaller groups by referring to the configuration of the strokes at the top of the character or component and the configuration of the strokes at the bottom of the character or component. By selecting the characters or components by their top and bottom configurations, the characters or their components can be divided into relatively small groups from which the desired character can be selected. Furthermore, in order to answer the need for providing all characters needed in modern communications, we have found that the greater part of the characters making up the written Chinese language can be formed from about 70 to 80 left hand components, each forming a classifier, and about 1,300 right hand components, each forming a phonetic. The left hand and right hand components can be combined to print or form about 90,000 Chinese characters, some of which actually do not exist, for the same reason that it is possible to spell words in the English language that do not exist.

The components referred to above do not permit the entire Chinese language to be printed, however, for the reason that some characters have the phonetics in the left hand position, while the classifiers are in the right hand position, and others have components in top and bottom relations, and still others are integral units. There is no advantage in breaking these down into components, and they are used as complete characters in our system. We have concluded that the development of a method to print by components, characters which have a classifier at the left and to print all other characters whole, is the only practicable way to limit the number of types to be provided in a typewriter.

In addition to the arrangement of the components of the characters, we have also devised a system for selecting either complete characters of the type which, as stated above, cannot conveniently be sub-divided or the

components of the characters by reference to the shape or design of the strokes making up certain positions of the characters or components. These may be the strokes making up the top and bottom of the character, but it will be understood that when applied to characters or symbols of other Oriental languages other than Chinese characters, then reference to other portions of such characters may be made.

For this purpose, according to the invention, an apparatus for selecting the characters or components of a written Oriental language for use in direct or indirect reproduction of said characters or components is characterised in that a number of elements, each bearing a character or component, are segregated into a number of main groups, each character or component of each main group containing a first symbol which is different in each main group, each main group being further segregated into smaller or sub-groups, each character or component of each sub-group containing a second symbol in addition to the said first symbol, first actuating means being operable to select one of the main groups of elements, second actuating means being operable to select a sub-group from the selected main group, third actuating means being operable to select the desired character or component from the selected sub-group, and means responsive to the said third actuating means being operable for causing engagement of the selected character or component with means co-operating therewith for direct or indirect reproduction of the said character or component. A visual indicator may be responsive to actuation of the said first actuating means for displaying a main group of characters or components having a corresponding first symbol, the indicator being further responsive to actuation of the said second actuating means for displaying a smaller or sub-group of characters or components each containing a second symbol in addition to the said first symbol.

A symbol, as used above and in the claims, is an essential configuration or part of a character or component and is that configuration or part which is present in each of a number or group of characters which are related to one another by the symbol and which are distinguished from one another by further strokes or configurations in addition to the common symbol, different groups of characters having different symbols.

For example, considering Chinese characters, when it is desired to print a complete character, such as a simple or integral symbol or one which the phonetic in the left hand position and the classifier in the right hand position, selection of all the characters having the same top configurations and the same bottom configurations will reduce the

number of characters from which a selection must be made to the average of four or five, thereby facilitating the final selection of the desired character. When a composite character is to be printed, the classifier in the left hand position can be selected by reference to the top configuration or symbol of the classifier. When a component is to be selected from the 1,300 right hand components or phonetics, reference may be had to the top and bottom halves of the configuration of these right hand components in order to select a relatively small number of right hand components having these configurations from which the desired component can be selected visually.

Composite characters in common use can be indexed and typed like integral characters when types for such whole composite characters are provided.

This arbitrary classification according to the top and bottom symbols or configurations of characters and components thereof permits a keyboard to be provided which has a relatively small number of keys in proportion to the number of components or characters that can be printed. Thus, for example, in the typewriter described hereinafter, the keyboard may be provided with thirty-six keys corresponding to the top configurations of these Chinese characters or components and twenty-eight keys corresponding to bottom configurations of the characters or components, and these sets of selector keys are sufficient for selecting all characters and components, or groups thereof, however composed. In addition, the keyboard may be provided with eight other keys by means of which the desired component or character can be selected and printed from the group which has been selected by manipulation of the top and bottom keys.

Chinese characters are highly stylized, and the characters are acceptable only when they are of conventional form. Therefore, it is necessary also to devise type arrangements by means of which acceptable characters can be formed.

In the usual type foundry, the types vary in width according to the shape or arrangement of the strokes forming the characters. An absolute standardization of these characters to a uniform width, making the characters substantially square, is necessary. We have discovered by statistical averages that the right hand component should be approximately three-fifths and the left hand component should be approximately two-fifths of the width of the square, and that fixing them at these respective widths achieves a most satisfactory result.

Furthermore, in order to achieve the effect of coherence and integration in the characters formed by combination of left hand and right hand components, it is necessary to

simulate the overlapping of strokes across the division of the character as actually takes place in the regular printer's types. We have found that, except in the case of two parallel vertical strokes which must not touch each other, it does not hurt, but helps, to have the horizontal and slanting strokes of the two parts touch each other. We have found that a composite picture of the seventy to eighty left hand components shows an empty space at the lower right corner. By actual tests, we have found it desirable to design the right hand components so that their horizontal and slanting strokes overlap in a sharply defined and carefully delimited area. Accordingly, in typewriters or teletypes embodying the present invention, each left hand component is arranged to take up approximately two-fifths of the width of the square defining the complete character and each right hand component is arranged to take up approximately three-fifths of the said width and, where necessary, to overlap beyond the three-fifths area to tie the two components together.

In a practical machine for typing, it is necessary to provide a suitable carrier for the printing types which will not be so bulky that it cannot be fitted into a typewriter of substantially conventional size. Obviously, if all the characters and their components which are required to print or form the complete Chinese written language were arranged on the surface of a drum, the drum would be large and heavy.

In a machine constructed according to the present invention, the types may be arranged on octagonal bars of suitable dimensions and a number of such type bars may be mounted in carriers on a rotatable frame so that the frame, hereinafter referred to as a printing cylinder, can be rotated and the individual type bars rotated independently to present the desired type to a printing position. Inasmuch as the printing cylinder is relatively heavy and has considerable inertia when moved, the paper and the paper carriage preferably are moved relatively to the cylinder in order to bring the selected type into proper printing relationship to the paper. Also, inasmuch as the Chinese language is printed in vertical rather than horizontal columns, a carriage is provided which moves the paper vertically during the spacing operations instead of horizontally, as in the case of the English typewriter.

Moreover, inasmuch as the type elements are fixed when they are brought into printing position, a printing hammer is required which always aligns itself with the character to be printed and thus moves with the paper carriage.

When two components are to be printed to form a single character, the paper should not move after the printing of the first or left

hand component. In our device, mechanism is provided whereby shifting of the paper carriage or the paper thereon takes place only after both the left and right hand components, or a complete character, have been printed.

Another feature of the typewriter is the provision of visible means for making the final selection of the character or the component to be printed. Thus, for example, when one of the left hand components is to be printed, a key bearing the top configuration of the left hand component is pressed. In response to the operation of this key, the left hand components having the same top configuration (average of two per top key), i.e., 70 to 80 divided by the number of keys, i.e. 36, are shown visibly on the top of the typewriter and a visual selection can be made of variants either in the top or bottom of the components of this group by depressing a printing key, that is, one of the eight keys referred to above, to print the selected component. Under these circumstances, the paper carriage does not move, inasmuch as the character will not be completed until the right hand component has been printed adjacent to the left hand component. The right hand component may be selected from the approximately 1,300 types available, by depressing one key (of the group of 36 keys) bearing the top configuration of that component and one of the twenty-eight keys having the same bottom configuration as the component thereon. This brings into view a visible index disclosing all of the components or characters having the same right hand top and bottom configurations as those on the depressed keys, a group usually consisting of one to eight (average 4) characters or components. Then the corresponding key of the group of eight printing and selecting keys is depressed to cause the selected character to be printed. This last operation of the printing key will cause the paper to be spaced into a position for receiving the next character.

If the character is complete and cannot be formed of right and left hand components, only three keys are operated to cause the printing of this character and the indexing of the paper carriage to a position for receiving the next printed character. Frequently used composite characters are also typed by pressing three keys when types for such whole characters are provided.

The above described system for selecting types may be used in printing telegraph instruments.

In order that the invention may be clearly understood, and readily carried into effect, a typewriter constructed according to the invention will now be more fully described, by way of example only, with reference to the accompanying drawings, in which:—

Fig. 1 is a perspective view, partly broken

away, of a typewriter embodying the present invention;

Fig. 2 is a plan view of the keyboard of the typewriter shown in Fig. 1 and a portion of the casing therefor;

Fig. 3 is a perspective view of the printing cylinder of the typewriter;

Fig. 4 is a side elevation, partly in section, of the printing cylinder;

Fig. 5 is an end view of the printing cylinder, partly broken away and partly in section, to show the construction of the type bars;

Fig. 6 is a plan view of the control mechanism for the type-carrying member illustrating one key and its connections for controlling the printing cylinder;

Fig. 7 is an end view of the mechanism shown in Fig. 6;

Fig. 8 is a view in cross section of the typewriter of Fig. 1 with parts removed and parts shown in dotted lines to illustrate details of the device;

Fig. 9 is a view in section of the portion of the device disclosing the connections for rotating the individual type bars;

Fig. 10 is a view in front elevation and partly in section and partly broken away of the mechanism shown in Fig. 9;

Fig. 11 is a plan view of a portion of the mechanism for controlling the position of the supporting member or paper carriage of the device;

Fig. 12 is a front elevation of the mechanism shown in Fig. 11;

Fig. 13 is a section taken on line 13—13 of Fig. 11;

Fig. 14 is a section taken on line 14—14 of Fig. 12;

Fig. 15 is a section taken on line 15—15 of Fig. 11;

Fig. 16 is a section taken on line 16—16 of Fig. 12, a portion of the device being shown broken away;

Fig. 17 is a section taken on line 17—17 of Fig. 12;

Fig. 18 is a section taken on line 18—18 of Fig. 11;

Fig. 19 is a front elevation of the mechanism for controlling the paper carriage, shown partly broken away to disclose details thereof;

Fig. 20 is a plan view of the mechanism shown in Fig. 19, also shown partly in section and partly broken away;

Fig. 21 is a section taken on line 21—21 of Fig. 20 and partly broken away, of the mechanism shown in Fig. 19;

Fig. 22 is a vertical section partly broken away showing the mechanism for actuating the printing hammer of the device and showing details of the paper feed mechanism and paper carriage;

Fig. 23 is a partial plan view of the mechanism shown in Fig. 22;

Fig. 24 is a view in elevation showing

details of the same mechanism seen from the rear end of the machine with parts broken away to disclose the mechanism more clearly;

5 Fig. 25 is a plan view showing the visible selecting mechanism for the characters with the shutter therefor broken away to disclose details;

Fig. 26 is a section taken on line 26—26 of Fig. 25 with parts broken away to show details of the construction;

Fig. 27 is a section taken on line 27—27 of Fig. 26 with parts removed to disclose the structure more clearly;

15 Fig. 28 is a detail view of the bars for actuating and exposing the cards bearing the characters to be selected visually;

Fig. 29 is a detailed plan view of the edge arrangement of the index cards;

20 Fig. 30 is a front elevation of the paper carriage illustrating the platen and the ribbon feed carried thereby with parts broken away to show details of the construction;

Fig. 31 is an end elevation, partly broken away, of the paper carriage with one of the type bars shown in section and a portion of the printing hammer illustrated in its relationship to the carriage;

Fig. 32 is a cross section taken on line 30 32—32 of Fig. 30;

Fig. 32A is a plan view, and Fig. 32B an inclined view, of the paper carriage with portions broken away to disclose details of the ribbon supports and feed, and the traversing mechanism;

Fig. 33 is a partial front elevation of the paper (feed) carriage with the paper feed rollers shown in section and partly broken away;

40 Fig. 34 is a section taken on line 34—34 of Fig. 33 illustrating the mechanism for actuating the paper return and also showing details of the bottom warning bell;

Fig. 35 is a perspective view of the drive mechanism for the typewriter and illustrating one printing key operated by the drive mechanism;

Fig. 36 is a layout view of the differential mechanisms and brake of the drive mechanism, each of these mechanisms being shown in section to show details thereof;

Fig. 37 is an end elevation of the brake mechanism, partly broken away to show details thereof;

55 Fig. 38 is an end view of one differential mechanism used in the drive, partly broken away to show details thereof;

Fig. 39 is an end view of the other differential mechanism of the drive shown partly broken away;

Fig. 40 is a diagrammatic illustration of the relationship between the size and extent of overlap of types corresponding to left hand and right hand components of Chinese characters;

Fig. 41 is a side elevation of a typewriter including a modified form of visual selector embodying the present invention, the casing of the typewriter being broken away to show details of construction;

Fig. 42 is a front elevation of a portion of the selector mechanism, parts of this mechanism being broken away to show details thereof;

Fig. 43 is an end elevation of the device shown in Fig. 42 with parts broken away to show details of construction;

Fig. 44 is a section taken on line 44—44 of Fig. 42; and

Fig. 45 is a perspective view of the selector mechanism looking upwardly from beneath the mechanism, only those details of the mechanism being shown which relate to the selecting mechanism.

Referring to the drawings the invention will be described in relation to a typewriter, but the invention is equally applicable to other devices for use in printing or otherwise reproducing characters. Typewriters and other devices to which the invention relates are equally useful for typing, forming the characters from component parts or selecting the characters or symbols of such other Oriental languages as Japanese and the like in which symbols are used instead of or along with an alphabet. The selector keys may easily be applied to establishing circuits in a teletype or radio typewriter. Therefore, the invention should not be considered as restricted to typewriters only, but instead should be considered as being directed to all forms of printing or print-forming devices for the Chinese language and other languages which use symbols instead of or along with an alphabet.

Referring now to Fig. 1, the typewriter shown therein includes a frame 10 which is generally of conventional shape having an opening 11 in the front in which are mounted the keys of a keyboard K. In about the middle portion of the frame 10 is rotatably mounted a printing cylinder C which is disposed in front of a paper carriage D that is moved relatively to the printing cylinder C and carries the paper thereon to bring it into alignment with a selected character on the printing cylinder C.

Between the printing cylinder C and the keyboard is positioned a selecting mechanism E by means of which a final visual selection of a character, or component thereof, can be made to permit it to be printed on the paper carried by the paper carriage.

Referring now to Fig. 2, the keyboard contains three rows of keys numbered 12 to 47 inclusive, each key corresponding to and bearing a symbol consisting of the top strokes of a Chinese character or a left hand or a right hand component thereof. In addition, the keyboard includes two rows each

of fourteen keys numbered 49 to 76, each of which bears a different symbol corresponding to the bottom strokes or bottom configuration of a complete character or of the right hand part of a Chinese character. Further, the keyboard includes a row containing eight keys 77a to 77h by means of which a selection can be made from a group of characters which are indexed into position by operation of keys in the above referred to five rows. At opposite ends of the row of keys 77a to 77h are two spacer keys 78a, 78b, either of which may be depressed to cause a spacing operation to take place.

By suitable operation of the various keys referred to above, and as described hereinafter, it is possible to select and print on the paper a Chinese character or a component which forms one of a large group of types mounted on the type bars of the printing cylinder C.

The type-carrying cylinder C, as best shown in Figs. 3, 4, and 5, is made up of a series of individual octagonal shaped type-carrying bars, six of these bars 80a to 80f being mounted in generally circular or disc-like end members 81 and 82 to form a unit carrying six main groups of characters. The end members 81 and 82 are connected by a shaft 83 which is journaled rotatably in disc-like end members 84 and 85 which form the end frames of the printing cylinder C. The end frames 84 and 85 are connected by means of a sleeve 86 in which is mounted a shaft 87 that supports the entire assembly in the frame 10 for rotation. As indicated particularly in Figs. 3 and 5, each of the end plates 81 and 82 carries six octagonal type bars 80a to 80f, each face of which is provided with a row of characters or components of such characters. The end plates 84 and 85 carry six of the type bar assemblies or units I, II, III, IV, V, and VI, thereby making a total of thirty-six type bars in the printing cylinder C. Each row of type on the type bars 80a to 80c of each unit may contain twenty-nine characters or components thereof, thereby providing 8,352 spaces for characters or components, a total number of types which is considerably in excess of the number required to type all of the Chinese characters and components required for the Chinese language.

The various type bars and the individual type forms on the bars may be brought into position for typing in a manner described hereinafter. However, generally, the operation consists in rotating the printing cylinder C to bring a unit I to VI containing the type bars 80a to 80f into typing position, rotating the type bar unit to bring the desired type bar 80a to 80f into a printing position, further rotating the selected type bar to bring a desired character into a position for printing, and moving the paper carriage to such

a position that the selected character or its component is in the proper position for printing on the paper.

The arrangement of the types on the thirty-six type bars is such that all of the characters of left hand or right hand components having the same top configuration are carried on one of the bars 80a to 80f. Also, all of the various components or characters comprising or including common configurations or symbols in the top and bottom parts thereof are mounted in a row extending around the type bar, thereby providing in one row eight characters which can be selected for printing. In some cases, less than eight characters or components have the same top and bottom configurations and, as a result, a part of the row of types around a type bar may be left blank. In other cases, more than eight of such characters or components have the same top and bottom configurations, and the excess over eight is placed in another row where spaces are available.

The manner of selection of a specific unit I to VI and the specific type bar 80a, 80b, 80c, 80d, 80e, or 80f of that unit and the mechanism for accomplishing this result is best shown in Figs. 1, 6, and 7.

Figs. 6 and 7 illustrate the mechanism controlled by one key. For example, the key 47 is pivotally supported on a shaft 88 extending transversely of the frame and is provided with an upwardly extending link member 47a which engages the ends of the two levers 89 and 90. The lever 89 is mounted on a shaft 91 which is one of six shafts 91, 92, 93, 94, 95 and 96 extending transversely of the machine behind the keyboard. Six of the keys 12 to 47 are connected to each of the shafts 91 to 96, respectively, in the manner that key 47 is connected. Each of the six keys connected to any one shaft, for example the shaft 91, bears a symbol or representation of a configuration, the corresponding types of which are located on type bars of similar position within the units I to VI. The lever 90 is connected to a shaft 97 which is one of a group of shafts 97, 98, 99, 100, 101 and 102, these shafts being related to the configuration of the symbol on all the keys connected therewith and carried by the individual type bars 80a to 80f of one of the units I to VI. Each of the shafts 97 to 102 has six of the keys 12 to 47 connected therewith. The connections between the keys 12 to 47 and the shafts 91 to 102 are such as to provide thirty-six different combinations, each corresponding to a key and to a type bar on the printing cylinder C.

Referring again to Figs. 6 and 7, the lever 89, upon depression of the key 47, rocks the shaft 91 in a counterclockwise direction and at the same time rocks the lever 103, also

connected to the right hand end of the shaft, as viewed in Fig. 6, upwardly. Downward movement of the key 47 also rocks the lever 90 and its shaft 97 to raise the lever 104, which is connected to the left hand end of the shaft 97. The function of the levers 104 and 103 is to adjust the position of the printing cylinder C into a printing position adjacent the paper so that the proper type bar 80a to 80f of a unit I to VI will be disposed adjacent the paper. This is accomplished by means of the catches or stops 105 and 106 adjacent opposite ends of the printing cylinder C. Each of the shafts 97 to 102 is associated with a separate stop member corresponding to the stop member 105. The six stop members 105, 107, etc., at the right hand side of the machine operate like the stop member 105 in the manner to be described. Stops 105 and 107 are shown in Fig. 1. The stop members 105 and 107 co-operate with the stepped cam member 112 (Figs. 3 and 4) which is carried on a drum 113 at the right hand end of the printing cylinder C. The drum 113 is rotatably mounted on the shaft 87 and is provided with a gear 114 which meshes with the gears 115, which are mounted respectively on the ends of the shafts 83 of the type-carrying end plates 81 and 82 of each of the units I and VI. The steps on the stop members 112 are so arranged that upon rotation of the type-carrying cylinder relatively to the drum 113, a selected one of the six octagonal type bars 80a to 80f connected to each gear is moved to the outermost printing position.

The stop members for co-operation with the stepped member 112 consist of the levers 105, 107, etc., which are slidably and rockably mounted on the cross pin 121 (Fig. 1) which is carried by a frame 122 in the machine. The stop levers 105, 107, etc., thus are capable of up and down movement, as well as rocking movement, toward and away from the drum 113, as viewed in Fig. 7. The lever 105, which is typical of the six levers, 105, 107, etc., is provided with a projecting portion 123 which bears against a bar 124 extending transversely of the machine so as to maintain the upper end of the member 123 out of the path on the steps 112 when the lever 105 is in its lowest position. The opposite side of the lever is provided with a projection 125 which is disposed in the path of the end of the lever 103.

Thus, assuming that all of the stop levers 105, 107, etc., are disposed in their lowermost positions, which usually is not the case, downward movement of the key 47 will lift the lever 105, for example, upwardly, disengaging the projection 123 from the cross bar 124 and allowing lever 105 to rock into engagement with the surface of the drum 113 in a position to limit the rotation of the drum 113.

The stop members 106, etc., at the opposite end of the machine are used to cause one of the six units I to VI to be brought into a proper position. Each of the shafts 97 to 102 is associated with a separate stop lever 70 arranged similarly to the stop levers 105, 107, etc. Of course, when the key 47 is depressed, the shaft 97 is rocked and one of the stop levers 106, for example, is lifted and allowed to engage the surface of the drum 127 which is fixed to the opposite end of the type cylinder, as shown in Fig. 4, and rotates with the end plates 84 and 85. The drum 127 is provided with a six-step stop band, each step corresponding to the position of 80 one of the type bar units I to VI. Thus, when the shaft 97 rocks, for example, the stop member 106 is rocked to engage the drum 127 and allows rotation of the drum only to a position such that a group of six 85 type bars or unit on which are one type bar has top portions of the characters corresponding to the symbol on the key 47 is brought into printing position at the rear of the cylinders. 90

Inasmuch as it is necessary to make repeated selections, it is also necessary to withdraw the stop levers from engagement with the drum before another selection is made. This is accomplished by means of 95 the bail member 129 at the right hand end of the machine and the bail member 130 at the left hand end of the machine. The bail members 129, 130 are pivotally mounted on triangular levers 131 and 132 at opposite 100 ends of the machine. When in its advanced position, as shown in Fig. 1, the bail member 129 engages behind the topmost ends of the levers 105, 107, etc. Also, the bail member 130 engages behind the uppermost ends of 105 the six levers 106, etc., at the left hand end of the machine. The triangular levers 131 and 132 are pivotally mounted on pins 133 and 134 carried by the casing 122 so that they can rock around these pins. Each of the 110 triangular levers 131 and 132 is provided with a bar 132a which will engage any one of the series of levers mounted on the shafts 97 to 102 and corresponding to the lever 104 so that as the shafts 97—102 are rocked, the 115 triangular members rotate in a counterclockwise direction and draw all of the levers 105, 107, etc., and 106, etc., to the left. This withdraws the lugs corresponding to the lug 123 from engagement with the upper edge of 120 the bar 124 and the levers 105, 107 are then pulled downwardly by means of springs 135 (Fig. 1), which engage the lever 136 carrying pins 121. This withdraws all of the stop levers from engagement with the drums 125 at each end of the printing cylinder C and releases these levers from the bails 129 and 130 after a predetermined counterclockwise rocking movement of the bails 129, 130. This withdrawing operation takes place at the 130

beginning of the depression of any key 12 to 49. Immediately following, upon further depression of, for instance, key 47, only the stop levers 105 and 106 corresponding to the key 47 will be lifted up to be brought into engagement with the drum members 113 and 127 at the ends of the roller.

The above described operation of the keys in the top three rows will set the machine to bring a type bar 80a to 80f of the units I to VI having all the characters or left hand or right hand components with the same top configuration into a position at the rear of the cylinder and adjacent to the paper carriage D for a printing operation. However, the individual type bars 80a to 80f of the selected unit are not positioned to print a character at this time. As indicated above, each of the eight rows of types on the type bar 80 may contain as many as twenty-nine different characters or components thereof. Therefore, a further selection must be made of one type of each of the longitudinally extending rows of types and, further, a selection must be made of one of the eight rows of types on a type bar in order to print a selected type.

As indicated previously, it is preferable to move the paper carriage D relatively to the printing cylinder C in order to bring the type in position for printing on the paper in a desired location than it is to shift the cylinder C axially relatively to the paper. Therefore, mechanism is provided for selecting one row of type that extends around a bar 80a to 80f by movement of the paper carriage as will be described hereinafter. Also, it is necessary to select one type from the group of eight, or less, which extends in a row around each of the type bars 80a to 80f. In order to select one specific type from the rows on the type bar, mechanism is provided for rotating any one of the thirty-six bars through a distance corresponding to that required to bring one of the eight rows into position. This is accomplished by means of one of the eight selector keys 77a to 77h on the keyboard. It will be noted that there are eight of these keys which correspond directly to the eight rows of types on a type bar 80a, 80b, 80c, 80d, 80e or 80f. Therefore, by pressing any one of these keys, the type bar may be rotated to present a selected row of type into printing position.

Referring now to Figures 8, 9, and 10, if one of the keys, for example key 77b, is depressed, it will rock a projecting lever arm 140 about a shaft 141 which extends transversely of the casing 10. All of the keys 77b to 77h have similar lever arms. The key 77a does not have a lever arm inasmuch as it corresponds to the row of types that normally is positioned for typing. The lever arm 140 is provided with a projection 142 having an irregular slot 143 therein for receiving the end of a link 144 that is connected to a lever 145.

The lever 145 is mounted on a shaft 146 which extends transversely of the machine and carries at its left hand end another lever 147. The other keys 77c to 77h, inclusive, are provided with slots 143 similar to the slot 143 of the lever 140, but as illustrated in Fig. 8, these slots are disposed at decreasing distances from the shaft 141 on which they are mounted and likewise they are connected to progressively shorter levers carried by the shaft 146 so that, upon equal rocking of the keys 77b to 77h, the shaft 146 will be rocked through progressively greater angular distances and, consequently, the lever 147 will be rocked through greater angular distances. The angular movement of the lever 147 determines the displacement of a rack member 148 which is connected to the lever 147 and meshes with a pinion 149 that is mounted on a shaft 150 (Fig. 10). The shaft 150 is journaled in a sleeve 151 that is mounted in a bracket 152 connected to the casing 10 of the machine. The right hand end of the shaft 150 is provided with a non-circular key portion 153 which is adapted to engage in a slot 154 in the end of the type bar 80a, for example, that is in alignment with the shaft upon endwise movement of the shaft 150. Endwise movement of the shaft 150 is produced by means of a sleeve 155 that is fixed to the pinion 149 and has a slot 156 therein for receiving a pin 157 fixed to the shaft 150. Inside the sleeve 155 is situated the sleeve 155a with a slot for pin 157 preventing the shaft 150 from turning until the pin 153 is engaged in 154. Thus, as the rack 148 moves upwardly, the pinion 149 is rotated and the pin 157 moves along both slots causing the end 153 to engage in the notch 154 in the type bar. Continued rotation of the pinion 149 then will cause rotation of the type bar 80a through a distance depending upon which of the eight keys 77a to 77h is depressed. In the case of key 77a, the type bar is not rotated. During the printing operation, the type bar will be stationary as the upper parts of the links 144 will be deposited on rests 144a of upright members 144b which are secured to the frame 10. At the end of a printing operation, the links will be pushed down from the rests 144a by cut-outs 143, and then the rack 148 will move in the opposite direction or downwardly, thereby rotating the type bar 80a to its starting position and retracting the key 145 from engagement with the type bar.

The functions and operation of the top keys 12 to 47 and the selector keys 77a to 77h have been described thus far. The following description covers the operation and the function of the keys 49 to 76 which select the proper group of types axially or longitudinally of the type bars. This is accomplished by shifting the paper carriage D and is shown more particularly in Figs. 1, 130

8, and 11 to 22 inclusive. The paper carriage, as shown in Fig. 1, includes a pair of end plates 160 and 161 which are connected by a transverse plate 162 to form a rigid structure.

5 The transverse plate 162, as shown in Figs. 1 and 22, is provided with bearings 163 and 164 at its upper and rear edges which engage in the rails 165 and 166, respectively, carried by a cross plate 167. The cross plate is, in
10 turn, supported upon rollers 168 and 169 at each side of the frame for reciprocating movement transversely of the frame.

The paper carriage assembly described above including the cross plate 167, the back
15 plate 162, and the end plates 160, 161 is adapted to move together as a unit, but relative movement between the cross plate 167 and the carriage including the plates 160, 161, 162 is also permitted in order to allow
20 spacing of the characters transversely of the sheet.

In order to bring the paper in such a position that a vertical column of characters can be printed, as illustrated in Fig. 1, and inas-
25 much as the Chinese language is typed in vertical columns from top to bottom and from right to left, means are provided for shifting the plate 167 bodily endwise to bring a selected character or component into the
30 column being typed.

For the left hand components of the character to be printed and which corresponds to the configurations of the thirty-six top component keys 12 to 47, endwise shifting movement of the paper carriage out of a central position is unnecessary, for the reason that depressing of any one of most of the thirty-six keys will ordinarily present to printing position not more than one or two
35 components having the same top configuration, although a few of these keys may correspond with three or four such components. These left hand components, totalling seventy-eight, can be located in the centre
40 portions of the thirty-six type bars 80a to 80f of the units I to VI.

For selecting a composite character or a right hand component in which both the keys representing the top configuration and the
50 bottom configuration must be operated, it is necessary to shift the paper endwise relatively to the type bars. The twenty-eight keys 49 to 76 are used for this purpose. Each of the keys 49 to 76 is connected by a suitable link
55 49a to 76a, respectively, to a series of levers 49b to 76b, as shown in Fig. 12. The group of levers 49b to 62b is longer than the group of levers 63b to 76b inclusive, as shown in Fig. 12, and each of the levers 63b to 76b co-operates
60 with a U-shaped bail 175, as shown in Fig. 13. The levers 49b to 62b, which are longer, are engageable with a U-shaped bail 176, as shown in Fig. 14, and are so related angularly to the levers 49b to 62b that either bail 175
65 or 176 can be displaced independently. The

bails 175 and 176 are pivotally mounted on pins 177 and 178 which are supported on a framework 179 fixed to the base of the casing 10. Each of the levers 49b to 76b is provided with a rearwardly projecting finger 70 which is adapted to engage one of a group of vertically slidable stop bars 180 to 207 (only the bars 193 to 207 being shown), each corresponding to one of the levers, as shown in Figs. 19 and 20. As shown in Fig. 21, 75 the slidable bars 180 to 207 are mounted for up and down movement in slots in a transverse bar 208, all of these bars normally being urged downwardly by means of springs 209 connected to their lower ends and to the
80 bottom of the casing 10. Each bar 180 to 207 may be lifted upwardly by depressing a corresponding key of the group of keys 49 to 76 to the position shown in Figs. 19 and 21 through the rocking of the corresponding
85 lever connected to that key, for example, lever 69b which is connected to key 69. During the upward movement of the bars 180 to 207, any other bar which is in an upper position is released and drawn down-
90 wardly. This is accomplished by means of the channel-shaped member 210 which extends across the machine behind all of the bars 180 to 207 and is pivotally mounted on pins 211 at its opposite ends. The channel
95 member 210 is urged toward the bars by means of the spring 212 carried by the bar 208 and it co-operates with the detents 213 and 214 to retain any of the bars 180 to 207 in its upper position. However, if another of
100 the bars 180 to 207 moves upwardly, the detent 213 thereon will cause the channel member 210 to rock about its pivot pins 211 so as to release any other bar that is in its upper position. 105

The bars 180 to 207 control the position of the paper carriage C in the manner best shown in Figs. 19 to 21. The back plate 167, which supports the paper carriage, is provided with a forwardly projecting guide
110 block 220 at its lower edge which carries a slidable stop member 221. As shown in Fig. 20, the slide member 221 has opposed flanges 221a and 221b having their inner ends spaced apart a sufficient distance to pass by the ends
115 of the bars 180, etc., on one side while it engages on the other side. When shifted upwardly, as viewed in Fig. 20, the flange 221b is in a position to engage a stop bar 200, as shown. Similarly, when the slide 222 is
120 shifted downwardly, as viewed in Fig. 20, the flange 221a is in a position to engage a bar, for example the bar 200. Thus, in either direction of movement of the carriage-supporting plate 167, the carriage would be
125 stopped in the same position by the stop bar 200.

The carriage is moved by means of a horizontal chain 222 which is supported on the sprockets 223 and 224 which are rotatably 130

mounted on shafts fixed to uprights supported on the casing 10 of the machine. The sprocket 223 is driven in one direction by means of a shaft 225 by means of bevel gears 226 and 227. Upon rotation of the shaft 225 in the direction of the arrow in Fig. 19, the chain will be caused to travel in the direction of the arrow in Fig. 20. The chain is provided with a number of upwardly projecting pins 228, 229, etc., which are adapted to engage the flange 221a or 221b, depending upon which one is displaced into a position to engage a stop bar 180 to 207. Thus, if, as shown in Fig. 21, the flange 221b is in position to engage a stop bar 200, the flange 221a is in a position to engage one of the pins 228, 229, etc. Under these conditions, the carriage assembly, including the supporting plate 167, will move to the left until the flange 221b engages one of the stop bars. If the slide 221 is pushed forward, the flange 221b will then engage one of the pins 228, 229 and the carriage, including the plate 167, will be moved to the right until the flange 221a engages the elevated stop bar.

The position of the carriage with respect to any longitudinal row of types on a type bar 80a, etc., can be determined by depressing a key of the group 49 to 76. These types, therefore, must be arranged to correspond to the bottom symbols on the keys representing the bottom of a character or component thereof.

The above described mechanism is not sufficient in itself to make possible the selection of a character in a longitudinal row, inasmuch as it is not possible to predetermine the position of the carriage C at the conclusion of any typing operation. Accordingly, it is necessary to provide a steering mechanism which will assure the movement of the carriage to the proper stop bar and also to return it to its central position for typing the classifying component, which is selected by depressing one of the top group of thirty-six keys, as described above.

After one of the keys 49 to 76 is depressed, but a printing operation has not occurred, the slide 221 may be so disposed that the paper carriage would move in the wrong direction upon actuation of another key nearer the centre but on the same side as the previously depressed key. In order to change the direction of travel, the device is provided with a two-part bell crank lever 230 mounted on the block 220 and having an end portion 230a that engages a pin 231a that is connected to the slide 221. Thus, if the carriage moves toward the left, as viewed in Fig. 20, the lever 230 will strike a fixed pin 232 and will rock counterclockwise, thereby shifting the slide downwardly, as viewed in Fig. 20, or to the right, as viewed in Fig. 21, and will cause the carriage to be connected to the lower or right hand flight of the chain

222, which, travelling in the direction of the arrow, will return the carriage toward the centre position. The two parts of the lever 230 are biased into a right angular relation by means of the spring 230b which further aids in moving the slide 221 quickly. As shown in Fig. 20, a flat rail 232a is provided adjacent to the pin 232 to restrain the end 230a against movement until the spring 230b is stressed. When the end 230a leaves the rail 232a, the spring snaps the slide 221 to the forward position.

A similar fixed nip 233 and rail 233a are provided adjacent to the opposite end of the chain for reversing the direction of travel of the carriage 167.

The return for the carriage to centre position is controlled by a lever 236 (Figs. 8, 11 and 12) which is not connected to any key. The lever 236 is longer than any of the other levers 49b to 76b and co-operates with the bail 237 which is also pivotally mounted on the pins 177 and 178. Upon movement of the lever 236, as described later, a stop bar 236b, Fig. 19, at the centre of the group of bars 180 to 207 is raised upwardly and, at the same time, the bail 237 is rocked forwardly, as viewed in Fig. 15. The function of the bails 175, 176, and 237 is to make certain that the carriage will move to its centre position at the conclusion of a printing operation ready to type another component or character. This is accomplished by means of the connections between the bails and a shaft 238 which also controls the position of the slide 221. The bail 175 (Fig. 13) is provided with a link 239 which has a sliding pivot connection with a pin 240 on a disc member 241. The bail 176 also is provided with a link 242 which has a sliding pivot connection with a pin 242a on the opposite side of the axis of the disc 241. Thus, if the bail 175 is rocked to the left, it tends to rotate the disc 241 in a clockwise direction when the pin is in the near end of the slot in the lever 239. Similarly, if the bail 176 is rocked to the left, the disc 241 may be rotated counterclockwise when the pin 242a engages in the end of the slot of the link 242.

The bail 237 is likewise connected to the disc 241 by means of a link 243 having a pin 243a which engages in a generally W-shaped cam groove 244 in the disc. Thus, when the bail 237 is rocked, the link 243 may urge the disc either to the left or to the right, depending upon the portion of the cam slot 244 in which it is engaged at the time. For simplicity, individual features of the disc 241 are shown separately in Figs. 13, 15 and 17. The position of the link 243 is controlled by a linkage system (Fig. 17) which includes a central link 243b straddling the shaft 238 and a pair of links 243c and 243e which are pivotally mounted on a yoke that is supported by the bail 237. The ends of the links

243c and 243e are connected by means of a spring and are urged against opposite sides of the link 243, thereby urging it towards centre position so that it can engage in either 5 portion of the cam 244, depending upon the rotated position of the latter. The position of the disc 241 is, of course, dependent upon the position of the shaft 238 which is connected by means of the levers 238c, link 238d 10 and bar 238e to the cam slide 221 and thus, in turn, is dependent upon the location of the stop bar that has been raised last with respect to the stop bar 236b. The disc 241 is retained in either of its rotated positions 15 by means of a cam 238a (Fig. 18) on the end of the shaft 238. A spring-urged lever 238b engages the came 238a and normally urges it out of a dead centre position.

The shaft 238 controls the position of the 20 slide 221 by means of the levers 238c at its opposite ends (Fig. 20) which are connected by means of links 238d to the opposite ends of a bar 238e. This bar is received in an opening in the slide member 221 (Fig. 21) 25 to shift it to its forward or rearward position in any displaced position of the slide along the stop bars 200 to 207, etc.

For example, if the stop bar 207 had been raised, the slide 221 would have been posi- 30 tioned to cause the paper carriage and the plate 167 to move to the left until the flange 221b engages the bar 207. In order to return the carriage, including the slide 221, to the middle position and in contact with the stop 35 bar 236b, the slide 221 must be shifted so that it will engage a pin on the lower flight of the chain 222, as viewed in Fig. 20, thereby urging the carriage to the middle position.

As indicated previously, the lever 236 is 40 not connected to any key, but it is, in fact, responsive to a printing operation, as will be explained hereinafter.

At this point, it is desirable to explain how each of the selector and printing keys 45 77a to 77h is used to select the proper character for a printing operation. As pointed out before, the printing keys 77a to 77h are used to select one type from a row of types extending around a printing bar. In order to 50 do this, it is necessary to provide some indication of the types that are in any annular row of types around each bar. This is done through the medium of the visible selector mechanism E on the device. The 55 visible selector consists of a number of cards, each one corresponding to one of the thirty-six keys 12 to 47, and these cards being identified as 12a to 47a, as shown in Fig. 25. Each of the cards is provided with twenty- 60 nine slots 49c to 77c extending therethrough so that when all of the cards are stacked one on top of the other, these slots will be in alignment. Interposed between and beyond the slots in each card are spaces for receiving 65 as many as twenty-nine vertical rows of

Chinese characters or components thereon. Each row corresponds with one row of type around a bar 80, and each card corresponds with one bar 80. Thus, if one of the cards is shifted endwise, the twenty-nine rows of 70 Chinese characters will be exposed through the aligned slots in the other cards. The mechanism for shifting any one of these cards consists of thirty-six cam bars 250, 251, 252, etc., all of these bars including an angular 75 portion connected to a rearwardly directed member 250a, 251a, and 252a, each one of these rearwardly turned members being connected to a different one of the keys 12 to 47 inclusive through a pin and slot connec- 80 tion so that when a key is depressed, its corresponding cam bar will be moved downwardly. The inclined portions of the cam bars 250, 251, etc. are disposed in slots 253, 254, and 255, etc., in a transverse member 85 256 extending beneath the stack of cards referred to above. The upper ends of the cam bars engage in slots 257, 258, 259, etc. in tabs 260, 270 271, etc. on the edges of the cards 12a to 47a. Only one of the cam bars 90 can be elevated at one time by depression of separate keys because of the catch-and-release bar 250b (Fig. 27). As shown in Fig. 28, when a cam bar, for example the cam bar 250, is moved downwardly, the correspond- 95 ing card is shifted to the right a sufficient distance to expose the characters and components on the card through the twenty-nine slots in the cards overlying the card being shifted. Inasmuch as this would expose 100 261 characters or components, or less, mechanism must be provided for reducing this number to those present in one row of types around a type bar. This is done by means of a shutter 272 which is supported on 105 sprocket rolls 273 and 274 at opposite ends of the card support member 275 (Fig. 27). The shutter 272, as shown in Fig. 1, is provided with a single slot 276 and this shutter is so arranged and connected with the 110 carriage plate 167 that it travels with the carriage back and forth so that the slot 276 corresponds in position to the position of the carriage in its printing position. Accordingly, only one row of characters is actually 115 exposed to view at one time.

A magnifying lens system L overlies the cards to render the exposed characters or components more readily visible. The lenses preferably magnify transversely prin- 120 cipally so that the characters or components may be made rectangular rather than square on the cards to fit the area exposed by the slots in the cards.

As indicated previously, when only the left 125 hand component of a character is to be printed, the carriage plate 167 is in its centre position and so also is the shutter slot 276 so that the left hand components, being grouped in the centres of the type bars 80, 130

are the only ones exposed to view for selection by means of the keys 77a to 77h. All that is necessary, therefore, to print a left hand component is to press the corresponding selector key of the group 12 to 47 and appropriate printing key 77a to 77h, thereby causing rotation of the selected type bar to the proper position and printing, as explained previously.

On the other hand, when a right hand component or a complete integral character is to be printed, a top key of the group 12 to 47 and a bottom key of the group 49 to 76 are pressed which will cause selection of the proper type bar and the shifting of the carriage, as described above, to position the paper adjacent to the row of type around a type bar which will contain the character or component to be selected. Such movement of the carriage and the shutter 272 will expose the characters to be printed and a cross index if there are more than eight characters in the group. The cross reference will indicate the proper key of the group of keys 49 to 76 to shift the carriage to a row of types containing the desired type.

The printing operation is mechanically controlled, preferably by an electric motor drive, and will be described presently. The actuation of one of the printing keys 77a to 77h will cause the printing operation to take place, as indicated before. Referring now to Figs. 8 and 35, a printing key 77h, for example, carries a loosely supported L-shaped link member 280 on its inner end. The link member 280 has an arcuate inner surface 280a which is disposed adjacent a driven friction roller 281 that is mounted on a driven shaft 282. In the position shown in Fig. 8, the link member 280 is normally maintained just out of engagement with the roller by means of a block 283 fixed to the bottom of the casing 10. The right hand end of the L-shaped link member engages a cross-bar 284 on a lever 285 which is pivotally supported on a shaft 286 extending across the back of the casing. The lever 285 is normally urged downwardly by means of a spring 287 to maintain the cross-bar 284 in engagement with the L-shaped member 280 on the key. The lever 285 also carries a pawl member 288 which is disposed beneath a hook-shaped extension 290 on a lever 291 which supports one end of a hammer bar 292 extending across the back of the machine, as shown in Fig. 1. The hammer bar 292 is supported at the opposite side of the machine by a similar lever 293 (Fig. 20). Assuming that the shaft 282 is being driven in the direction of the arrow, Fig. 35, when the key 77h or any other of the keys 77a to 77g is depressed, the L-shaped link member 280 will be lifted and will clear the edge of the block 82. The pressure of the lever 285 on the link 280

will swing the latter against the roller 281 and the roller will proceed to depress the key 77h farther and to lift the lever 285. As a result, the pawl 288 will engage the hook-shaped element 290 and will rock the hammer bar 292 to the dotted line position, at which time the pawl 288 will disengage itself from the hook-shaped extension 290 and will allow the hammer bar to swing forwardly under the biasing action of a spring 294. At the same time, the L-shaped member 280 will have swung up to the dotted line position so that the pin 295 thereon will be disposed above the cam plate 296. Upon attaining this position, the pin will strike the spring 294 and will draw the arcuate drive surface 280a out of contact with the roller 281, allowing the key 77a to move up to its proper position because of the action of the lever 285 and the spring 287. As the lever 285 moves downwardly, a cross bar 297 thereon will engage a latch 298, which is pivotally supported on the lever 236 in the middle position of the carriage control bars and will rock the lever 236 counterclockwise, thereby elevating the stop member 236b, retracting all of the other stop members and rotating the shaft 238 by means of the bail 237 (Figs. 11 and 20) to shift the slide 221 so that the plate 167 and the paper carriage will return toward centre position with the slide 221 in engagement with the stop member 236b.

None of the other levers 49 to 76 include the hook 298, so that only the stop bar 236b will project after a printing operation has been concluded.

The hammer bar 292 extends entirely across the back of the machine so that it will be in a position to engage a hammer pin 300 (Fig. 8) by means of which an impression is made on the paper. The hammer pin 300 is mounted in a sleeve 301 connected to the back plate 167 and is inclined at such an angle as to force the paper against a selected type on the printing cylinder C. The hammer pin has a rounded inner end 300a which rockably receives a cap member 302 so that this cap member can adjust itself to make up for any inequality of the surface of the type.

The manner in which the paper is supported and advanced with relation to the carriage will now be described.

The structure of the paper carriage C and other elements is best shown in Figs. 8, 22, 23, 24, and 30 to 34. The paper carriage includes the side plates 160 and 161 which support the feed roller or platen 305 which has an adjusting knob 306, Fig. 30, connected to its right hand end. The shaft of the feed roller 305 supports two rearwardly and upwardly inclined bars 307 and 308 which are connected by one or more cross bars 309 and carry at their upper ends a rotatable shaft 310 having sprockets 311 and

312 thereon. Other sprockets 313 and 314 are mounted at opposite ends of the roller 305 and support, with the sprockets 311 and 312, the feed chains 315 and 316 (Fig. 1). The feed chains are provided with a transversely extending resilient clip 317 which may be opened by means of the thumb levers 318 and 319 at its opposite ends so that the end of a sheet of paper may be gripped therein. The roller or platen 305, as illustrated in Fig. 33, is hollow and a coil spring 320 is interposed between it and the shaft 321 which extends through the roller so that when the paper is in its lowest position, the spring 320 is wound up and normally tends to urge the clip 317 upwardly through the medium of the chains 315 and 316.

The lower end of the paper, as best shown in Figs. 8 and 30, passes over a supporting plate 322 extending substantially tangentially to the roller 305, then rearwardly substantially parallel or tangential to the surface of the drum to another S-shaped plate 323 below the end of the hammer pin 300. A parallel guide plate 324 is also provided. The plates 322, 323, and 324 are connected to the side plates 160 and 161. Disposed behind the guide plates 323 and 324 are a pair of hollow tensioning rollers 325 and 326 which guide the paper into a scroll-shaped paper receiver 327 disposed below them and extending from one side plate 160 to the other side plate 161. As shown in Fig. 33, the rollers 325 and 326 are hollow and are mounted on the shafts 328 and 329. The shaft 328 is journaled in the side plates 160 and 161. The roller 326 may be rocked out of engagement with the roller 325 by means of the levers 333 and 334 which are mounted on the transverse shaft 335 and which have an eccentric pin or pins 336 thereon engaging one or both of the levers 330 and 331.

At the right hand end of the roller 325, a conical friction clutch surface 337 is provided which engages a complementary conical clutch surface 338 carried by the sleeve 339 which is mounted on the shaft 328. A similar clutch mechanism 340 is located at the opposite end of the cylinder 325 and these two clutching elements are normally urged into engagement by means of the spring 341 connected to the shaft 328 and the sleeve 342. Thus, the roller 325 is capable of rotation relatively to the shaft 328. Similarly, the roller 326 is rotatable relatively to the shaft 329, under frictional restraint. The rollers 325 and 326 in combination with the clip 317 maintain the paper under tension. Of course, there is some slackening of the paper due to the impact of the hammer pin 300 when a printing operation takes place. In order to overcome this slackening, the sleeve 339 is provided with a grooved pulley 343 which is engaged by a complementary cut-off-disc member 344 (Fig. 33) carried by

a gear 345 which is geared to a gear 346 on the roller 305 by means of a gear referred to hereinafter. The disc 344 is spring-biased by means of a spring 347 to turn the pulley 343 and consequently the roller 325 in the direction to maintain tension on the paper, in opposition to the spring 320 of the roller 305. Thus, the disc 344 can give when the paper is struck by the hammer shoe 300a but will rotate the roll 325 in a reverse direction to take up any slack that is created. Two similar friction ratchet mechanisms 350, each having a spring 347 similar to that associated with the disc 344, are mounted at the left hand ends of the rollers 325 and 326, see particularly Fig. 34, to limit the pull on the paper to the tension created by the friction clutches 337 when the paper is pulled upwards by the clip 317.

The paper normally will be started with the clip 317 near to the printing cylinder C and will move upwardly as each character is printed. In order to indicate when the paper has reached the uppermost position, the chain 315 is provided with a removable and displaceable deflecting member 351 which engages a striking lever 352 carried by the side bar 307 and spring biased towards the position shown in full lines in Fig. 34. The striking lever is disposed adjacent a bell 353 so that when the deflecting member 351 engages the lever 352, it will rock the latter clockwise, as viewed in Fig. 34, and when it passes beyond the lever 352 it will release the lever to rebound and strike the bell 353.

The paper, the major portion of which initially was disposed within the scroll 327, may be returned to the scroll and the carriage spaced by means of the carriage return lever 354 at the left hand end of the paper carriage. The lever 354 is pivotally connected to a gear sector 355 which is pivotally mounted on a pin 356 carried by the end plate 161. The sector 355 meshes with the pinion 357 on the end of the shaft 321 so that when the lever 354 is pulled forwardly and downwardly, the roll 305 and the roll 325 are rotated in a direction to feed the paper down into the scroll-like receiver 327. An overrunning clutch is interposed between the pinion 357 and the shaft 321 to permit return of the sector 355 to its upper position. Also, as the return lever 354 approaches its lowermost position, it is arranged to strike a roller 358 (Figs. 30 and 32A) with a cam 359 (Fig. 33) to displace the L-shaped lever 360 on which the roller 358 is mounted, to the right. The L-shaped member 360 is supported by parallel links 361 and 362 on the side frame 161 of the carriage. The link 362 has an extension 362a, the free end of which engages in a slot 363 in a slide bar 364 which carries a pawl member 365 thereon. The slide bar 364 is guided in guide members 366 and 367

which are secured to the cross plate 162 extending between the end members 160 and 161. The pawl member engages a rack 369 which is fixed to the plate 167. A spring urged ball catch 365a, mounted on the back plate 162, engages the rack 369 to cause the elements of paper carriage C to move with the plate 162. Thus, when the L-shaped member 360 is pushed to the right, as viewed in Fig. 30, the pawl 365 will engage one of the teeth of the rack 369 and, upon downward movement of the return lever 364, the pawl will be urged against the rack and as the latter is fixed, the coercion of the pawl with the rack will cause the paper carriage to be displaced bodily to the right relatively to the back plate member 167. The number of spaces provided by this operation can be controlled by a slide 370 slidably mounted on the plate 162 so that one end of the slide 370 can engage with the pawl 365 to prevent the pawl from engaging with the rack until the slide 370 has been displaced to the left as seen in Fig. 32A relatively to the bar 364. The position of the slide 370 will therefore determine the amount of lost motion of the lever 354 before the pawl engages with the rack 369 and consequently determines the movement given to the paper carriage for each operation of the return lever 354. The spacer control slide 370 can be moved to one of two positions for single or double spacing by shifting it endwise.

It is necessary to place the ink ribbon 35 between the paper and the printing cylinder C. As best shown in Figs. 30, 31, 32A, and 32B, the ribbon R extends across the entire front of the paper carriage and is supported by spools 371 and 372 which are mounted 40 in the carriage. As shown in Fig. 32B, the spool 371 is mounted on an L-shaped lever 372a which is pivotally supported on a bracket 373 on the side frame 160. The L-shaped member 372a has a roller 374 at its 45 outer end around which is looped the ribbon R. The lever 372a may be biased by means of a spring 375 to its outer unloading position, as shown in dotted lines, or to an inner operating position, as shown in full lines. In 50 order to drive the spools as the typing proceeds, a transverse shaft 376 is provided having the worms 377 and 378 thereon which may be meshed alternately with the worm gears 379 and 380 on the spool spindles. The 55 shaft 376 is driven by means of a suitable gear 378a driven by the gear 345, Fig. 31.

Gears 346, 346a and 345 transmit rotation of the roll 305 to the roll 325. The ratio of the gears 345 and 346 is such that the paper 60 while being moved down is under the tension created by the friction device 337, tending to give the roller 325a circumferential speed slightly more than that of the platen 305.

The shaft 376 is mounted for endwise 65 movement to drive one or the other of the

spools 371 and 372. The shaft is maintained in one or the other positions by means of a spring-biased roller 381 which engages on one side or the other of a double cone roller 382 fixed to the shaft 376. Thus, the spools, 70 for example the spool 372, may be driven until the end of the ribbon is reached on the spool 371, at which time the resistance to movement is sufficient to prevent the gear 380 from rotating and then it will be moved 75 axially by the worm 378 to displace the shaft 376 endwise, thereby disengaging the gears 378 and 380 and engaging the gears 377 and 379, which will then cause the device to drive in the opposite direction. Suitable brakes 80 383 are provided for engaging the spools to maintain the ribbon under tension (Figs. 30 and 32B), and are alternatively released by the movement of the shaft 376.

Having described above the operation of 85 the various keys, the operation of the power mechanism for operating the device will now be described. As indicated previously, the device preferably is motor-driven. For that purpose an electric motor 400 or other power 90 source, such as a spring motor or crank, is mounted within and on the base of the casing 10. The motor through a reduction gearing and the pulleys 401 and 402 drives the shaft 282 (Figs. 8 and 35). As indicated previously, 95 the shaft 282 is provided with a series of rollers 281, one roller for each of the eight selector and printing keys 77a to 77h. Only one of these rollers 281 is illustrated, however, for purposes of clarity. The right hand 100 end of the shaft 282 is provided with a differential mechanism 403, which is best shown in Figs. 36 and 38. The shaft 282 drives a sun gear 404 which meshes with the planet pinions 405 that are mounted on a 105 drive gear 406. An internal gear 407 is similarly connected to a sprocket 408, both of the sprockets 406 and 408 being rotatable relatively to the shaft 282, but under certain conditions driven thereby. The sprocket 406 110 is connected by means of a chain 409 to the sprocket 410 which drives another differential gear 411. The sprocket 410 acts as a carrier for the planet pinions 412 which mesh with a sun gear 413 fixed to the shaft 115 87 (Figs. 3, 4, 5, 36 and 39) and with an internal gear 414 which is fixed to the sleeve 415 on which is mounted the drum 113 (Figs. 3, 4 and 5).

The sprocket 408 (Figs. 35, 36 and 37) is 120 connected by means of a chain 416 to a sprocket 417 on a braking or slip-clutch device 418. The sprocket 417 is connected through a multiple disk clutch or brake 419 to the shaft 420, which, in turn, is connected 125 through the bevel gears 225 and 226 (Figs. 19, 20 and 35) to the carriage drive chain 222. Thus, in operation, the shaft 282 is driven continuously, with the result that the sprockets 406 and 408 tend to be driven. 130

However, when the shaft 87 and the sleeve 415 are restrained against rotation because the steps 112 and 127 are engaged by the stops 105 and 106, for example, the drive must take place to the sprocket 417. If the carriage chain 222 is likewise stopped, then the power of the motor is dissipated through the brake mechanism 418. However, the full motor power is available at all times to operate any of the mechanisms. Thus, when a key of the group 12 to 47 is depressed thereby shifting the stop members of the 105, etc. and 106 series to permit rotation of the printing cylinder C, the motor drives the shaft 87 and the sleeve 415 until the stop levers engage their respective steps on the drums 113 and 127. Likewise, when one of the stop levers 180 to 207 moves upwardly, the chain 222 is freed for movement to shift the carriage and the chain can move until one of the stop flanges 221a or 221b engages the newly elevated stop bar of the series of bars 180 to 207 or the bar 236b.

When a character including a left hand component and a right hand component is to be printed, the paper should not be spaced following the printing of the left hand component, so that the right hand component can be printed in its proper relation to the left hand component. The mechanisms for accomplishing the printing without a spacing operation and the mechanism for regulating the spacing are best shown in Figs. 22 to 24. When, for example, one of the keys 12 to 47 is depressed, in the normal course of operation the paper carriage will be in its centre position, as indicated above, and the lever 236 will have been rocked to raise the stop bar 236b in a position to retain the carriage in its centre position. When one of the printing keys for selecting the component is depressed, a lever 425 will be in the dotted line position shown, inasmuch as this lever is pivotally connected to the stop bar 236b. The lever 425 is pivotally mounted on a shaft 426 carried by a bell crank lever 427 fixed to a shaft 428 extending transversely of the casing 10. The lever 425 is connected at one end to the stop member 236b and at its opposite two ends the shaft 426 has levers 425a connected to two links 429 which have their upper ends connected to two similar pivotally mounted triangular members 430. The pivotally mounted triangular members carry a cross bar 431 which extends across the back of the machine, the triangular members are supported on pivot pins 432 connected to the hammer bar levers 291 and 293.

The cross bar 431 can be positioned to engage in an inclined cam slot 433 on an L-shaped member 434 (Fig. 22) which is supported at one end by a pivotally mounted link 435 connected to the carriage plate 167.

The other end of the L-shaped member 434 is slidable longitudinally on a cross bar 436 extending along the paper carriage and fixed at the ends of two levers 436a which are mounted on two pins 437 supported on the end plate 161 of the carriage. The bottom of the member 434 slides in a slot of part 220, the top in a slot 434a, so that the member 434 moves longitudinally with the back plate 167. The pin 437 is provided at its opposite end with a short lever 438 which is connected by means of a link 439 to one end of an escapement lever 440 which cooperates with the ratchet wheel 441 of the escapement which is connected to the end of the paper feed roller shaft 321, as shown in Fig. 33. Thus, when the hammer bar 292 is swung outwardly to the dotted line position, Fig. 22, with the cross bar 431 in the position shown in full lines, the escapement is actuated to advance the paper following a printing operation. When the lever 425 is in the dotted line position, 236b being raised, the triangular member 430 is rocked to the lowest dotted line position so that the cross bar 431 cannot engage in the slot 433. As a result, when the hammer bar 292 is swung backwardly, the escapement is not actuated and the paper does not advance.

A spacing operation can be accomplished with a spacer key 78a or 78b by a similar operation and without printing, inasmuch as the spacer key 78b, as shown in Fig. 22, is connected by means of a link 450 to the bell crank lever 427 so as to rock the entire lever 425 upwardly to the dotted line position. This upward movement of the triangular member 430 caused by the movement of the link 429 will displace the L-shaped member 434 without movement of the hammer bar 292 and will allow the escapement to advance the paper one step.

The upper part of the paper carriage can be collapsed by means of a thumb lever, Fig. 22, mounted on the carriage bar 307. The lever 451 is pivoted on a pivot pin 451b and it carries a pin intermediate of its length for engagement with a lug or short lever, shown in dotted lines in Fig. 22, on the hinge 451a, and when so engaged, prevents the upper part of the support from turning in a clockwise direction, as seen in Fig. 22, about the hinge 451a. This lever 451 is connected by means of a link 452 to a pair of supporting levers 453. The upper ends of the levers 453 carry a pin, not shown, which bears against the lower part of the support to prevent the latter from turning about the shaft 321. Movement of the lever 451 unlocks the hinge 451a and displaces the supporting lever 453 so that the upper part of the support 307-308 can be folded downward and the lower parts of 307-308 turned around 321. When the upper parts of 307-308 are stored in the back of the case 10, the pins

451*b* serve to prevent the chains 315 from getting loose.

In operation, let it be assumed that a composite character, including a left hand component and a right hand component, is to be printed. To accomplish this operation, one of the keys 12 to 47 having the same top configuration as the left hand component of the character is depressed, with the result that the printing cylinder C may be rotated and a type bar assembly rotated relatively to the cylinder C to bring the type bar adjacent to the paper carried by the paper carriage. As explained above, this is accomplished by means of the stop levers 105, etc., and 106, etc., which are actuated by the key depressed and always bring the corresponding type bar to its printing position under the action of the motor 400 and through the rotation of the drum shaft 87 and the sleeve 415.

The paper carriage D will be in its centre position for the reason that the stop bar 236*b* is projected to engage the slide member 221 and thereby hold the carriage plate 167 in its centre position. At the same time, the visible index card corresponding to the key depressed will be moved into view through the slot 276 (Fig. 1) in the curtain 272 which is in its centre position. A group of characters and components will be presented to view and, assuming that the component desired is shown in the next to the topmost position, the selector key 77*b* which bears the numeral 2, will be depressed. Upon depressing the printing key 77*b*, the corresponding drive roller 281 will engage the L-shaped member 280 connected with the key and will lift it upwardly, at the same time rotating the shaft 146 (Figs. 8, 9 and 10), thereby engaging the shaft 150 with the selected type bar 80*a* to 80*f* and rotating it to the second position in which the desired component is presented to the paper. At the same time, the printing hammer bar 292 will be forced backwardly by the pawl 288 (Fig. 8) on the lever 285 to the dotted line position and then released for forward movement to strike the hammer pin 300 and print the component on the paper. As described above, however, the stop bar 236*b* will be in its uppermost position so that the triangular member 430 and the cross bar 431 (Figs. 22, 23 and 24) will not engage the slot 433 in the escapement control member 434 and the paper will not be advanced.

The paper remains in position to receive the right hand component of the character. One of the keys 12 to 47 having the same top configuration as the top configuration of the right hand component is depressed. Then one of the keys 49 to 76 having the same configuration as the bottom configuration of the right hand component is depressed. This action, as described above, will elevate one of the stop bars 180 to 207 and depress the

stop bar 236*b*. As a result, the cross plate 167 carrying the paper carriage will move from the centre position into a position right or left into engagement with the stop bar, the slide 221 (Figs. 19 to 21) being shifted 70 at the same time to engage the chain and carry the carriage into engagement with the elevated stop bar through the rocking action of the shaft 238 (Figs. 11 and 20). This action shifts the paper into a position for receiving one of the row of types extending around the type bar.

The selection of the specific type from the group of eight, or less, is made by referring to the visible index which has a row of 80 characters or components now exposed through the slot 276 in the curtain or shutter 272 at a point other than at the centre of the machine. The desired character is then printed by depressing one of the keys 77*a* to 77*h* corresponding to the location of the desired character.

Sometimes there are more characters having the same top and bottom configuration than can be received in one row of type around a type bar and, in this case, a cross index is provided telling which key should be depressed in order to print the character. When the proper keys of the group 49 to 76 and of the group 77*a* to 77*h* are depressed, a 95 printing operation takes place, as described above, with the exception that a spacing operation follows the printing operation. Referring now to Fig. 22, it will be observed that at this time the centring stop bar 236*b* will be depressed, with the result that the triangular member 430 is elevated and the cross bar 431 engages in the cam slot 433. Therefore, when the printing hammer travels backwardly, the escapement 105 is actuated by reciprocation of the member 434 and the character is printed and the paper is advanced one step.

The spacing operation, without printing characters, has been described above and is produced by operation of a spacer key 78*a* or 78*b*.

One of the features of the applicant's invention is the design of the components of the types in which the left hand component takes up only two-fifths of the square occupied by an entire Chinese character, while the right hand component takes up three-fifths of this area and may overlap into a portion of the left hand character. Also, horizontal and diagonal strokes may be formed on the right hand character which extend over into the left hand character so that when printing composite characters, these two characters are properly integrated and are in acceptable form for printing the Chinese language. Fig. 40 of the drawings illustrates diagrammatically the areas of the left hand component L and the right hand component R. The shaded area shows the

extent of overlap of the components L and R. If the square in which the character is formed is 20 mm. square, the right hand area R is 12 mm. wide, and the left hand area L is 5 8 mm. wide, then the overlapping area is 2 mm. in width in the centre and 3-4 mm. at the bottom, and is of a peculiar shape as illustrated in Fig. 40.

The above-described device is susceptible 10 to considerable modification in its component parts, for example, the visual selecting means described above can be simplified and somewhat improved by the form of visual selector disclosed in Figs. 41 15 to 45 of the drawings.

In the selecting mechanism described above, a group of characters or components corresponding to the types in a row around a bar is printed on a separate card or slide 20 member, and a sufficient number of cards to display all of the different groups is arranged in the machine above the keyboard, with the printed characters and components thereon covered by adjacent cards. When 25 keys are depressed, the card bearing the corresponding group of characters and components is projected into view to permit the final selection to be made.

Inasmuch as many cards are required to 30 display all of the various groups of characters and components, the cards and the characters and components thereon must be small because of space limitations. As a result, they are somewhat difficult to see, 35 even with magnifiers. Also, the cards cannot be disposed in a single vertical plane, thereby making it necessary to scan the top of the machine to locate the projected card.

The form of selector illustrated in Figs. 40 41 to 45 is considerably less complicated than the card system, and, moreover, it makes possible the display of the characters and components at a fixed location on the machine, thereby facilitating selection of 45 the desired character or component from the group.

The modified form of selector includes a second or auxiliary drum corresponding generally to the type-carrying drum and 50 following generally the movements of the type carrying drum and the paper carriage. The auxiliary drum is provided with printed characters and/or components so that the auxiliary drum is moved to expose, at the 55 front of the machine, the group of characters and/or components corresponding to the row of types in position to print on the paper. Inasmuch as the auxiliary drum moves with both the type-carrying drum and the carriage, 60 only the characters and/or components on the auxiliary drum corresponding to the row of types around a type bar that is in position to print are exposed at any one time.

By providing a suitable magnifying or 65 projecting system, the printed matter on the

auxiliary drum may be shown enlarged for ready and easy viewing.

The typewriter is illustrated only partially in Figs. 41 and 45 but it is essentially the same as that described above. The typewriter 70 includes the casing 510 and has the keyboard including the groups of keys 511, 512 and 513 which are utilized in the same manner as the corresponding keys described above.

The typewriter also includes type-carrying 75 drum 515 which includes the disc-like end plates 516 and 517 mounted on the shaft 518 so that the drum as a whole can be rotated by means of the shaft 518.

Between the end plates 516 and 517 are 80 mounted the groups 519, 520, 521, 522, 523, 524 of type bars, each group of type bars being made up of six octagonal bars 525 which are rotatably mounted in the disc-like end plates 526 and 527. Each set of end 85 plates 526 and 527 is mounted on a shaft 528 which is rotatably mounted in the end plates 516 and 517 and can be rotated by means of the shaft 518 to bring any of the several groups 519 to 524 adjacent to the 90 paper carriage 530. Each of these groups of type bars can be rotated as described above to bring any of the individual bars 525 adjacent to the printing hammer 531.

As indicated previously, types having the 95 same basic top and bottom configuration are arranged in rows extending circumferentially around the type bars 525, thereby providing in one row a maximum of eight variations 100 of this character and/or component.

The visual selecting mechanism illustrated in Figs. 41 to 45 includes an auxiliary selecting drum member 540 which is best shown in Figs. 42 and 43. This auxiliary drum member consists of six bars 541, 542, 543, 105 544, 545 and 546, each having, as illustrated, six faces. Each of the hexagonal bars 541 to 546 corresponds to a different one of the groups 519 to 524 of type bars. Each of the 110 faces of the bars 541 to 546 corresponds to the entire periphery of a different one of the type bars 525 and is provided on its face with indicia, symbols, characters or components thereof corresponding to the types extending around the corresponding type bar 115 525. Thus, as shown in Fig. 42, one face 542a of the type bar 542 is provided with a number of groups 547, 548, etc. of printed characters and components. As shown, these groups may consist of eight or less characters, 120 each group corresponding to a different row of types around one type bar 525.

The bars 541 to 546 are rotatably mounted in disc-like end plates 550 and 551 which are mounted on hubs 552 and 553 which in turn 125 are supported slidably on a pair of sleeve shafts 554 and 555. The sleeve shafts 554 and 555 are rotatably mounted in Y-shaped end plates 556 and 557 which are connected by cross rods and spacers 558, 559 and 560 130

to hold the assembly rigid. The sleeve shafts 554 and 555 are rotatably mounted on a rod or shaft 561, fixed in the framework of the typewriter so that the sleeves 554 and 555 can rotate relative to the shaft and the entire mechanism 540 can slide axially of the sleeves 554 and 555.

As shown in Fig. 42, the hub member 553 is keyed by means of a machine screw to a tubular spacing sleeve 562 extending between the end plates 550 and 551 and the sleeve 555 is further slidably and non-rotatably connected to the hub 553 by means of flats 564, as shown thereon.

The hub 552 is rotatably and slidably mounted on the sleeve shaft 554. This shaft also carries an internal gear 565 which is slidable but non-rotatable with respect to the shaft 554 and engages continuously with the small pinions 566, 567, 568, 569, etc., which are connected to the various bars 541 to 546. Thus, upon rotation of the sleeve shaft 554, all of the bars 541 to 546 are rotated about their axes. Upon rotation of the sleeve shaft 555, the entire drum assembly, including the end plates 550, 551 and the bars 541 to 546 mounted therein, is rotated bodily relative to the Y-shaped end plates 556 and 557. The above-described indicator is constructed and arranged and is driven in such a way as to duplicate the movements of the type-carrying drum 515 and also the movement of the paper carriage so that the various groups of characters 547, 548, etc., displayed on the various bars may be brought into view to permit the selection of a desired character or component to be typed or printed, as described above. These motions are produced by connecting the indicating device 540 to the paper carriage 530 and to the type-carrying drum 515, as described hereinafter. Referring now to Fig. 41 of the drawings, the sleeve shaft 533 which rotates the groups 519 to 524 of type bars 525 is provided with a sprocket 570 which is connected by means of a chain 571 to a smaller idler sprocket 572. A still smaller idler sprocket 573 is connected to the sprocket 571 and by means of a chain 574 to a larger sprocket 575 which is fixed to the sleeve shaft 554. Thus, upon rotation of the sleeve shaft 533 to rotate all of the groups 519 to 524 of type bars, all of the bars 541 to 546 will be rotated simultaneously through the same angle.

At the outer end of the shaft 555 is a sprocket 576 which is connected by means of a chain 577 to a sprocket 578 fixed to the shaft 518 which is utilized to rotate the entire type drum 515. The chain 577 may be passed over suitable idler sprockets 579 and 579' to clear other elements of the typewriter. Thus, upon rotation of the type drum 515 bodily, the end plates 550 and 551 and the indicating bars 541 to 546 are rotated bodily. In

this way, the individual bars 541 to 546 follow exactly the movements of the groups of type bars 519 to 524.

In order to present the various groups of characters, symbols or components at a central location or viewing window in the front of the typewriter, it is necessary to move the indicating device 540 bodily relative to this viewing window to correspond to the movement of the carriage 530. This may be accomplished by providing a downwardly extending member 580 on the bottom of the carriage and connecting this member by means of a chain 581 or other equivalent mechanism to the indicator 540 so that as the carriage moves in one direction, the indicator 540 will move bodily in the same direction. As best shown in Fig. 45, the chain 581 is supported on four idler sprockets 582, 583, 584 and 585 disposed in the lower part of the typewriter casing. The sprockets 583 and 584 drive a pulley 586 and a sprocket 587 over which pass respectively a ball chain 588 having one end connected to a chain 589 which passes around the sprocket 587. One end of the chain 589 is connected by means of a spring and take up member 590 to an arm 591 which extends downwardly from the end frame member 556, as shown in Figs. 43 and 45. One end of the ball chain 588 is also connected by means of a suitable coupling 592 to the arm 591. Therefore, as the carriage 530 moves back and forth, the indicating device 540 moves back and forth but in the same direction along the sleeve shafts 554 and 555. It will be understood, of course, that the groups of indicia on the indicator 540 will be so arranged that when exposed through the viewing window to be described, they will correspond to the row of characters or components disposed directly in front of the printing hammer on the carriage.

While it would be possible to merely provide an opening and a magnifier in the front of the typewriter casing to permit the indicia on the bars of the mechanism 540 to be viewed, one group at a time, it is preferred to project these indicia onto a ground glass screen 600 and to enlarge them for clarity. Therefore, as shown in Fig. 41, the typewriter may be provided with an upwardly projecting housing 601 in which the ground glass screen 600 is mounted. This housing 601 covers a projection lens system 602 which includes a magnifying lens 603 and a mirror 604. The indicia of a group on the face of a bar 541 are illuminated by means of small electric light bulbs 605 and 606 which are provided with suitable reflectors 607 so that the light directed against and reflected from the face of the bar 540 will be transmitted and magnified by the lens 603 and reflected from the mirror 604 onto the screen 600 where the groups of characters may be seen

enlarged and in great clarity. From this group of enlarged characters, it is possible to select one by depressing one of the series of keys 513 which rotates the type bar 525 adjacent the printing hammer to bring the selected character beneath the printing hammer so that a printing operation can take place.

While the invention has been described above with reference to a typewriter for typing the Chinese language, it will be understood that the same structure, but with modified key symbols and type arrangements, may be used for printing other languages which are based upon the English alphabet and still other languages in which alphabets are not used. If desired, symbols, characters or alphabets for printing other languages can be applied to the keys and types inserted in the cylinder C for printing such symbols, inasmuch as the cylinder has sufficient blank spaces to receive such symbols.

The device may be simplified by reducing the number of type bars and corresponding keys, or by reducing the number of rows on a type bar and the number of types in a row and number of bottom symbol keys in proportion. Such a simplified device may be useful for some purposes, but will not permit the printing or selection of all of the words that can be printed or selected with the device described above.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed we declare that what we claim is:

1. An apparatus for selecting the characters or components of a written Oriental language for use in direct or indirect reproduction of said characters or components, characterised in that a number of elements, each bearing a character or a component, are segregated into a number of main groups, each character or component of each main group containing a first symbol which is different in each main group, each main group being further segregated into smaller or sub-groups, each character or component of each sub-group containing a second symbol in addition to the said first symbol, first actuating means being operable to select one of the main groups of elements, second actuating means being operable to select a sub-group from the selected main group, third actuating means being operable to select the desired character or component from the selected sub-group, and means responsive to the said third actuating means being operable for causing engagement of the selected character or component with means co-operating therewith for direct or indirect reproduction of the said character or component.

2. Apparatus according to Claim 1,

characterised in that a visual indicator is responsive to actuation of the said first actuating means for displaying a main group of characters or components having a corresponding first symbol, the indicator being further responsive to actuation of the said second actuating means for displaying a smaller or sub-group of characters or components each containing a second symbol in addition to the said first symbol.

3. The apparatus according to Claim 1 or Claim 2, in which three groups of keys are provided, a first group of keys bearing symbols each like the symbol comprising or included in the top configuration of a different main group of elements, a second group of keys bearing symbols each like a symbol comprising or included in the bottom configuration of a different sub-group of elements, and a third group of keys for selecting a particular variation from a group of elements all having the same basic symbol in the top configuration or having the same basic top symbol and bottom symbol and causing said element to be reproduced on a supporting member.

4. The apparatus according to Claim 3, in which any key of the first group of keys can be actuated to produce relative movement between a movable member carrying the said elements and the supporting member to position a main group of elements each having the same top symbol adjacent to a predetermined portion of the supporting member, thereafter any key of the second group of keys can be actuated to produce additional relative movement between the movable member and the supporting member to position the smaller or sub-group of elements having the same top symbol and the same bottom symbol adjacent to the predetermined portion of the supporting member, and any key of the third group of keys can be actuated to select variations of these basic symbols or reproduce the character or component on one of the elements positioned adjacent to the predetermined portion of the supporting member.

5. The apparatus according to Claim 4, in which the movable member comprises a rotatable cylindrical member having a number of bars carrying the elements for reproducing the characters and components, the elements being arranged in main groups on the bars, each main group containing all the elements having the same top symbol and the top symbol of each main group being different from that of the other main groups, the said main groups being further subdivided into sub-groups, each sub-group having a different bottom symbol.

6. The apparatus according to Claim 5 in which the bars are mounted for rotation relative to the rotatable cylindrical member, the elements having the same top symbol

being arranged in rows extending lengthwise of the bar, and the elements having the same basic top and bottom symbols being arranged in rows extending around the bars.

5 7. The apparatus according to Claim 4 in which the movable member includes a rotatable cylindrical member having a number of groups of bars, the said groups being rotatable relative to said cylindrical member, and 10 each of the said bars being rotatable and having a plurality of rows of elements for reproducing characters and components extending longitudinally thereof, the rows containing equal numbers of spaces for the 15 elements extending along the bars, and all of the elements on a bar having the same top configuration.

8. The apparatus according to Claim 7, in which each of the keys of the first group 20 corresponds to a different one of the bars, each key of the second group corresponds to a space lengthwise of all of the bars and each of the keys of the third group of keys corresponds to a longitudinal row on each of the 25 bars.

9. The apparatus according to any one of Claims 3 to 8, in which the supporting member is a carriage movable lengthwise of the movable member, and the second group of 30 keys controls the carriage to cause it to move relatively to the movable member to position a predetermined portion of the carriage adjacent to a selected sub-group of elements having the same basic top and bottom configuration. 35

10. The apparatus according to any one of Claims 3 to 9, in which the supporting member is a carriage for supporting a sheet of paper or the like and is provided with a 40 hammer for impressing a selected element on the paper.

11. The apparatus according to Claim 1 or Claim 2, which comprises a typewriter having a rotatable printing cylinder on which 45 a plurality of type-carrying bars are rotatably mounted, each type bar having a plurality of rows of type extending longitudinally thereof and the said rows being adapted to contain equal numbers of types 50 occupying corresponding positions along the said bars, the types on each bar corresponding with one of said main groups and the types in the same longitudinal position in all said rows on each bar corresponding with one 55 of said sub-groups, the said first actuating means comprising a first group of keys each of which corresponds with one of said type bars, the said second actuating means comprising a second group of keys 60 each corresponding with a longitudinal position along each of said bars, and the third actuating means comprising a third group of keys each corresponding with one of the rows on each type bar, a paper carriage 65 movable parallel to the axes of said bars

adjacent to said cylinder, means responsive to the keys of said first group for moving said cylinder to position a type bar corresponding to an actuated key adjacent to said paper carriage, means responsive to actua- 70 tion of the keys of said second group for positioning a predetermined portion of said carriage adjacent to a type space corresponding to an actuated key, and means responsive to actuation of the keys of said third group 75 to rotate a bar adjacent to said carriage to present a selected type to said paper carriage.

12. The apparatus according to Claim 11, in which a printing hammer is mounted on the paper carriage, means are provided for 80 moving a sheet of paper perpendicular to the said type bars and between the said bars and the hammer, actuation of any one of the second group of keys being operative to move the carriage to dispose the hammer in 85 alignment with a type occupying a longitudinal position corresponding with the actuated key, and actuation of any one of the third group of keys being operative to rotate the type bar selected by one of the 90 first group of keys to align a type in one of said rows with the hammer and to actuate said hammer to force the paper against the said selected type.

13. The apparatus according to Claim 11, 95 or Claim 12, in which means are provided for normally maintaining the paper carriage centered with respect to the type bars, a type corresponding with a left hand component of a Chinese character being disposed sub- 100 stantially in the middle of each of the said rows of types, the said second group of keys corresponding with the longitudinal positions of the types in the rows except the said central types bearing left hand components, 105 whereby a type bearing a left hand component will be disposed adjacent to said paper carriage by actuation of one of said first group of keys to select a type bar and actuation of one of said third group of keys 110 to select a row of type.

14. The apparatus according to Claim 13, having spacing means for moving a sheet of paper step by step perpendicular to the said bars, and means for rendering the spacing 115 means ineffective upon printing a left hand component type.

15. The apparatus according to Claim 1 or Claim 2, which consists of a typewriter comprising a rotatable printing cylinder having 120 a plurality of groups of type bars, each group comprising a pair of spaced apart members rotatably supported on said cylinder and a plurality of type bars rotatably mounted between said members adjacent the peri- 125 pheries thereof, a first drum fixed to one end of the said cylinder and having angularly spaced stop surfaces thereon, a second drum at the opposite end of and rotatable relatively to said cylinder having other angularly 130

spaced stop surfaces thereon, means for rotating said cylinder and said second drum, a key corresponding to each type bar, stop members adjacent to the said first and second
 5 drums adapted to engage different stop surfaces on said drums, means connecting each of the said keys to a pair of stop members, one member being adjacent to the first drum and the other stop member being adjacent
 10 to the second drum, and each key being connected to a different pair of stop members, the said connecting means moving the stop members connected to a key into engagement with the drums upon actuation of said
 15 key, and gearing connecting the second drum to each of the said groups of type bars whereby upon rotation of the cylinder and the second drum a type bar corresponding to an actuated key is moved to a predetermined
 20 mined position.

16. An apparatus according to Claim 7, in which the cylindrical member is provided with a series of angularly related stops corresponding to the positions of the groups
 25 of bars, the groups of bars are connected to a drum having a series of angularly related stops thereon corresponding to the bars in each group, the first group of keys are arranged to actuate mechanism for engaging
 30 the stops on the cylindrical member and for engaging the stops on the drum, thereby to position a selected bar adjacent to the supporting member.

17. The apparatus according to Claim 1
 35 or Claim 2, which consists of a typewriter comprising a printing cylinder having a plurality of rows of types extending parallel to the axis of said cylinder, a paper carriage assembly adjacent to said cylinder and sup-
 40 ported for movement substantially parallel with the axis of the cylinder, means for moving the carriage assembly parallel with the cylinder in both directions, the said second actuating means comprising a group
 45 of keys, each key corresponding to the position of a type longitudinally of each row of types, a stop member corresponding to each key, means responsive to actuation of a key for moving a corresponding stop member
 50 into position to stop the carriage assembly adjacent to the type position corresponding to the actuated key, an additional stop member corresponding to the centre of said rows of types, means normally maintaining
 55 the additional stop member in position to stop the carriage assembly in the centre position, and means actuated by movement of any of the first mentioned stop members to carriage assembly stopping position for
 60 withdrawing the additional stop member out of its carriage assembly stopping position.

18. A typewriter according to Claim 17, in which the means for moving the carriage assembly parallel with the cylinder includes
 65 an endless member driven continuously in

one direction, and a member on the carriage movable selectively to engage with one or the other of the two parallel flights of the endless driven member to move the carriage
 70 endwise in either direction.

19. A typewriter according to Claim 18, in which the carriage is provided with movable means actuated at the opposite ends of transverse movement of the carriage for disconnecting the carriage assembly from the flight
 75 to which it is connected and connecting it to the other flight.

20. The apparatus according to Claim 3, in which the supporting member comprises a carriage which is supported for transverse
 80 movement, an endless member being disposed adjacent to the carriage and arranged to be driven in one direction, means on the carriage being movable into a first position to engage with one flight of the endless mem-
 85 ber to cause the carriage to be moved in one direction, and movable to another position to engage with the other flight of the endless member to cause the carriage to be moved in the opposite direction, stop members
 90 adjacent to said carriage being movable into and out of the path of said movable means by a number of keys connected to different stop members whereby a stop member can be moved into the path of said movable
 95 means upon actuation of a corresponding key, one sub-group of the said second group of keys being connected with means for moving the said movable means to the said first position upon actuation of any key of
 100 the said sub-group, and another sub-group of the said second group of keys being connected with means for moving the said movable means to the second position upon actuation of any of this latter sub-group of keys.
 105

21. The apparatus according to Claim 20, in which an extra stop member is provided corresponding to a centered position of the carriage, the extra stop member being
 110 movable into the path of the carriage to stop the carriage and being movable out of the path of movement of the carriage upon movement of another stop member into the path of the carriage, and mechanism responsive to movement of the extra stop member
 115 into the carriage path to cause the carriage to move toward the extra stop member.

22. A typewriter according to any one of Claims 10 to 14, in which the paper carriage has a rotatable roller extending transversely
 120 thereof and is mounted on a supporting member for movement axially of the roller, the said supporting member being supported for movement axially of the roller on a second supporting element, the first support-
 125 ing member being movable under the control of the element-selecting keys and the roller being rotatable by means of an escapement under the control of the third group of keys, the escapement being inoperative to rotate
 130

the roller when the first supporting member is in a centered position relative to the printing cylinder.

23. The typewriter according to Claim 22, in which the carriage is provided with spacing means for moving the carriage endwise relative to its supporting means.

24. The apparatus according to any one of Claims 10, 21, 22 and 23, in which the carriage is provided with two or more rollers which are spaced apart and over which a sheet of paper may be advanced, and a printing hammer having a rockable paper contacting end portion mounted between the rollers for engagement with the back of the sheet to force it against a forming element.

25. The apparatus according to Claim 24, in which a typewriter ribbon is supported by spools on the carriage, the ribbon being so located that the sheet passes between the ribbon and the hammer.

26. The apparatus according to any one of Claims 9 to 15 and 17 to 25, in which the carriage or carriage assembly includes a first roller rotatably mounted in the carriage, a pair of rollers spaced from the said first roller, the said first roller and one of the said pair of rollers being connected to rotate in unison, a receptacle for a sheet of paper being mounted behind the said pair of rollers from which the said sheet may be withdrawn between the pair of rollers and over the first roller, spring means normally tending to rotate the said connected rollers in a direction to withdraw the sheet from the receptacle.

27. The apparatus according to Claim 26, in which the first roller is provided with escapement means for permitting intermittent rotation of the roller to withdraw the sheet from the receptacle.

28. The apparatus according to Claims 26 and 27, in which a pinion is connected to the first roller by an overrunning clutch, and a pivotally mounted segment on the carriage meshes with the pinion to rotate the latter to return the sheet to the receptacle.

29. The apparatus according to any one of Claims 26 to 28, in which biasing means is provided for one of the rollers to maintain the sheet under tension.

30. The apparatus according to any of Claims 26 to 29, in which the carriage or carriage assembly is provided with a movable member for gripping the end of the sheet, the gripping member being supported by endless chains which connect it to the first roller for movement in unison therewith to draw the sheet over the first roller.

31. The apparatus according to Claim 2, in which the visual indicator includes a member having an opening therein for exposing a group of the said elements to view, and means responsive to actuation of another key for moving the said member and the said

element carrying means relatively to bring the said opening in alignment with a sub-group of elements having characters and components containing the symbols corresponding to the actuated key.

32. The apparatus according to Claim 31, in which the means carrying the character and component elements comprise a number of superimposed cards, each card having one or more rows of the elements thereon, and each of the cards having slots therein adjacent to the columns for exposing therethrough a row of elements on a card member displaced by actuation of a key or keys.

33. The apparatus according to Claim 32, in which the cards carrying the character and component elements are carried by a movable shutter having a slot therein, the shutter being movable in response to actuation of a key or keys to expose through its slot the displaced card.

34. The apparatus according to any one of Claims 31 to 33, in which means is provided for magnifying the exposed sub-group or row of character and component elements.

35. Apparatus according to any one of the preceding claims, in which a motor is provided for actuating components of the apparatus in response to actuation of the keys to reproduce the characters or components.

36. The apparatus according to Claim 1, including a rotatable cylindrical mechanism provided with a plurality of groups of bars having longitudinal rows of characters and components of characters around the said bars, the groups of bars being rotatable about axis parallel with the cylinder axis and each bar being rotatable about its own axis, and a carriage movable parallel to the said bars for reproduction of the said characters or components thereon, indicating means bearing characters and components corresponding with the characters and components on said bars being connected with said drum mechanism so as to display the characters or components corresponding with those on the bar which is disposed adjacent to said carriage.

37. The apparatus according to Claim 36, in which the said indicating means comprises a plurality of indicating bars rotatably mounted on a drum, each indicating bar corresponding to one of the said groups of bars of said cylindrical member and having a face corresponding to each bar of the said group and having symbols thereon corresponding to the characters or components on each of said bars, the said drum being supported for rotary and axial movement, means connecting the said drum to the carriage for moving the drum axially in response to movement of the carriage, means connecting the drum to the cylindrical member for simultaneous rotation, and means being pro-

vided for rotating the bars of said drum simultaneously with the said group of bars of the cylindrical member.

38. The apparatus according to Claim 37, 5 in which the said drum comprises a pair of co-axial end members supported for rotation about their common axis and for axial movement, the said indicating bars being rotatably mounted in the said end members eccentric 10 to the axis of the latter, the said end members being connected to the carriage for axial movement in response to movement of the carriage, the said end members being connected to the cylindrical member for rotation 15 of the end members in response to rotation of the cylindrical member, and the indicating bars being connected to the said groups of bars for rotation of the indicating bars in response to rotation of the said groups of 20 bars relative to the cylindrical member.

39. An apparatus according to Claim 36, 25 in which the said indicating means comprises a rotary indicating member having groups of characters and components thereon corresponding to the groups of characters or components on the said groups of bars, a viewing means disposed adjacent to the said rotary indicating member for exposing one group of the said characters or components to view at

a time, and means connecting the said cylindrical member and the carriage to the indicating member to move the latter to expose through the viewing means a group of characters or components including the characters or components to be reproduced, 35

40. The apparatus according to Claim 39, in which the viewing means comprises a screen and means for projecting on the screen an image of the said group of characters and components on said indicating member. 40

41. An apparatus according to Claim 13, in which actuation of any one of the said third group of keys also renders ineffectual the means which normally maintains the paper carriage centered with respect to the 45 type bars.

42. An apparatus according to Claim 1, having its parts constructed and arranged substantially as described with reference to Figs. 1 to 40 or as modified with reference 50 to Figs. 41 to 45 of the accompanying drawings.

Dated this 9th day of November, 1949.

For the Applicants,

GILL, JENNINGS & EVERY,

Chartered Patent Agents,

51/52, Chancery Lane, London, W.C.2.

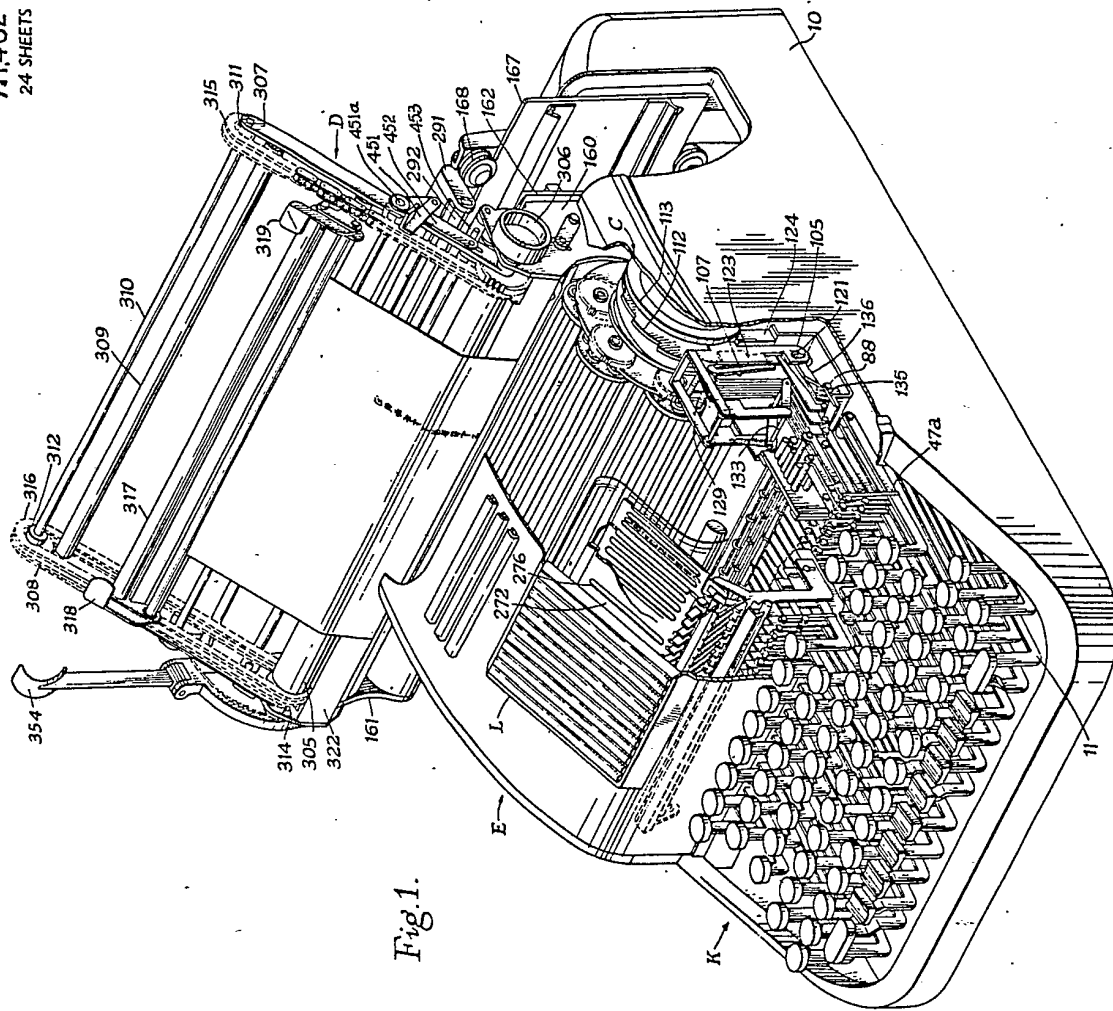
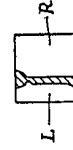


Fig. 40.



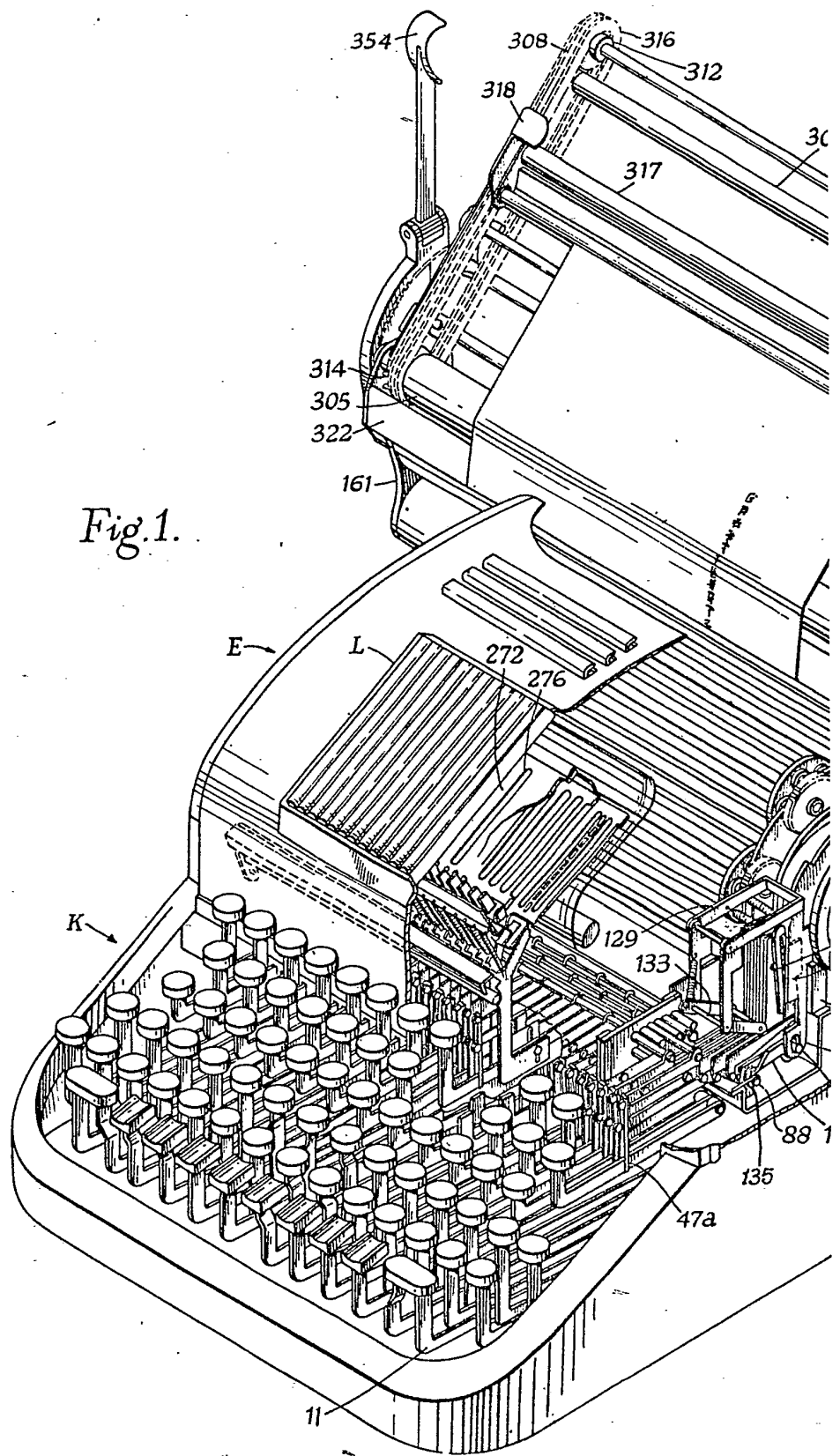


Fig.1.

711,462 COMPLETE SPECIFICATION

24 SHEETS

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the Original on a reduced scale.

SHEET 1

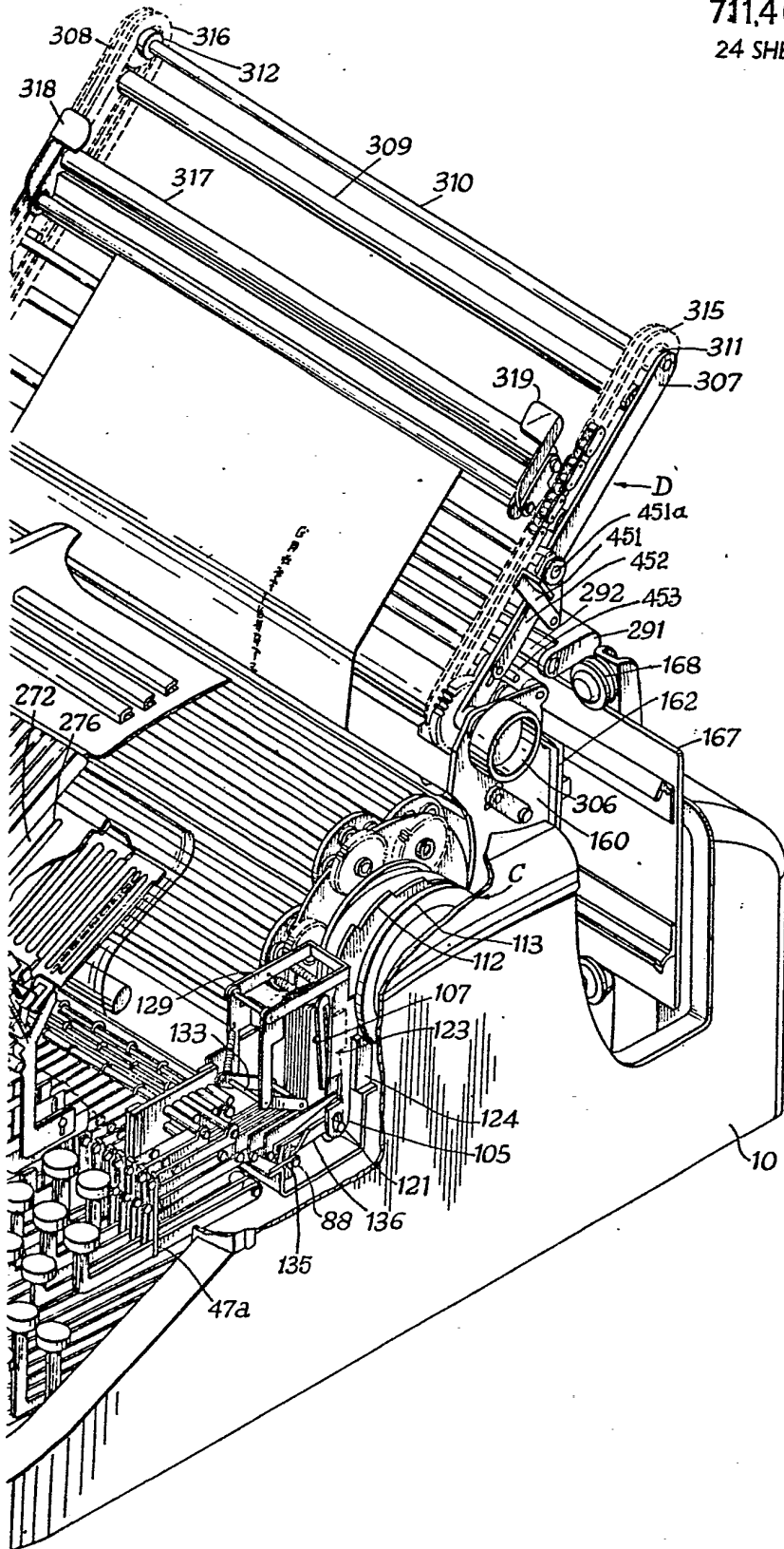
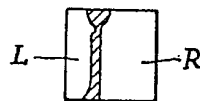


Fig. 40.



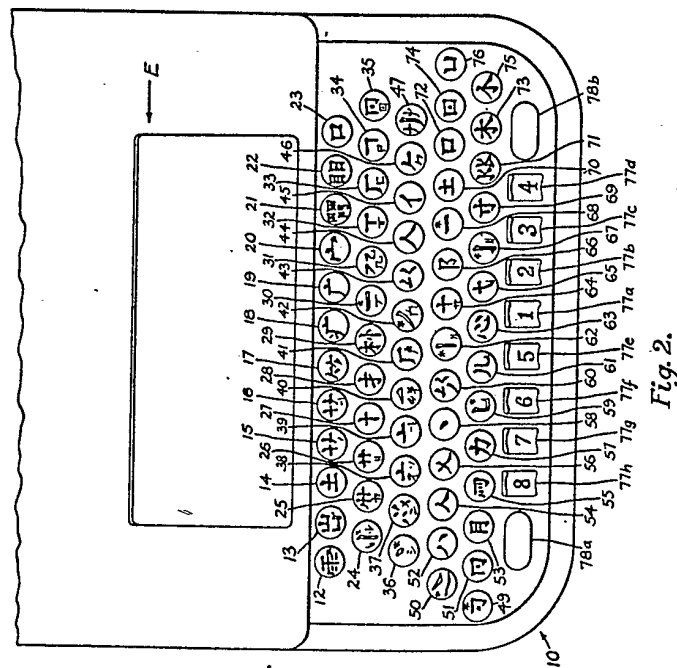


Fig. 2.

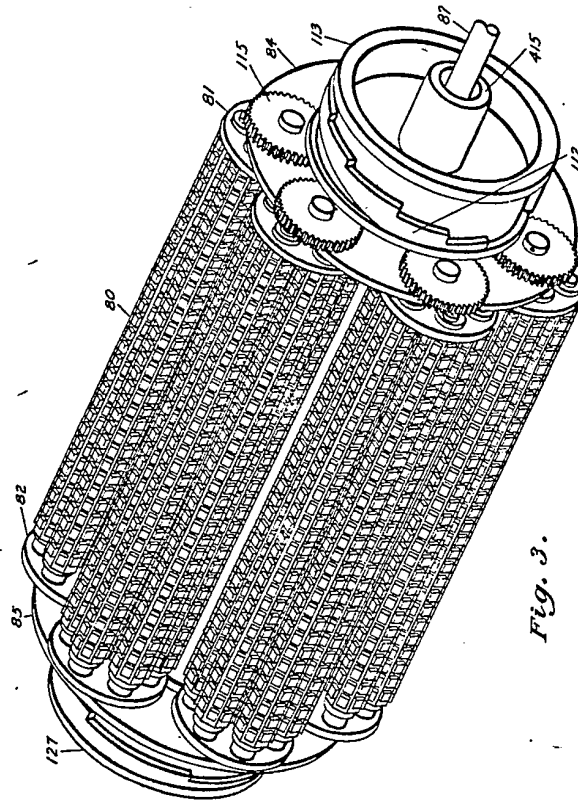


Fig. 3.

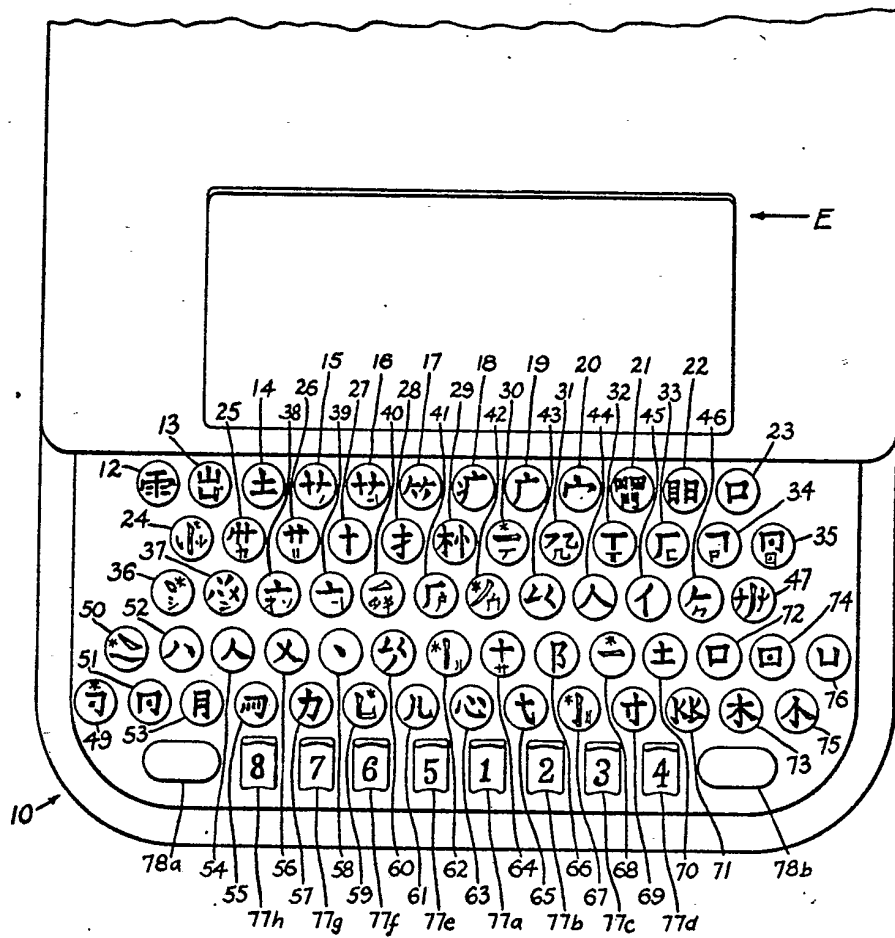
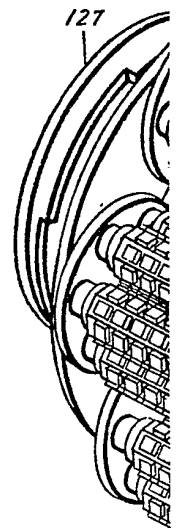


Fig. 2.



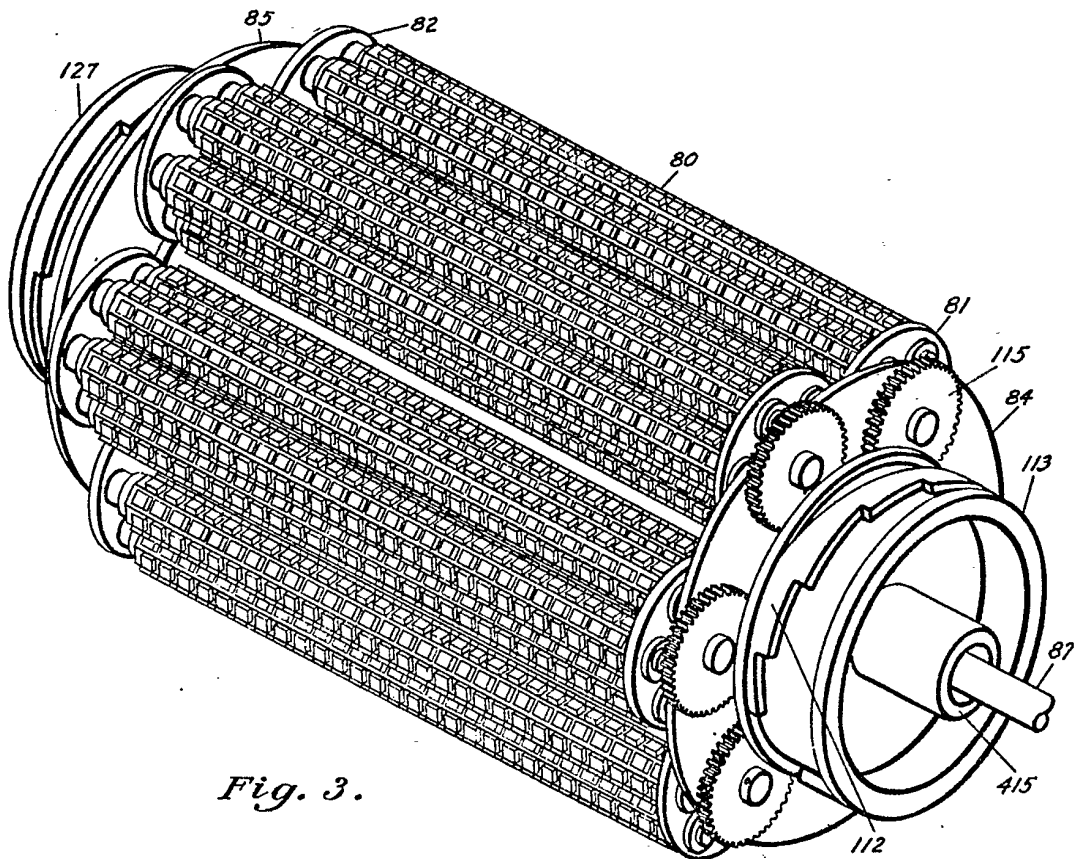
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COMPLETE SPECIFICATION

24 SHEETS

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SHEETS 2 & 3



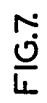
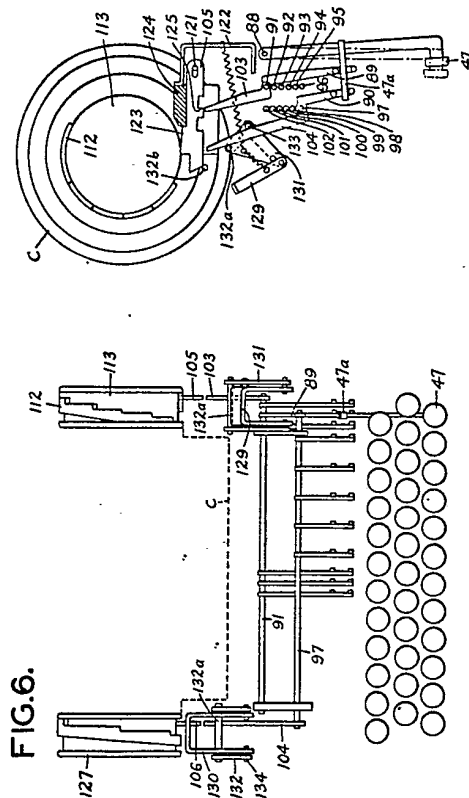
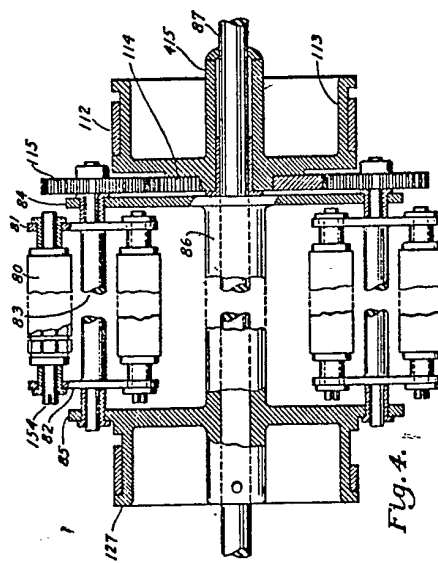
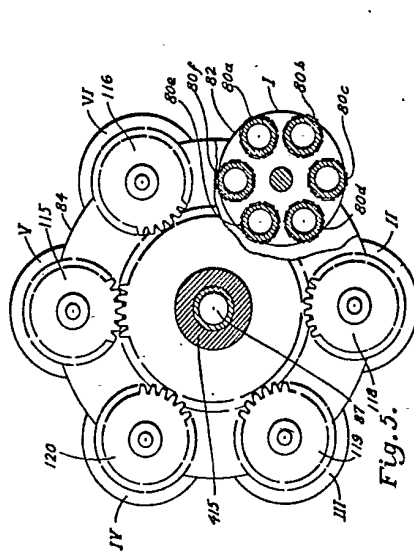
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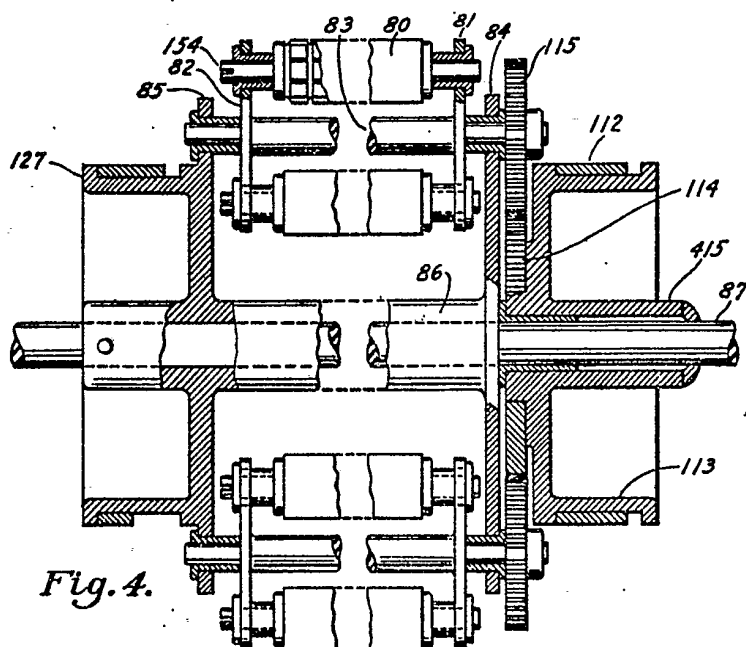
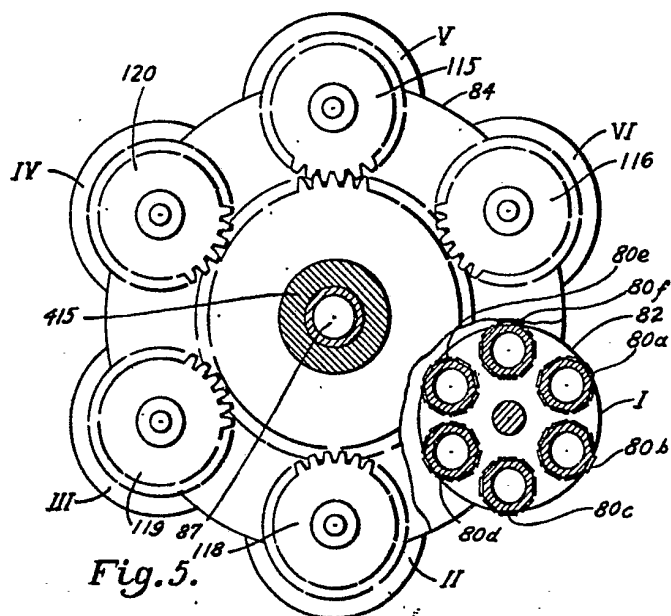
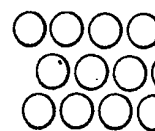
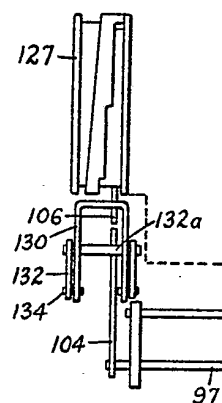


FIG.6.



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24 SHEETS

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SHEETS 4 & 5

FIG.6.

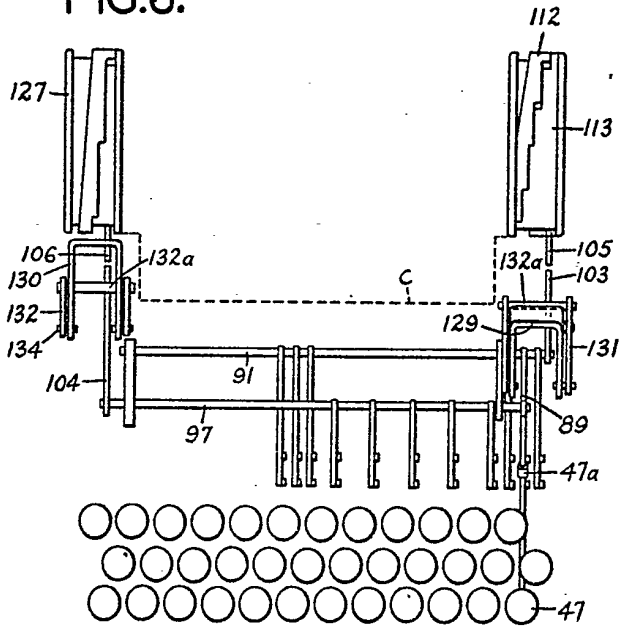


FIG.7.

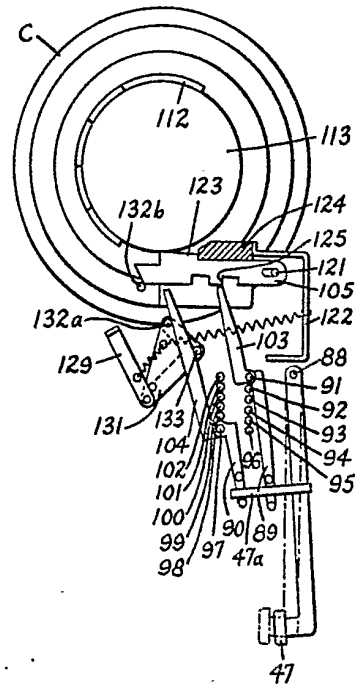


Fig. 8.

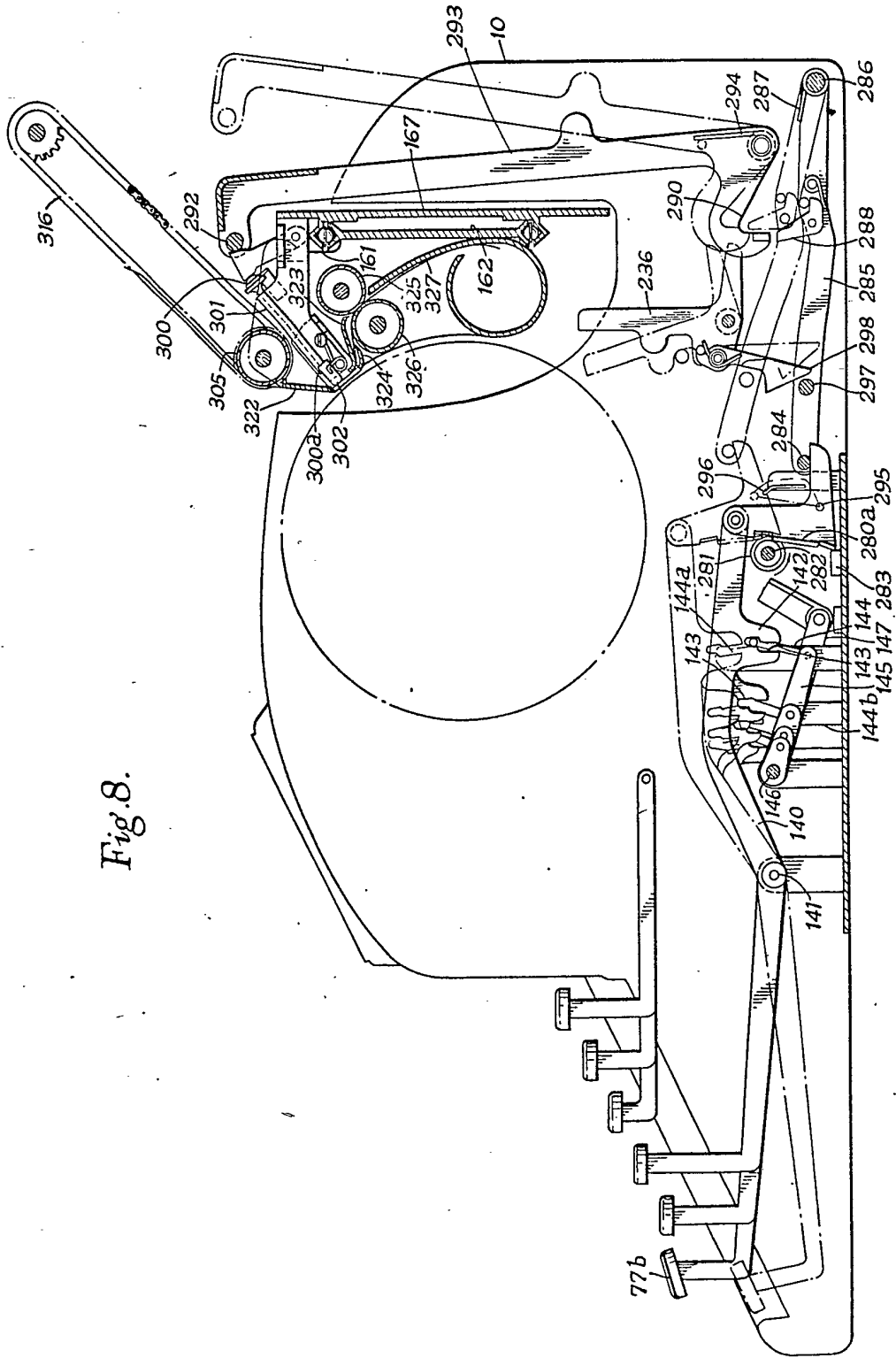
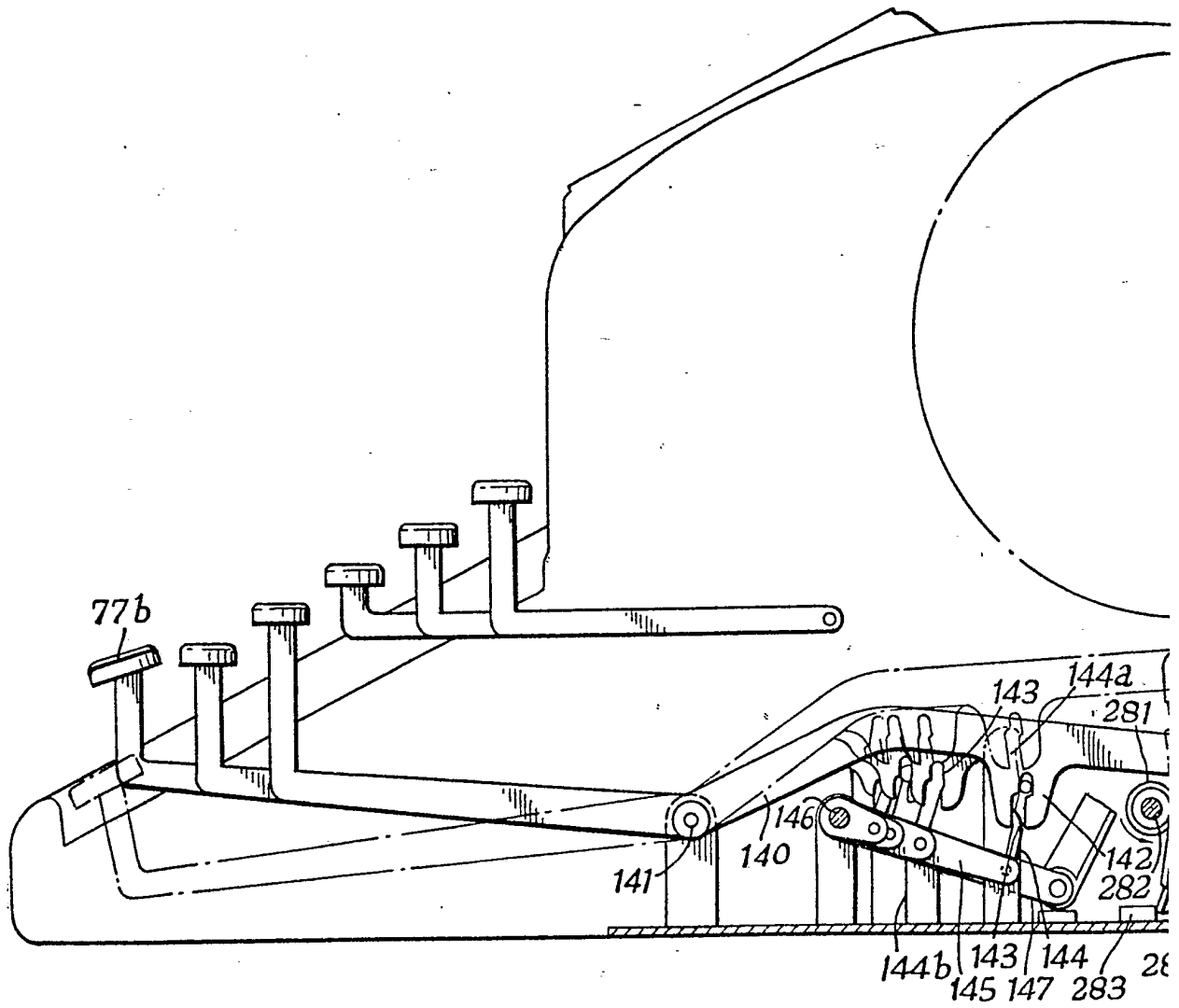


Fig.8.



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24 SHEETS

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SHEET 6

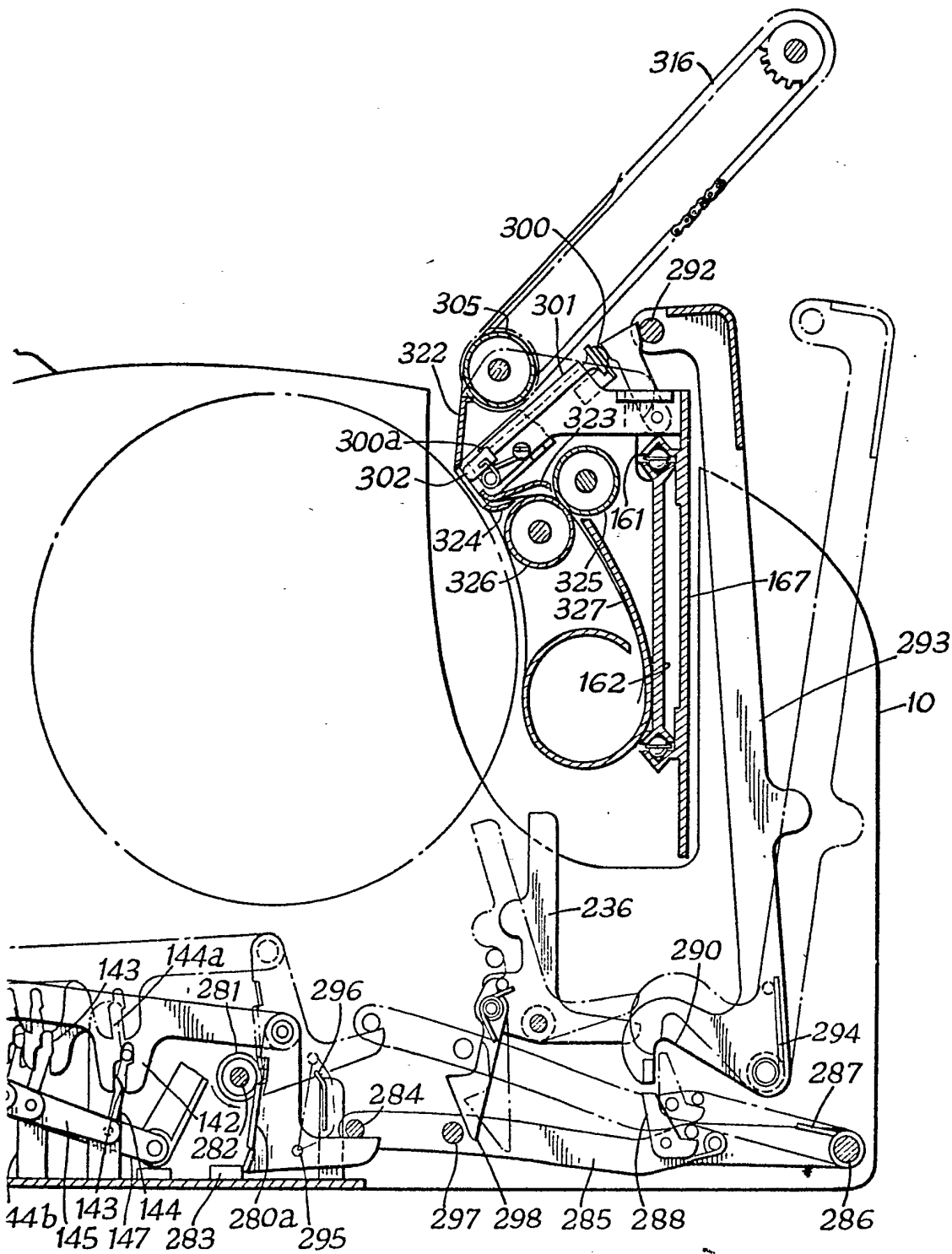


Fig. 9.

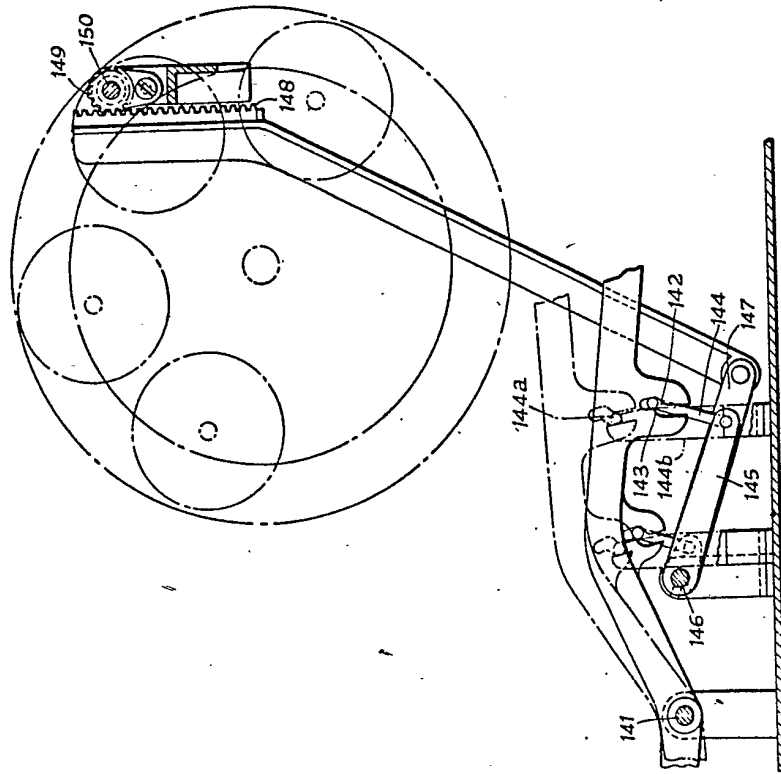


Fig. 10.

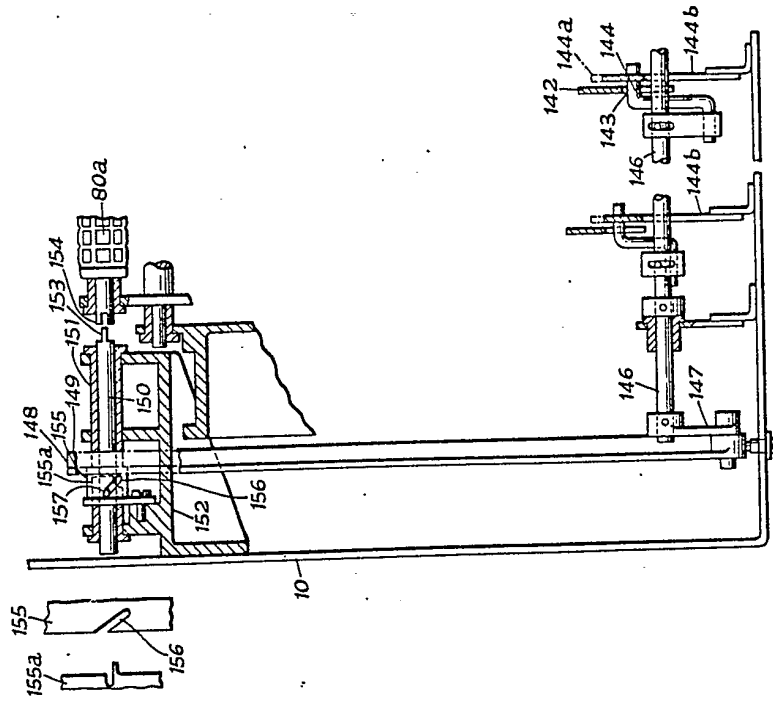
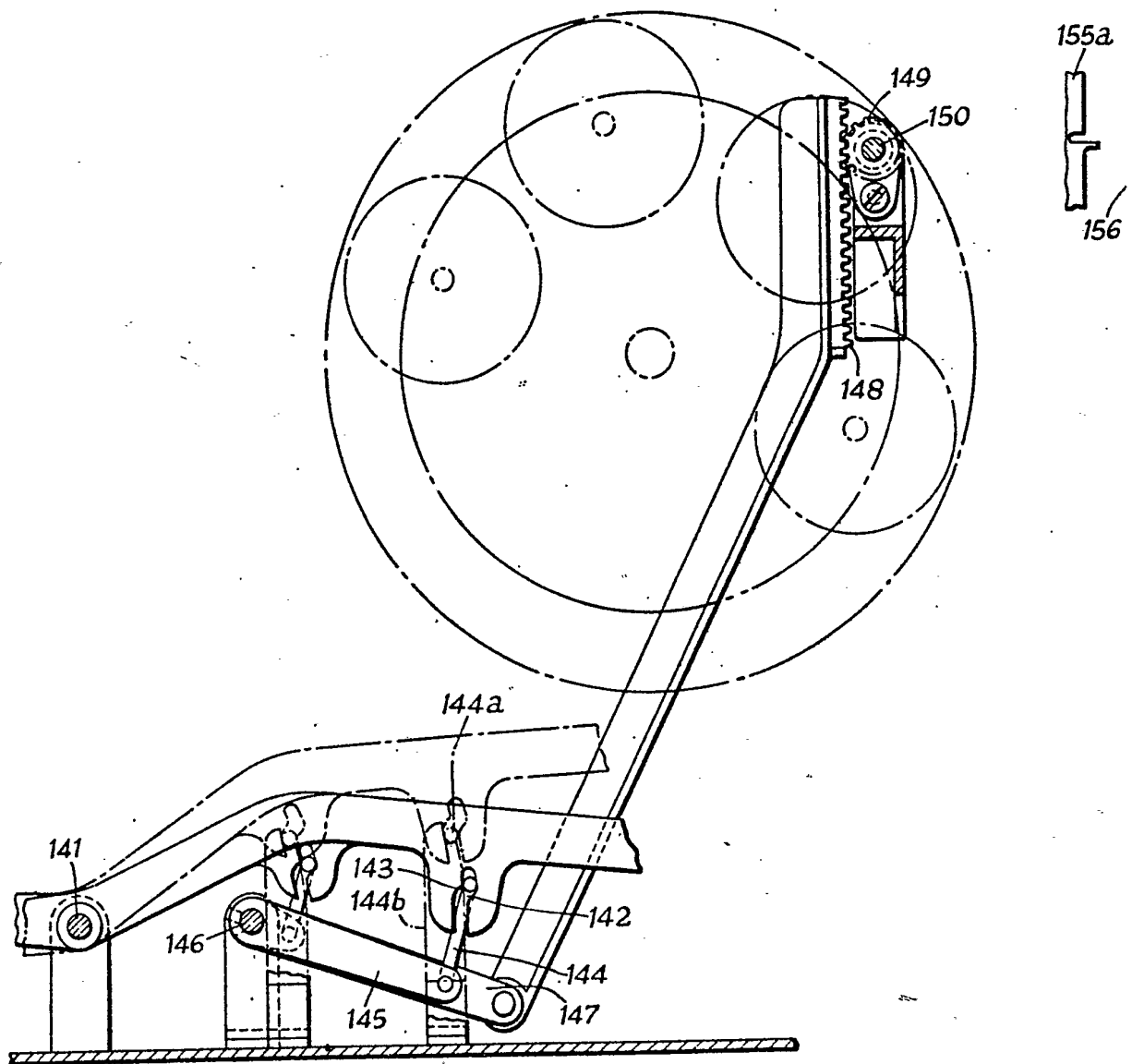


Fig. 9.



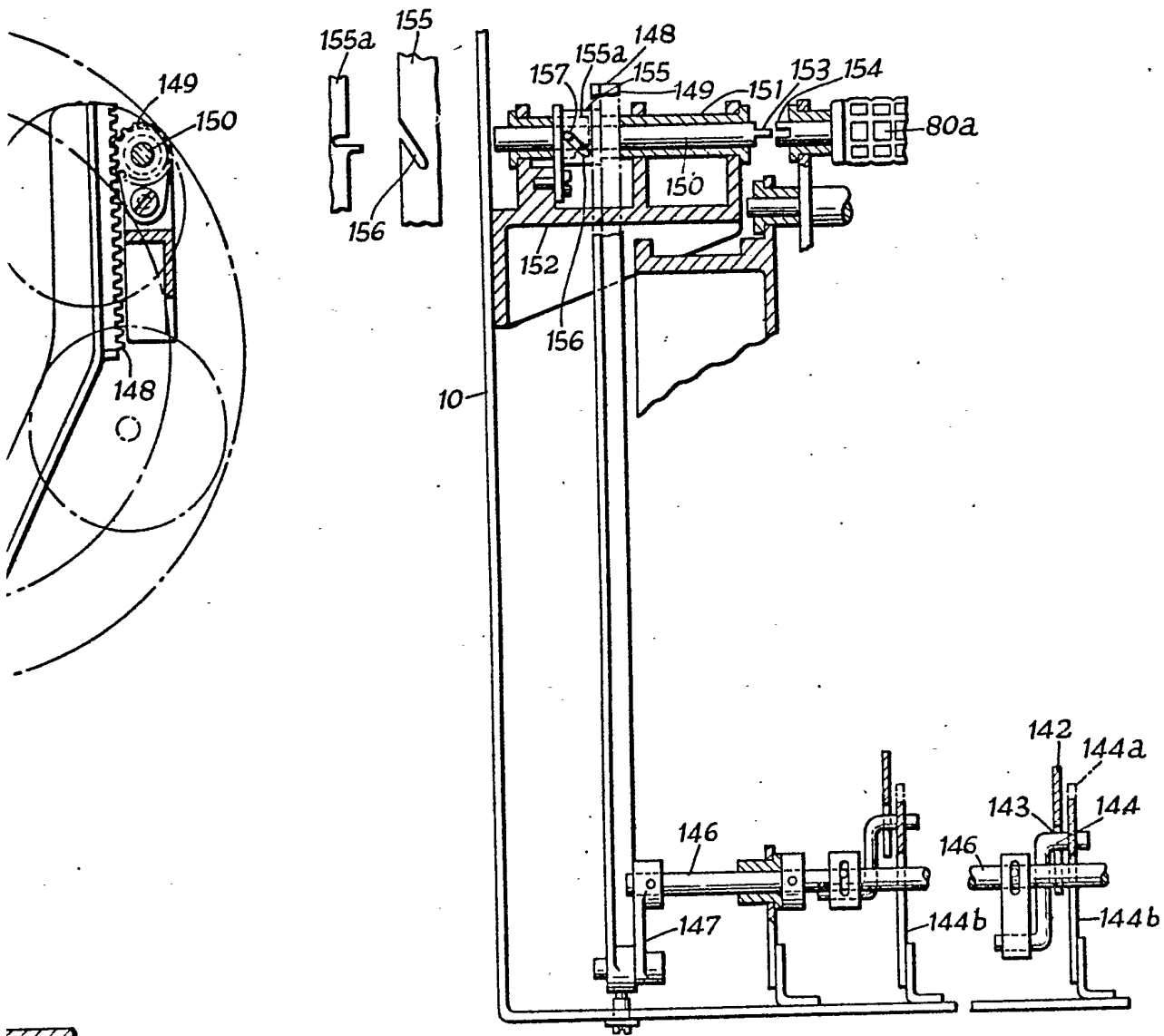
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24 SHEETS

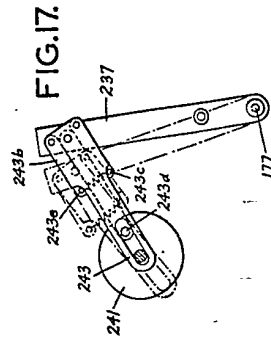
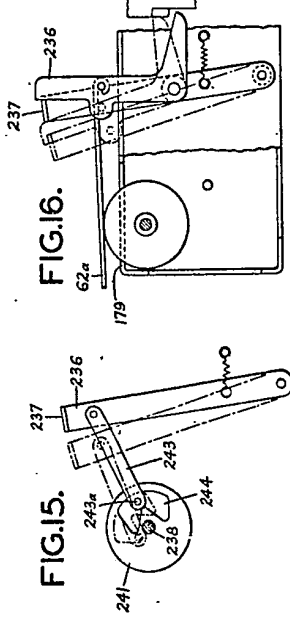
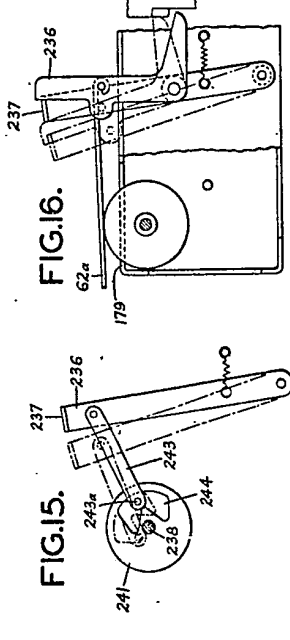
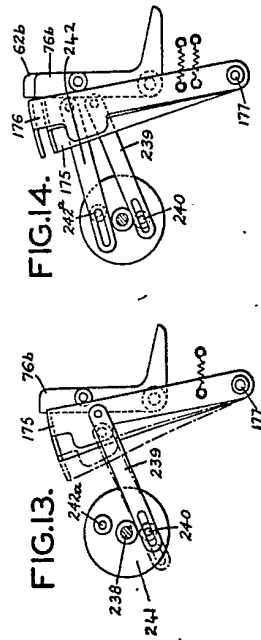
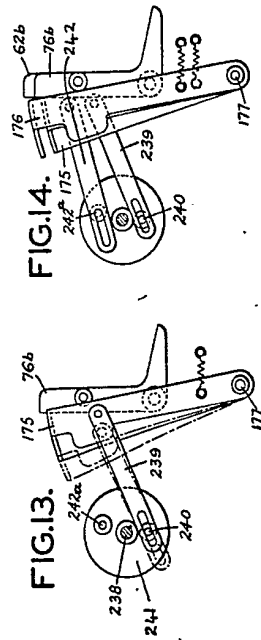
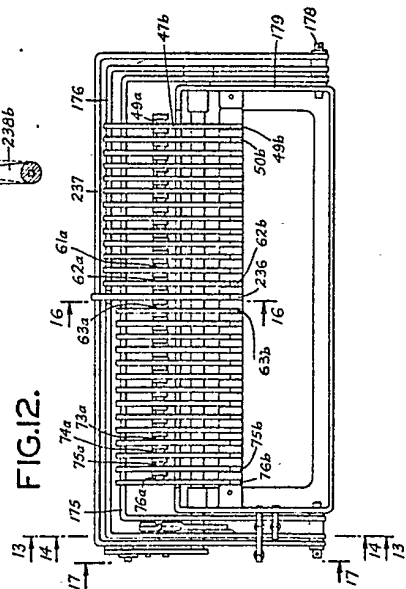
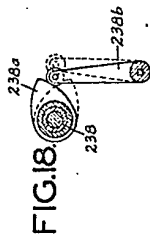
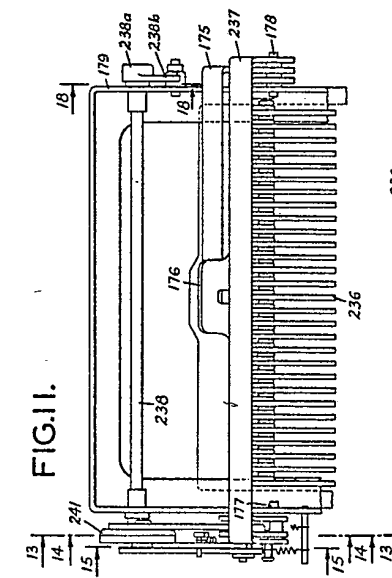
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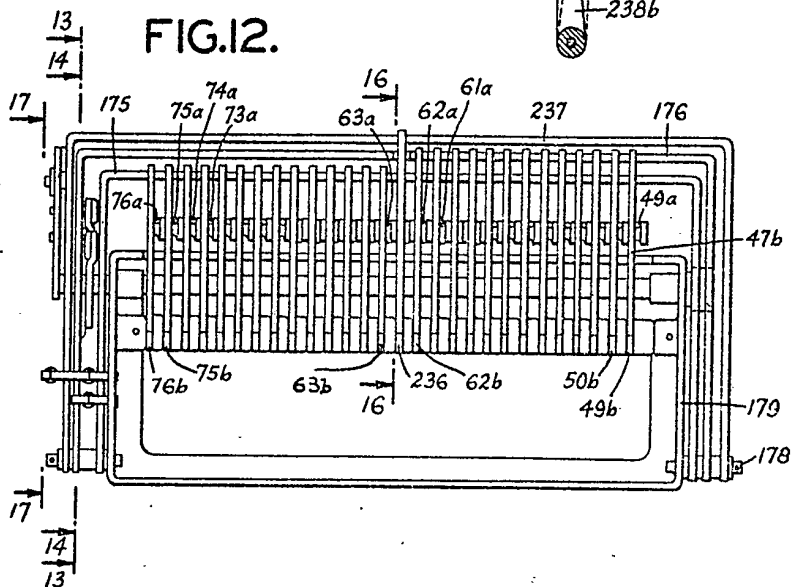
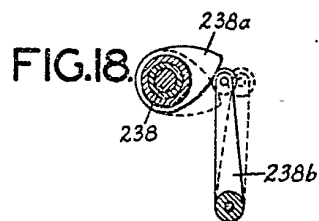
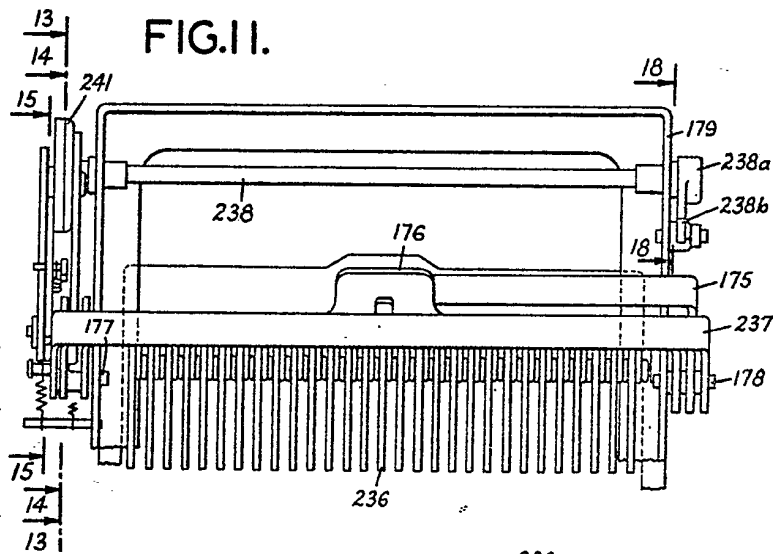
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SHEETS 7 & 8

Fig.10.





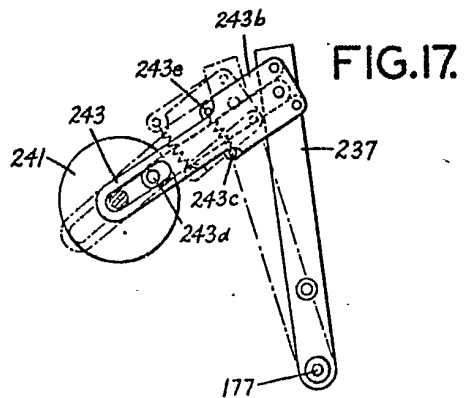
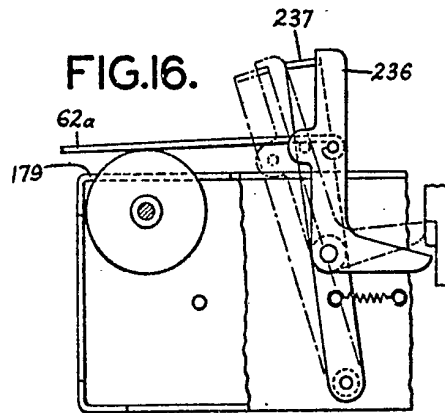
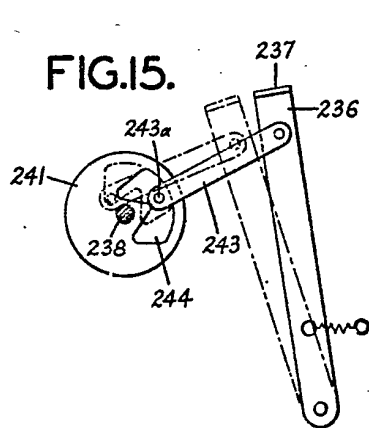
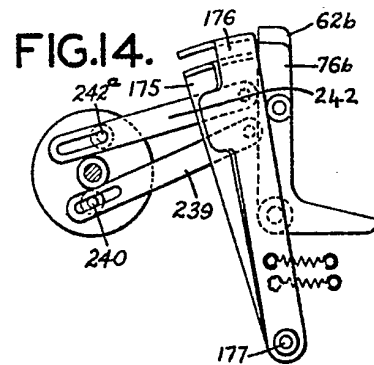
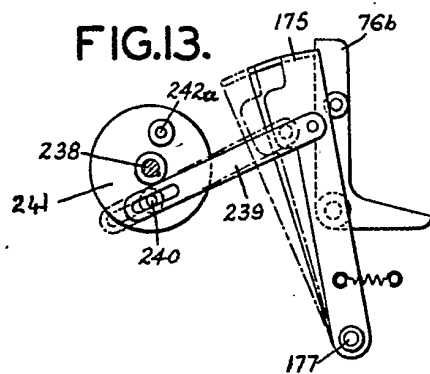


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24 SHEETS

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SHEETS 9 & 10



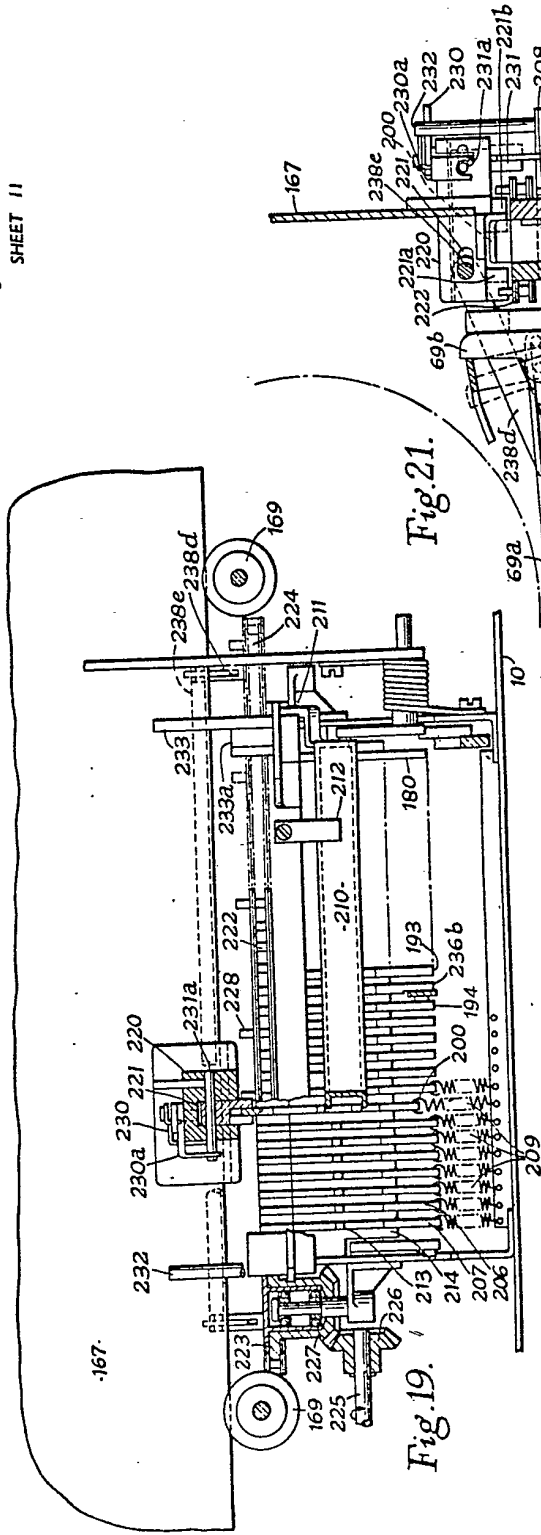
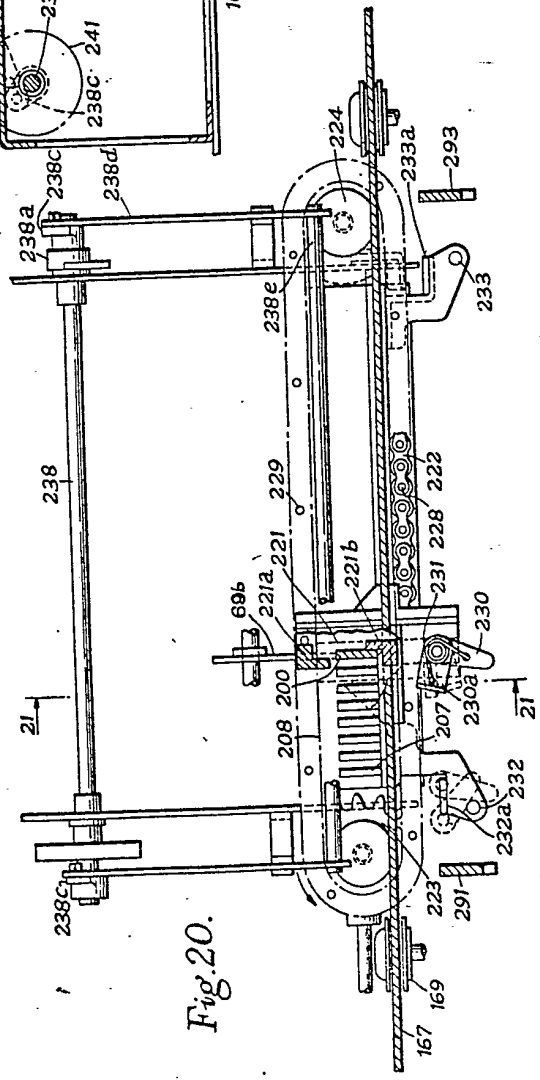
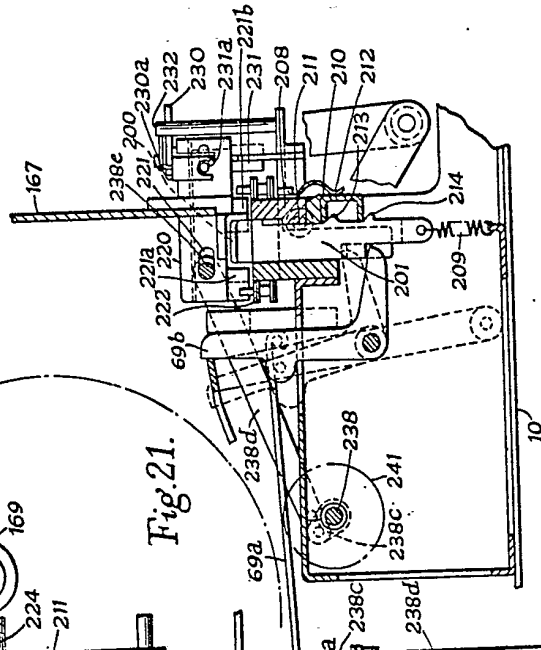
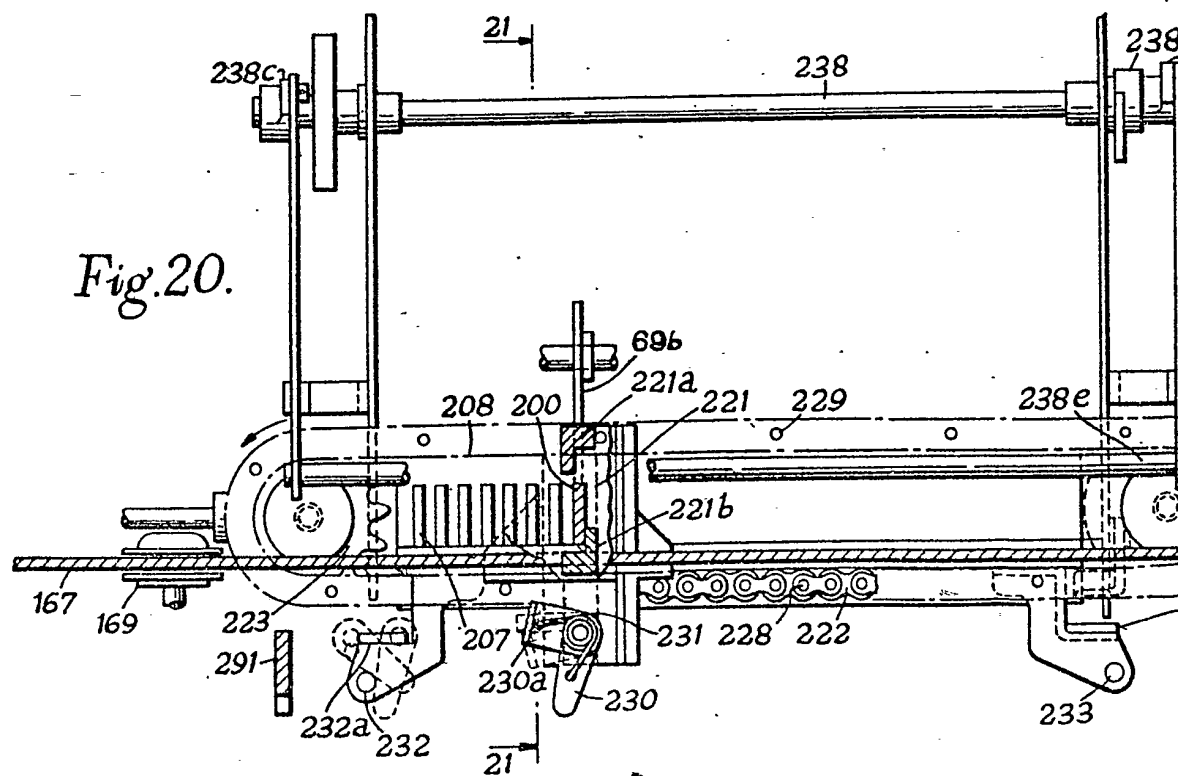
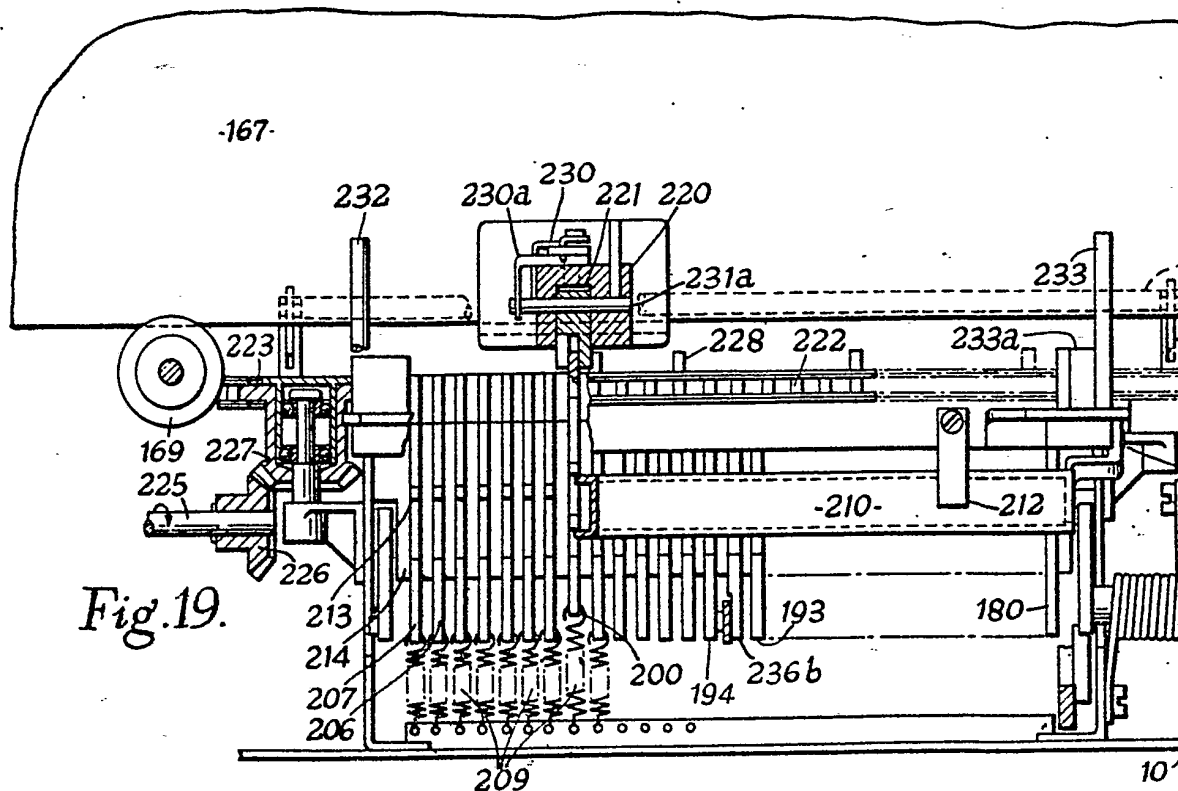


Fig. 21.





24 SHEETS

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SHEET 11

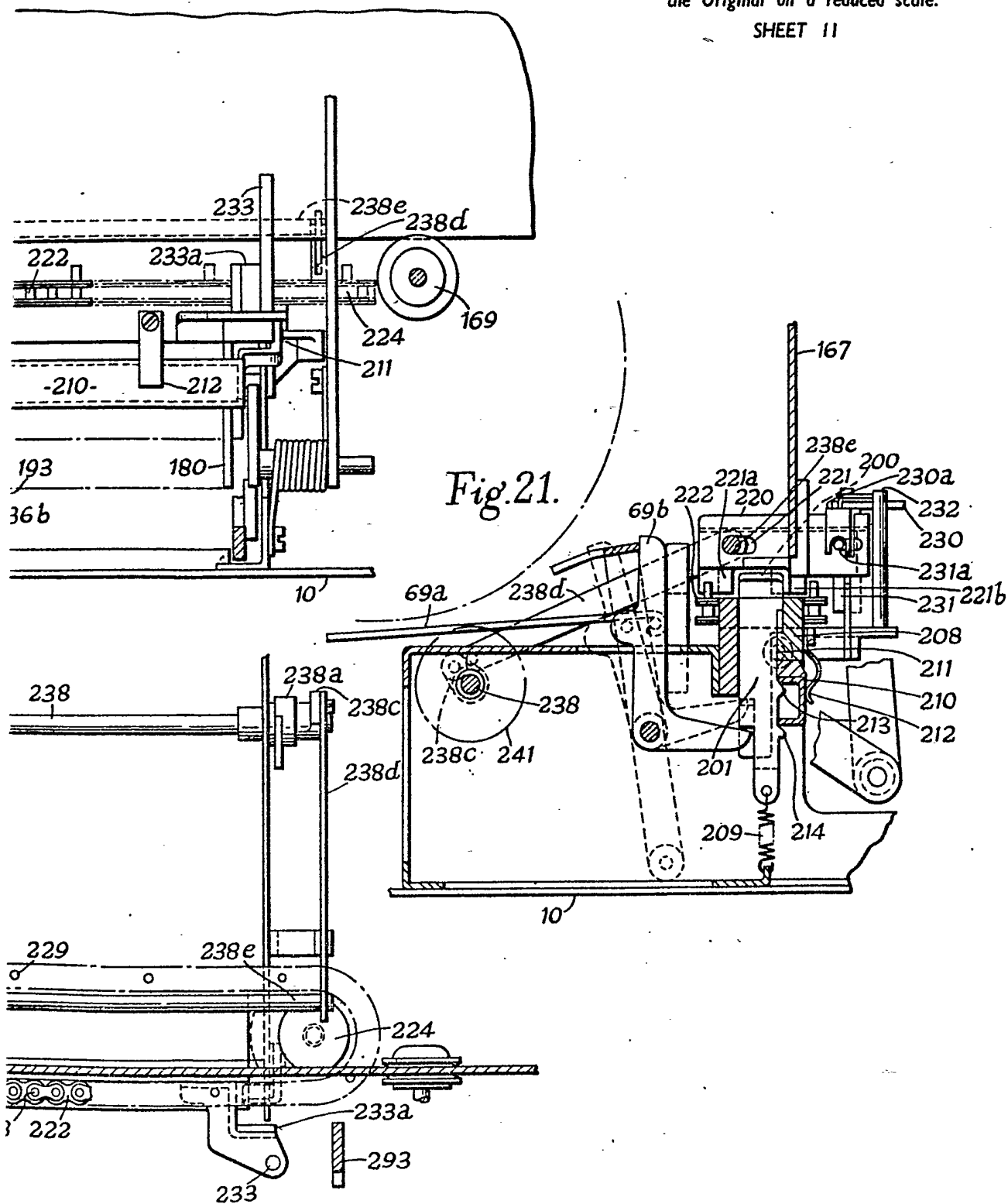


Fig.23.

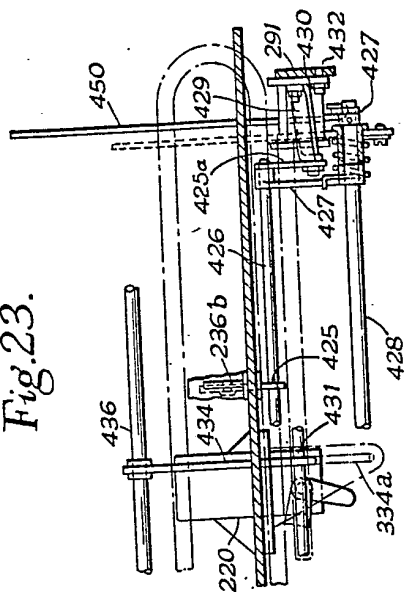


Fig.24.

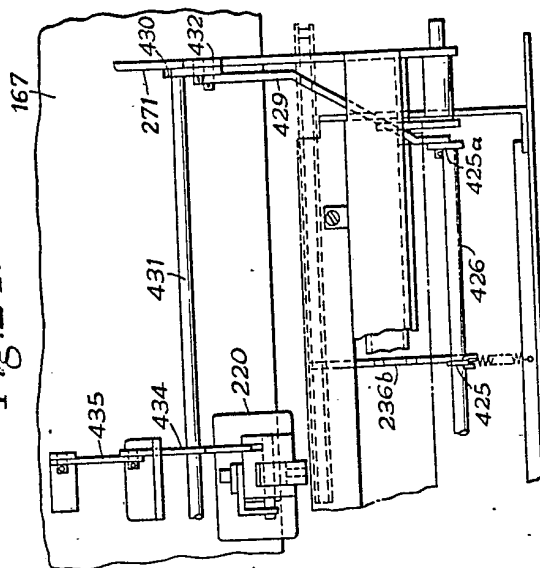


Fig.22.

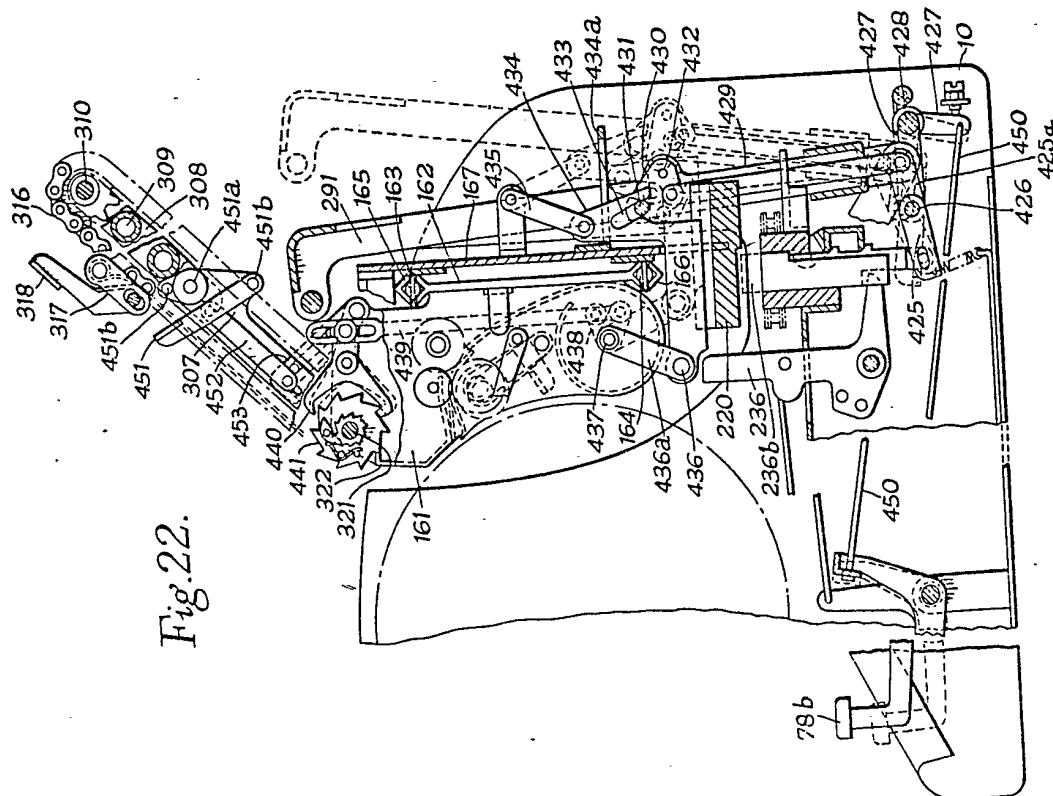


Fig.22.

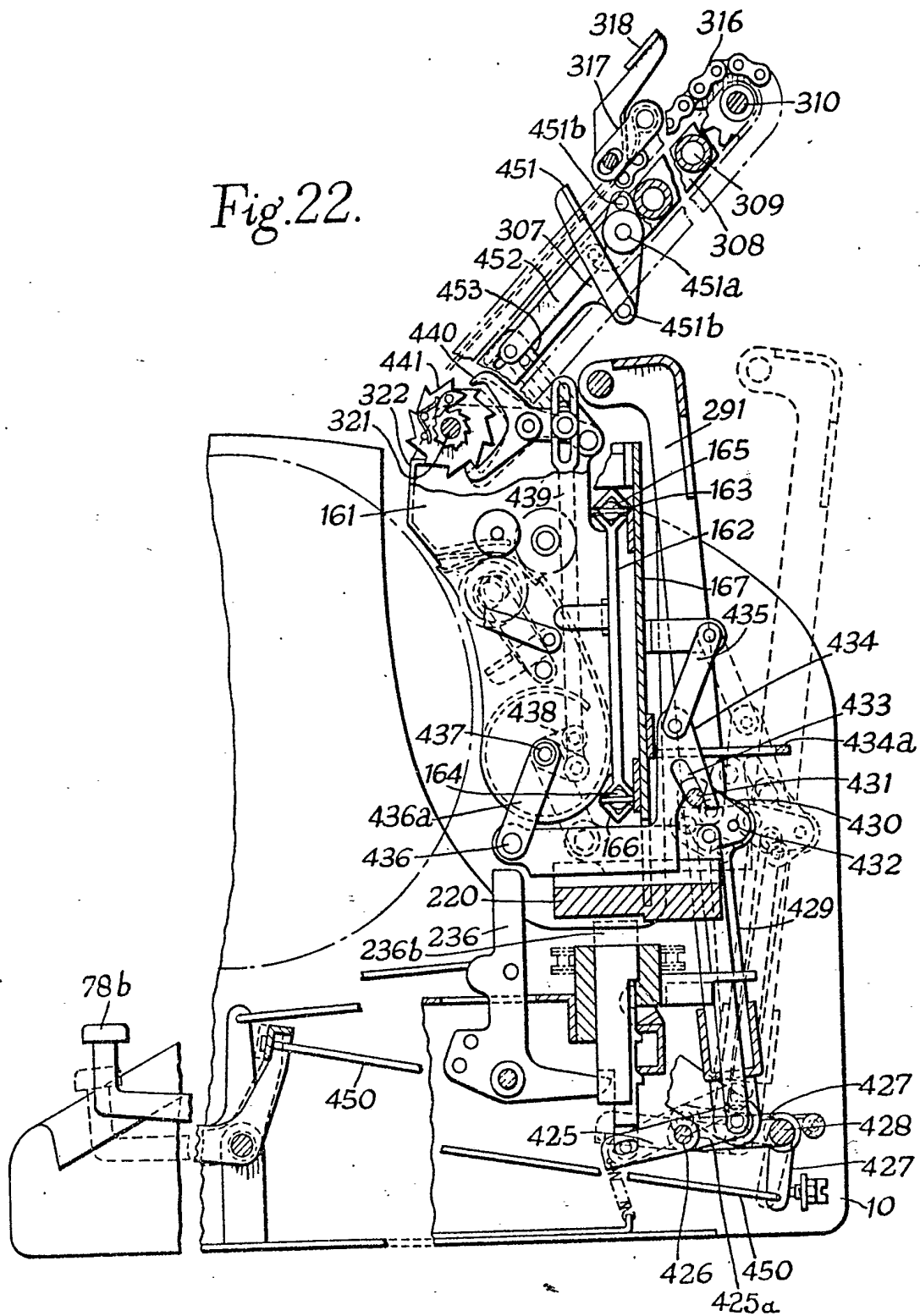


Fig.23.

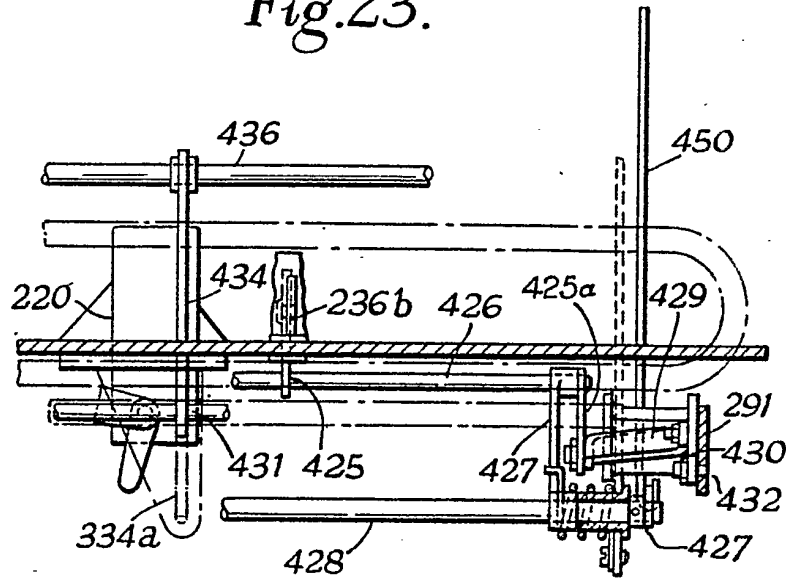
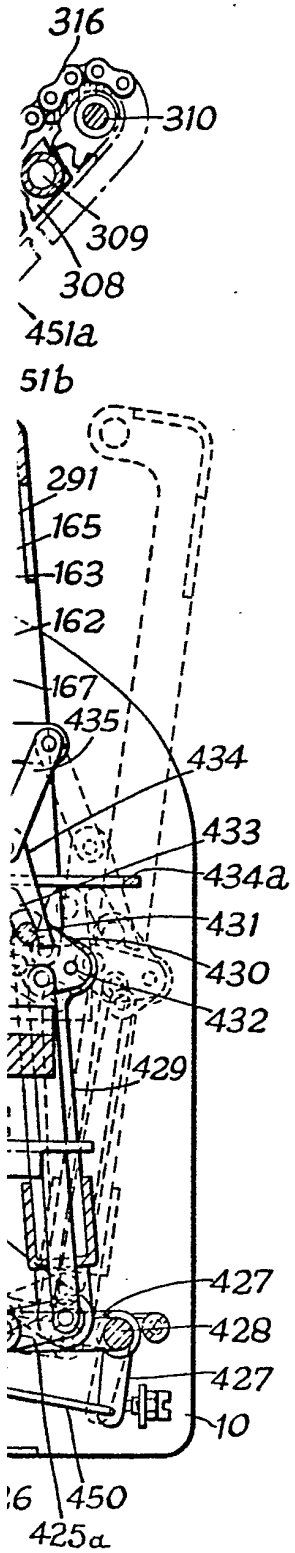
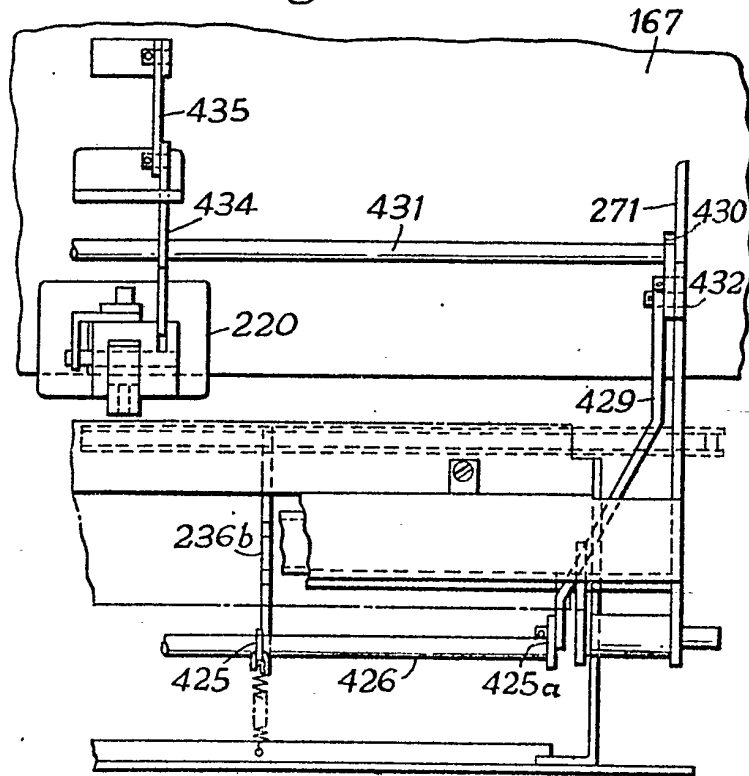


Fig.24.



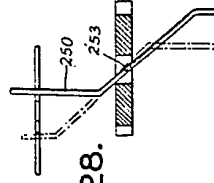
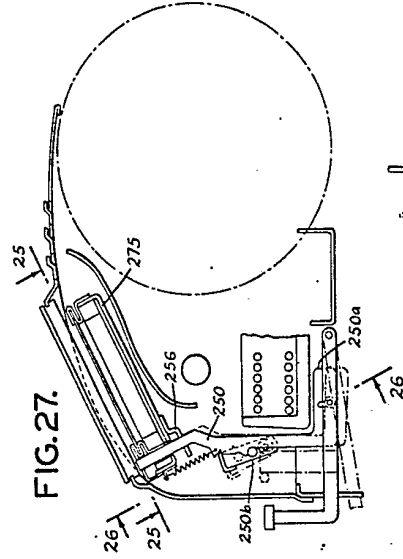


FIG. 28.

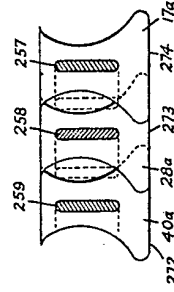


FIG. 29.

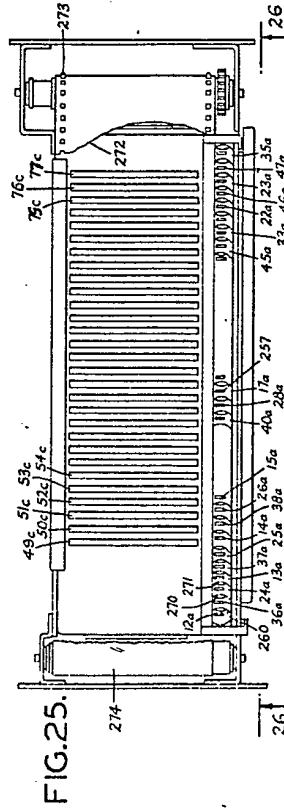


FIG. 25.

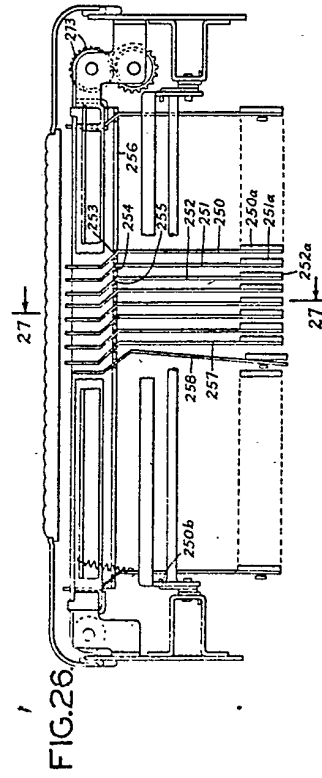
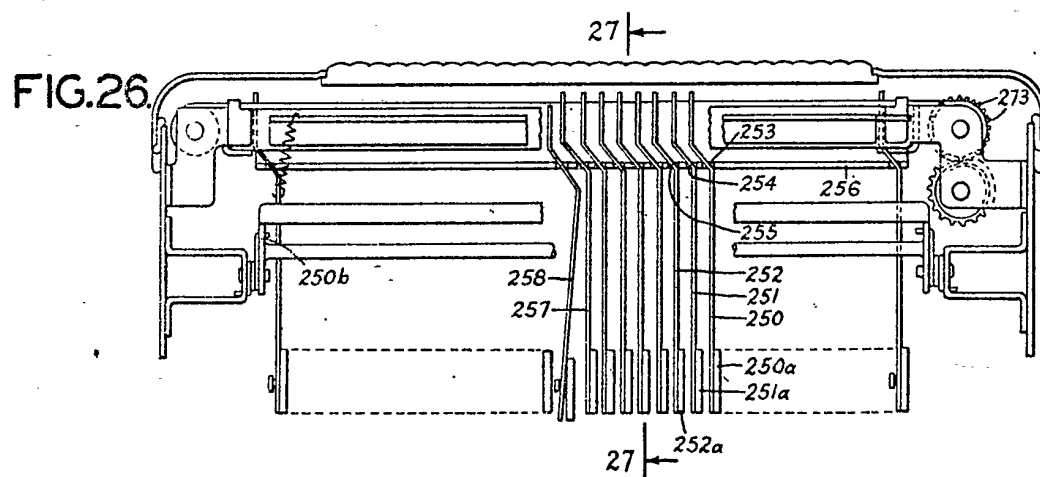
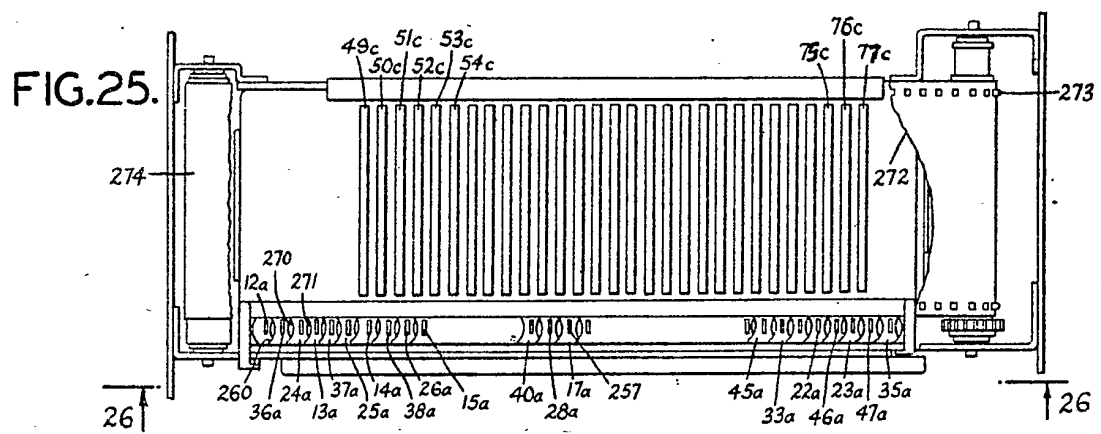


FIG. 26.



711,462

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24 SHEETS

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SHEETS 14 & 15

FIG. 27.

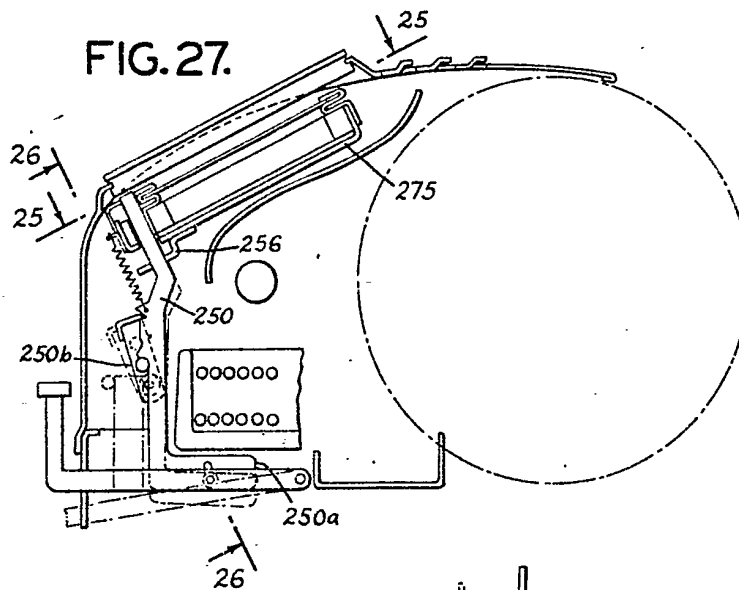


FIG. 28.

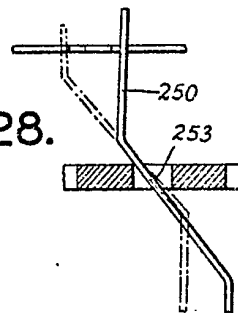
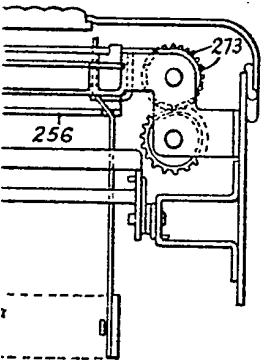
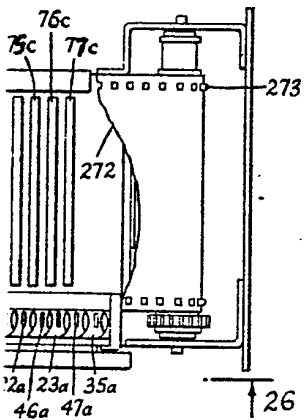
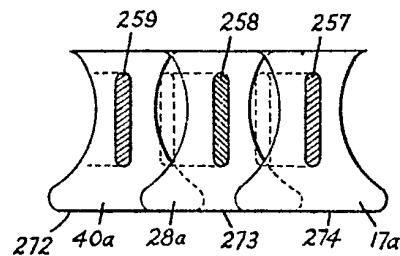


FIG. 29.



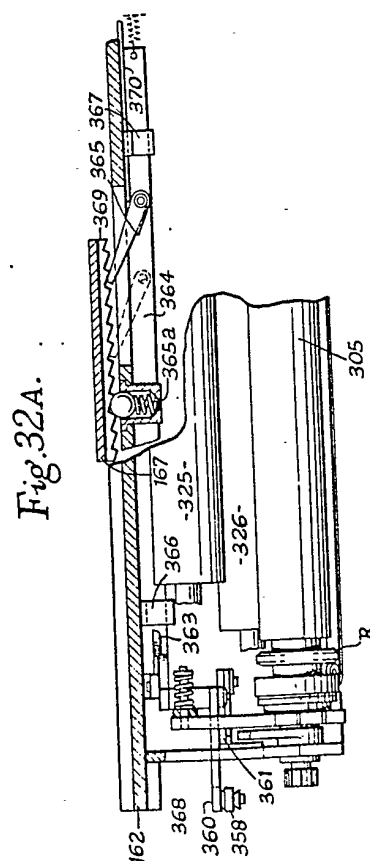
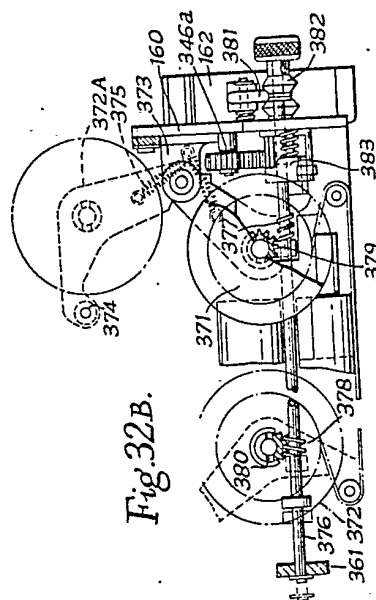
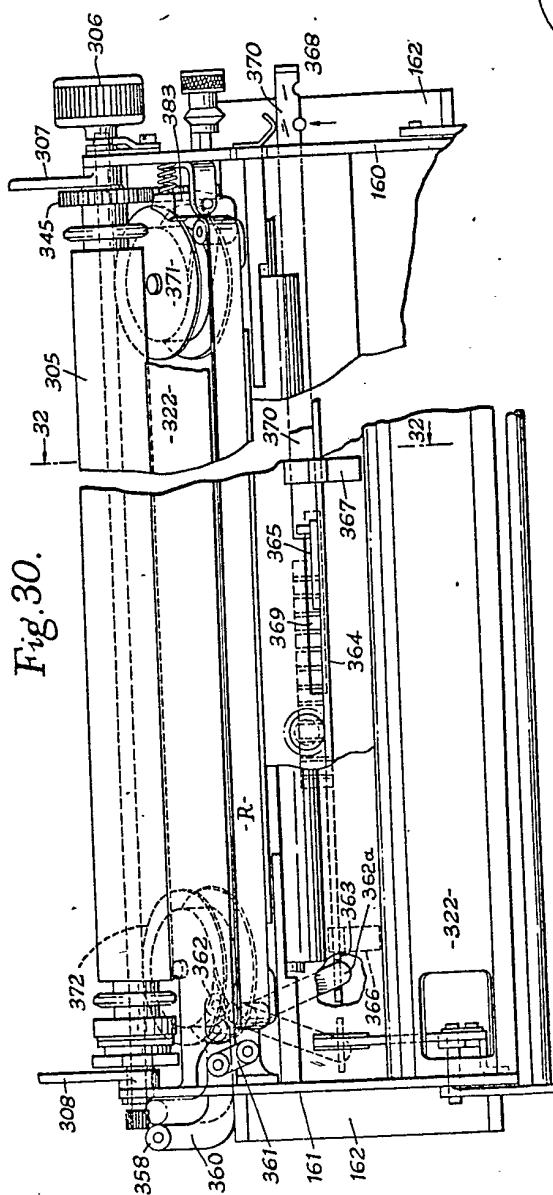


Fig. 30.

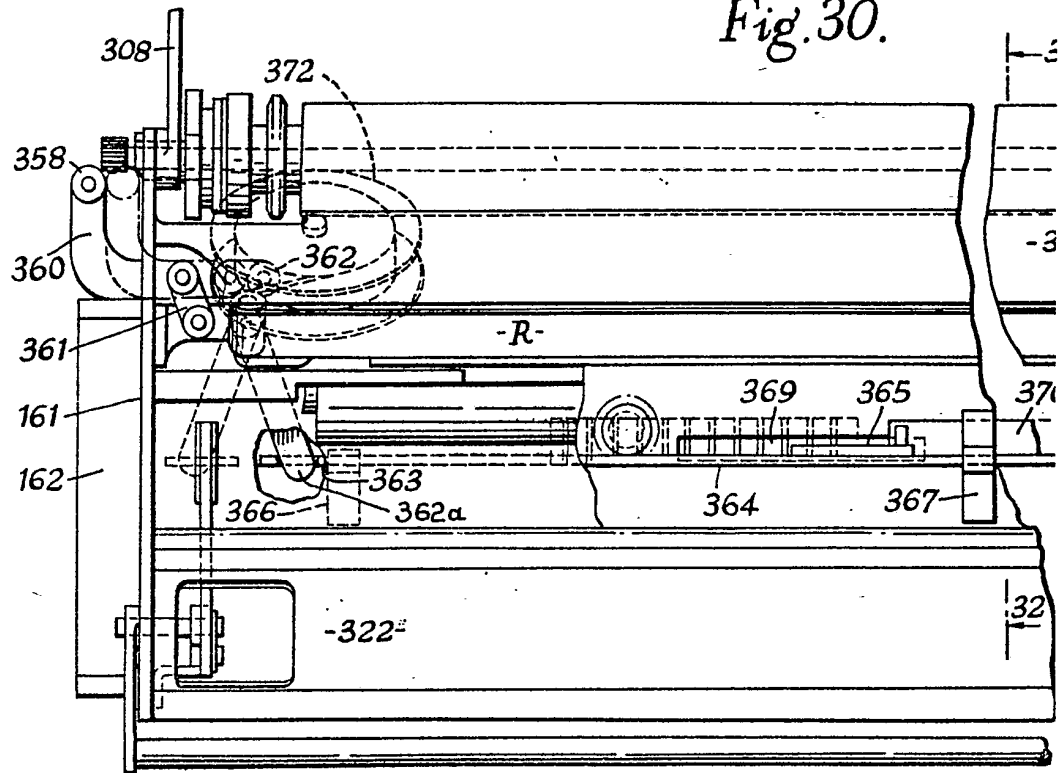
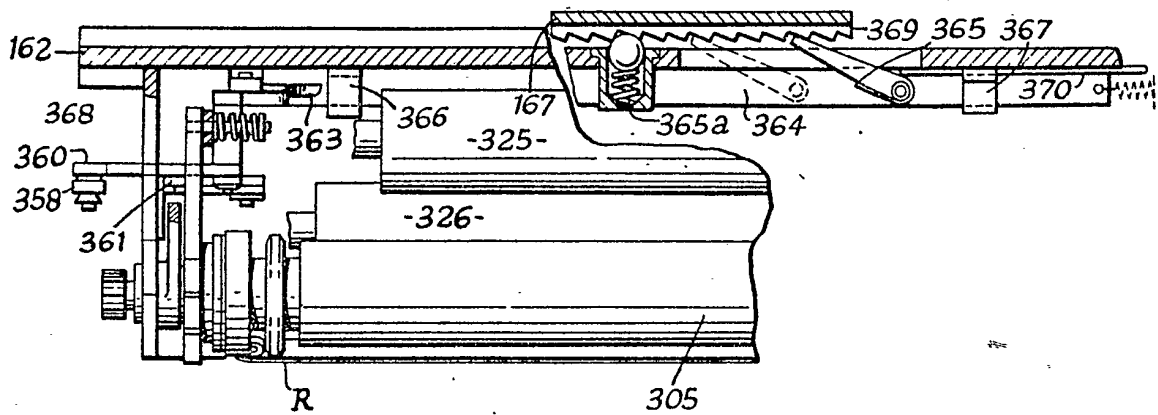


Fig. 32A.



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Fig. 30.

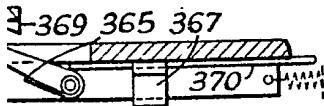
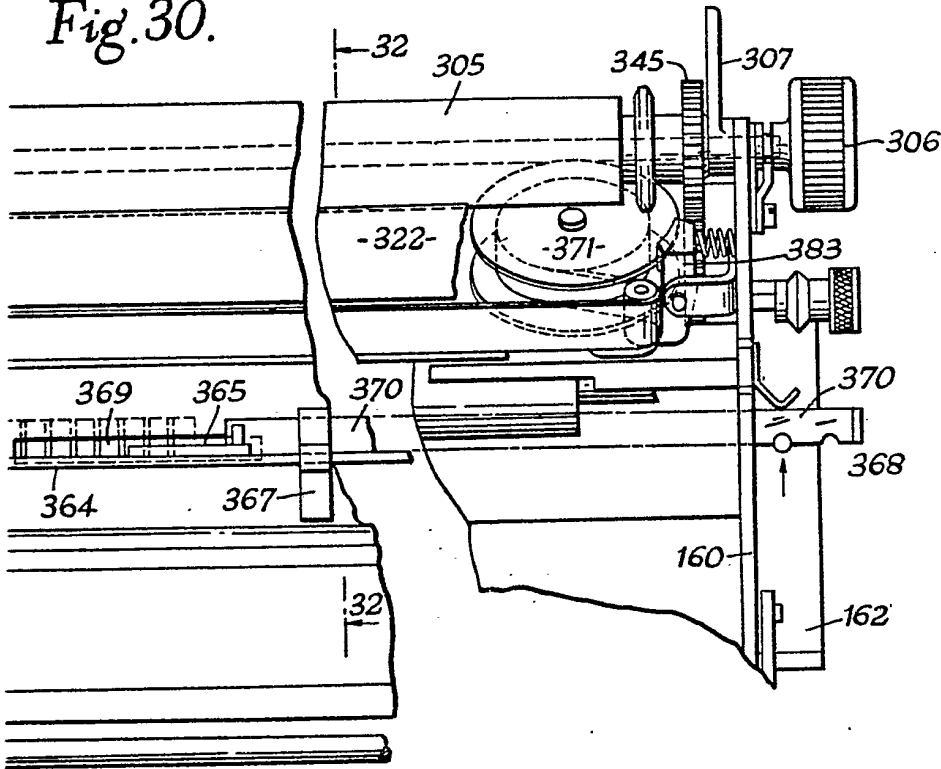
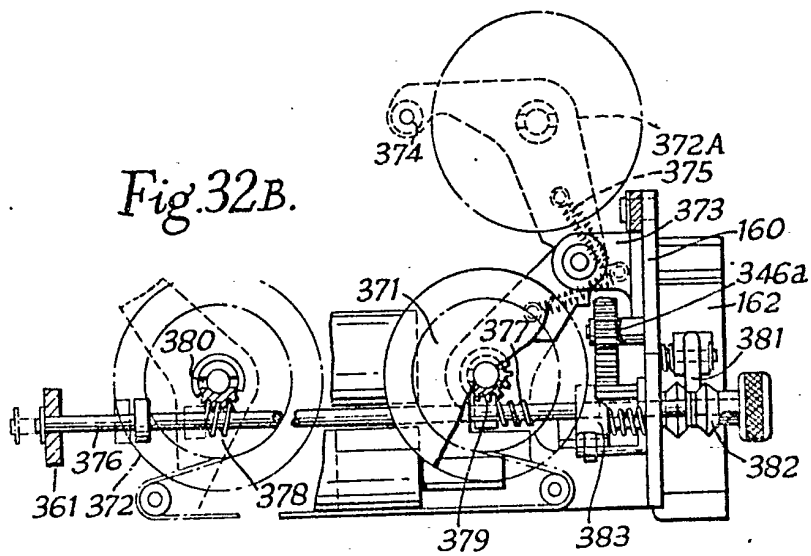


Fig. 32B.



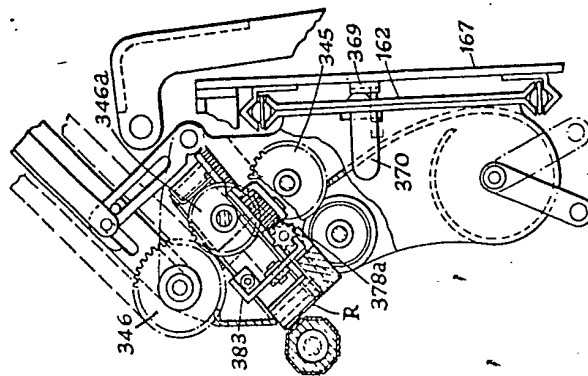


Fig. 31.

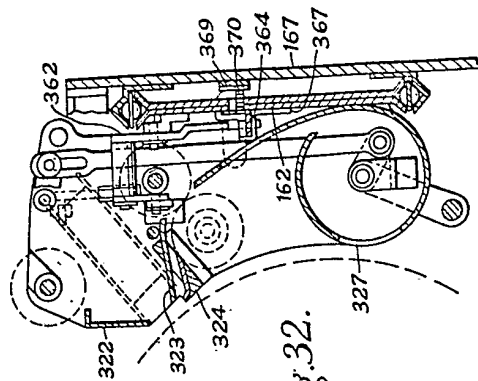


Fig. 32.

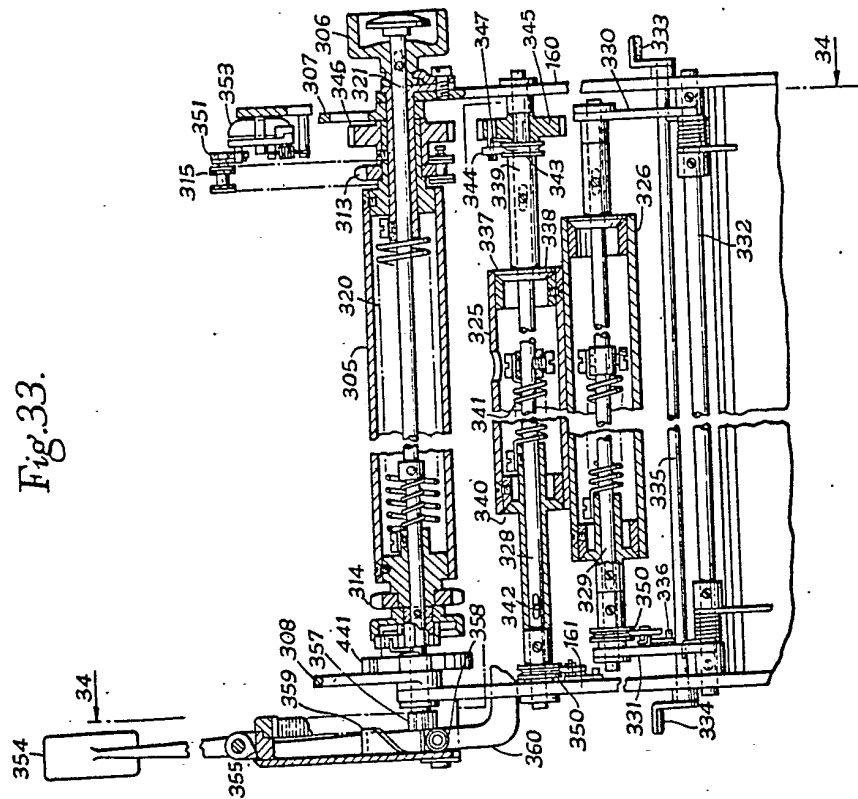


Fig. 33.

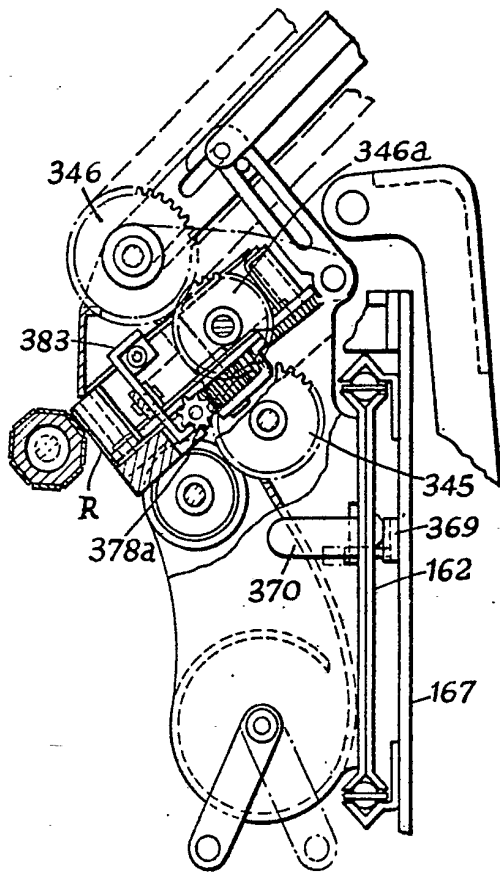


Fig. 31.

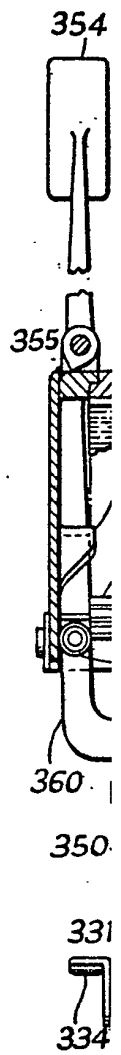
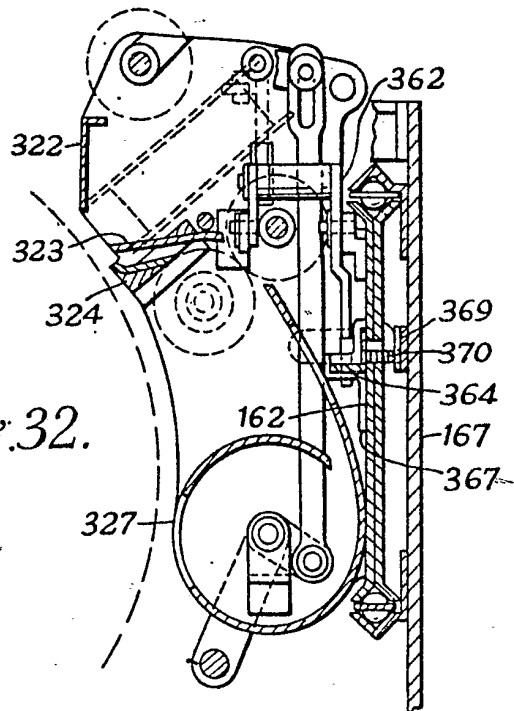


Fig. 32.



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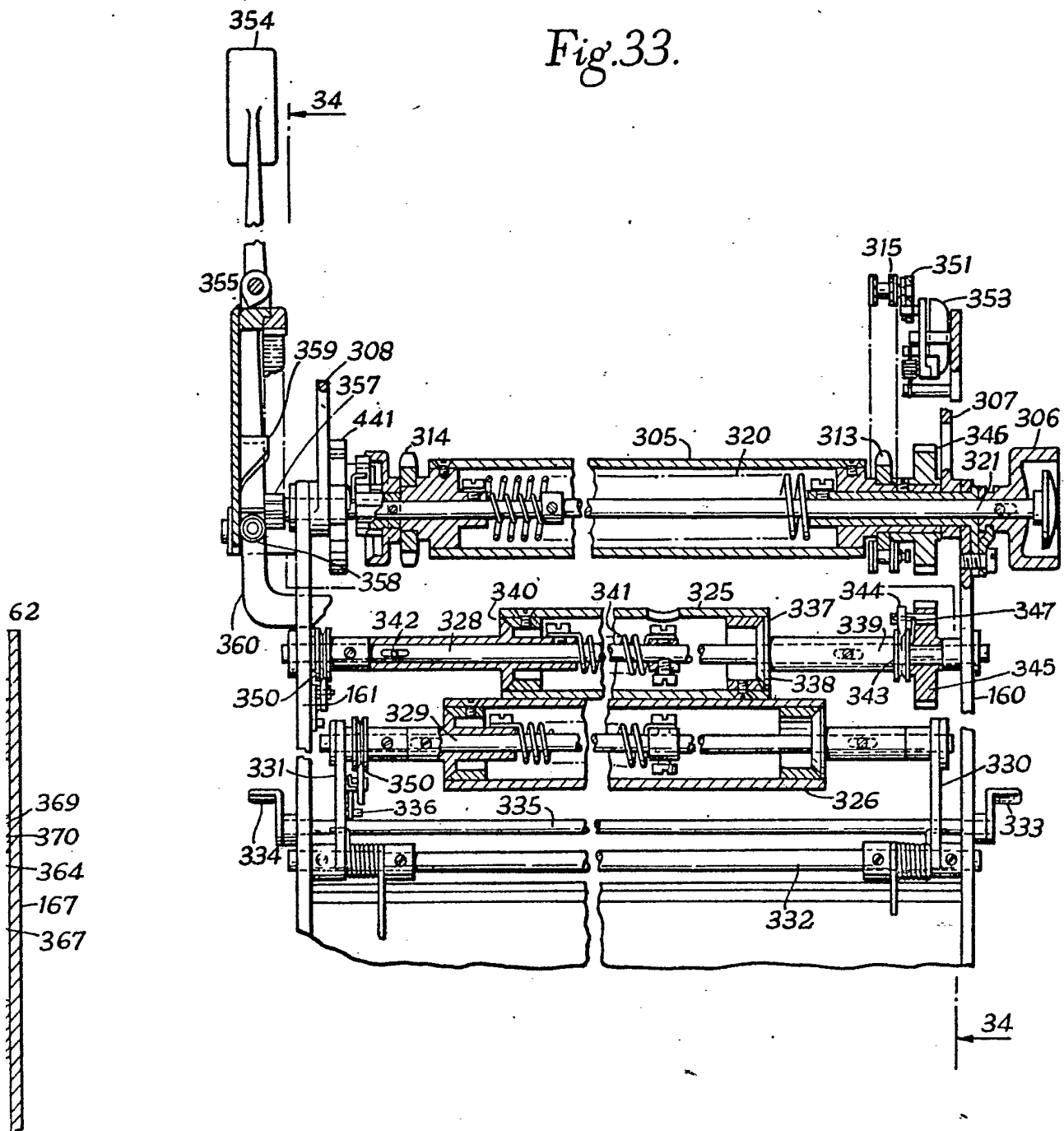
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24 SHEETS

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Fig.33.



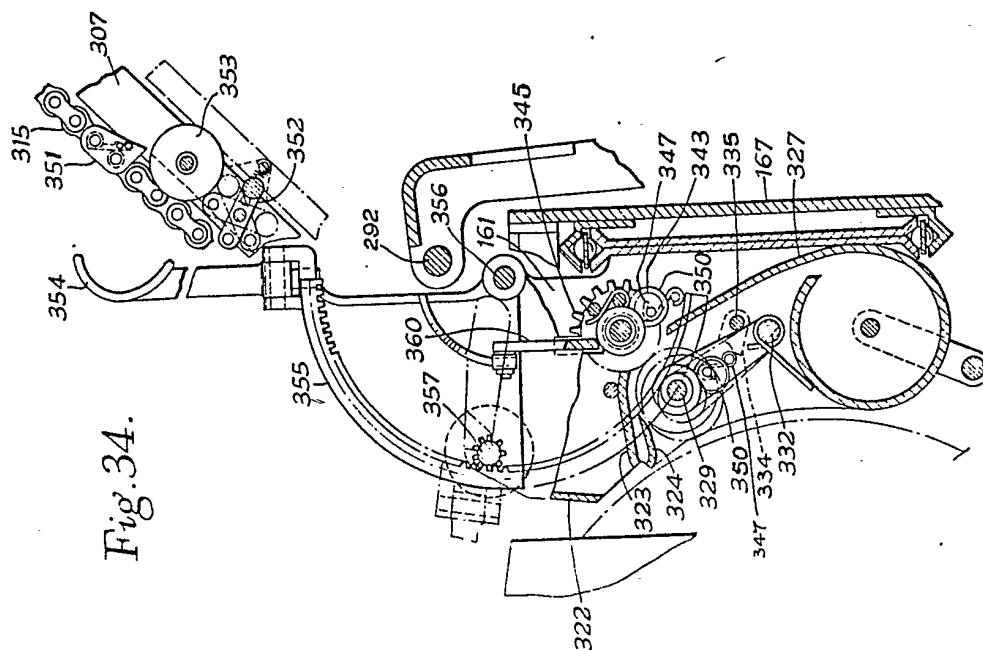


Fig. 34.

FIG. 42.

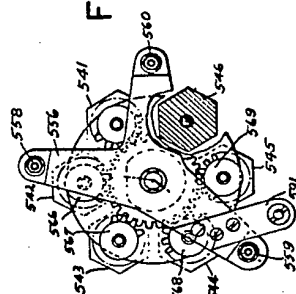
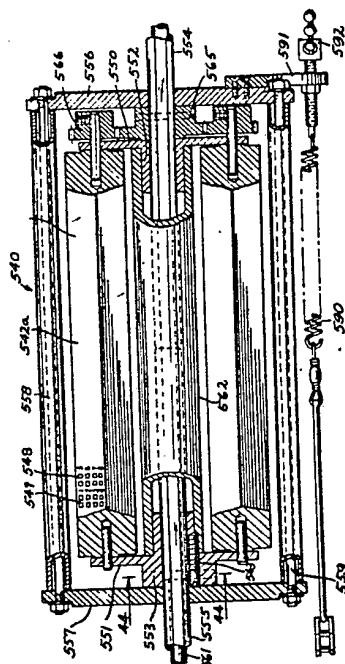


FIG. 43.

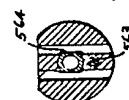
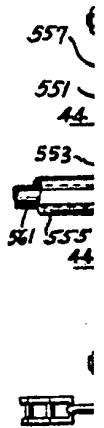
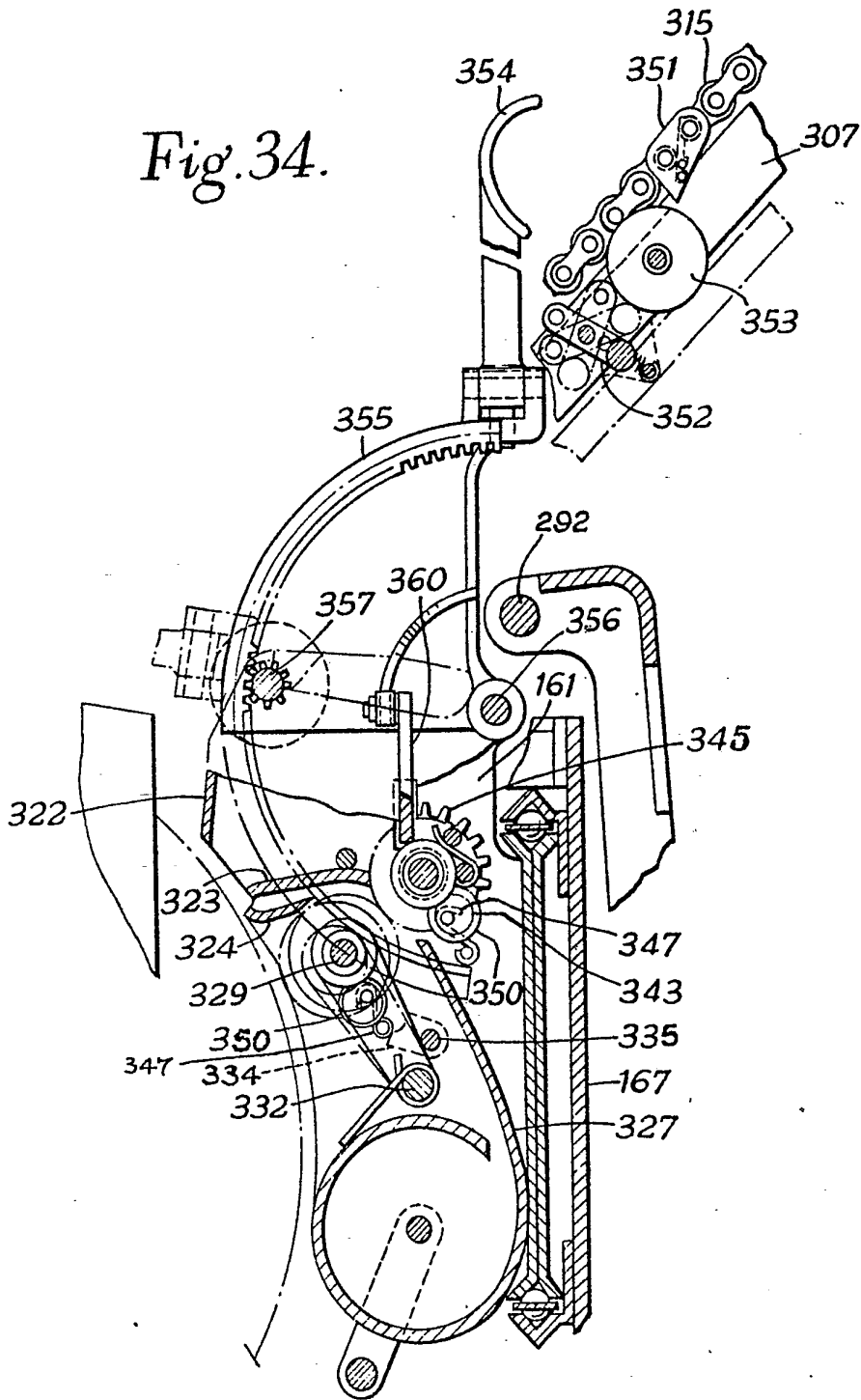


FIG. 44.

Fig. 34.



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SHEETS 19 & 23

FIG. 42.

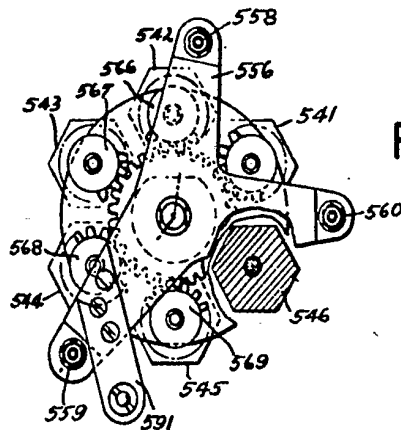
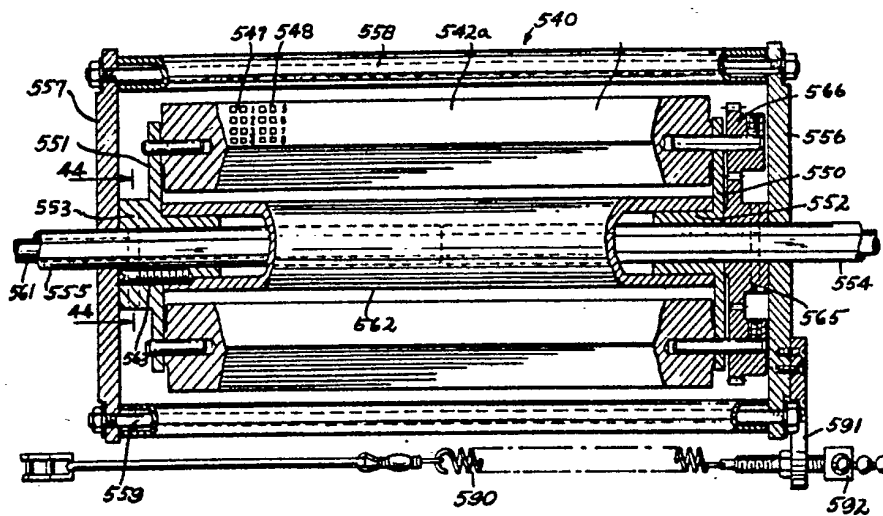


FIG. 43.

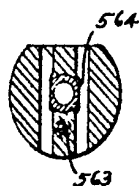
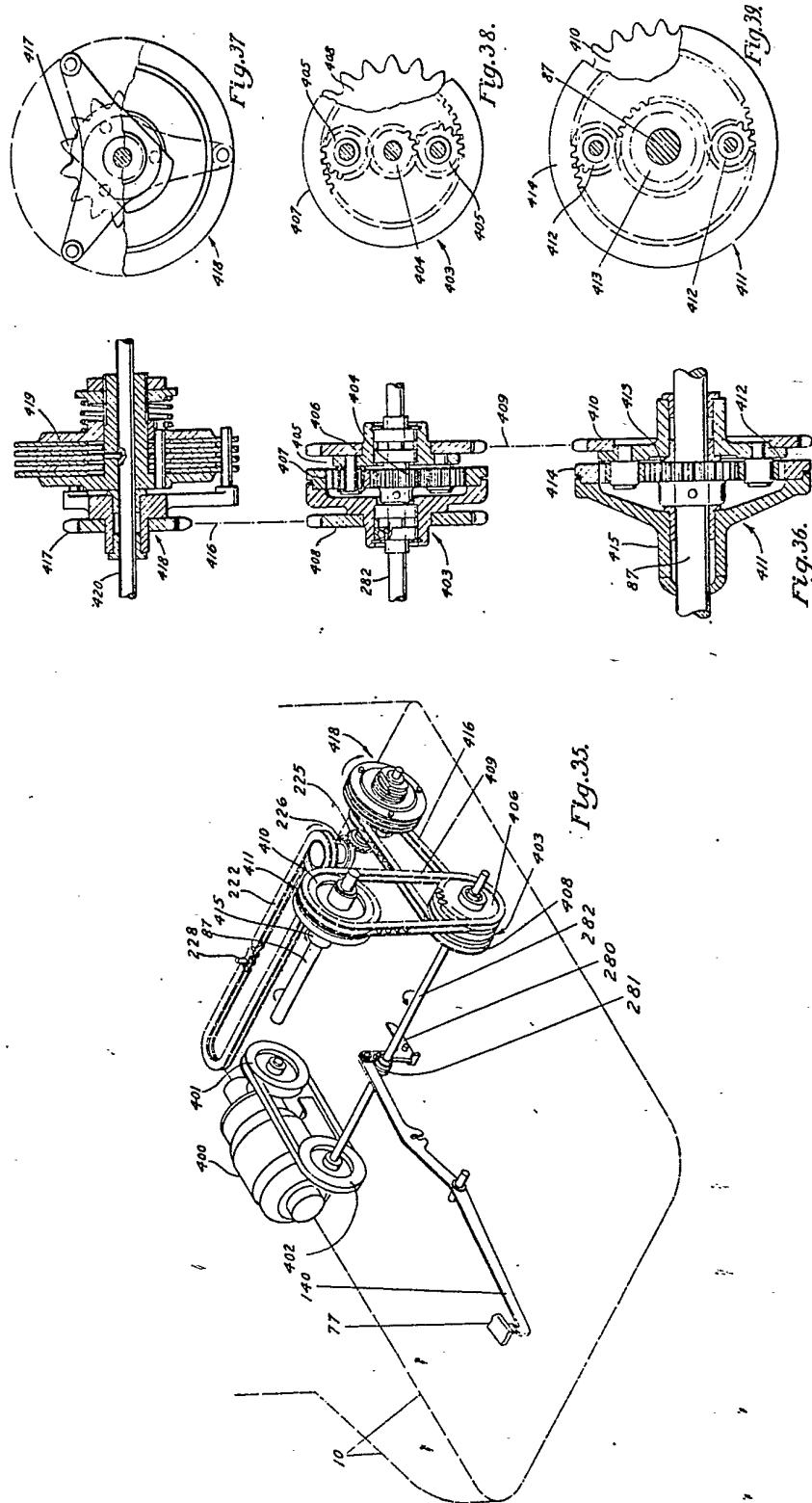
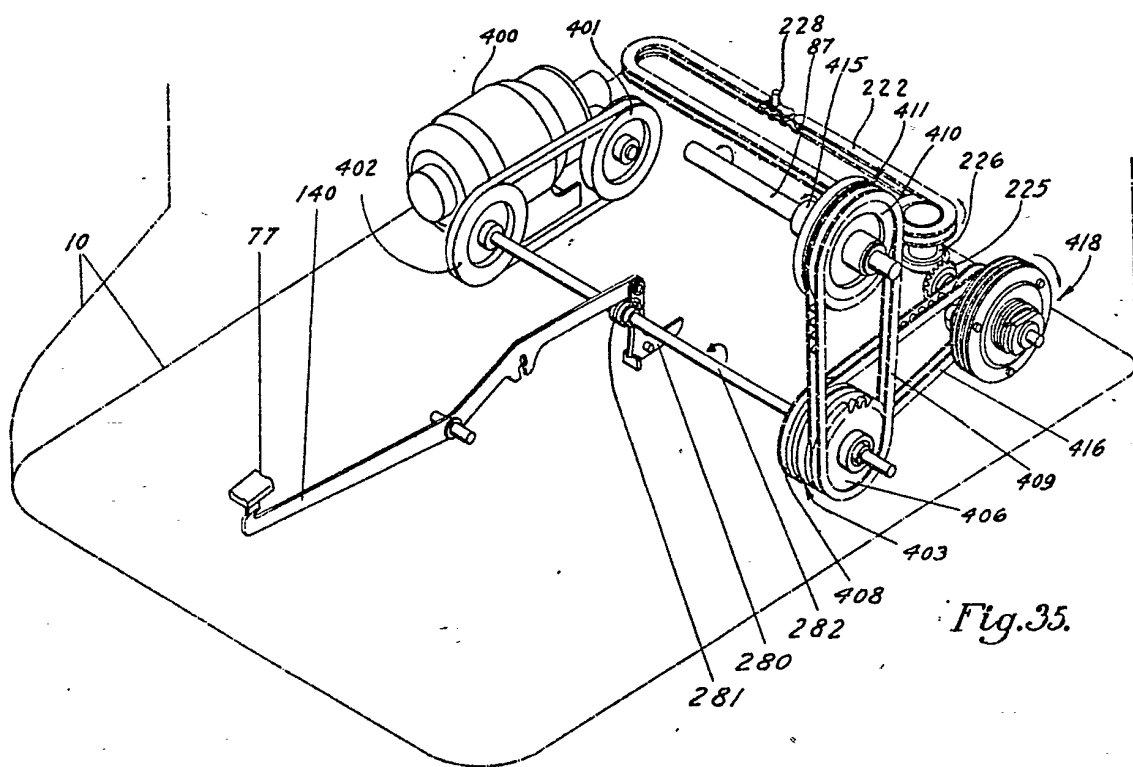


FIG. 44.





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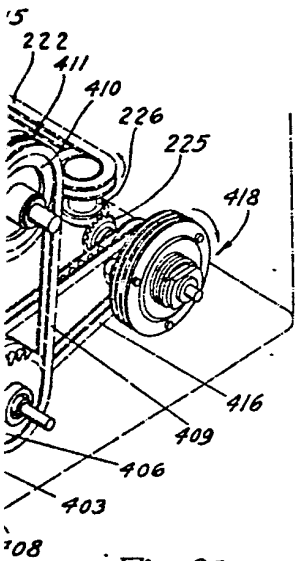


Fig. 35.

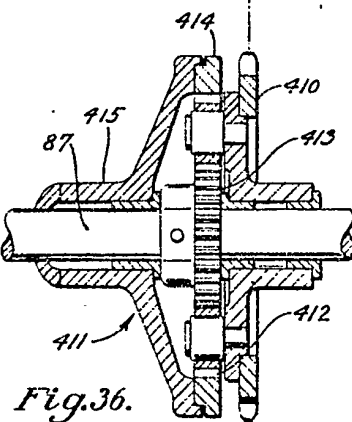
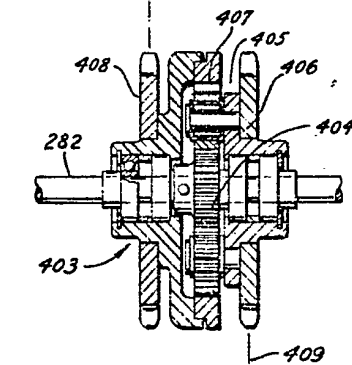
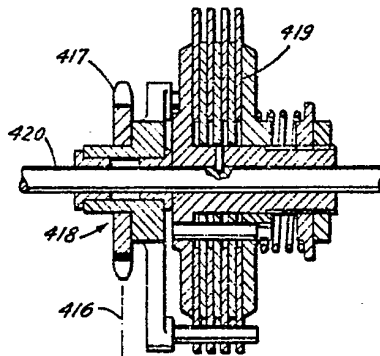


Fig. 36.

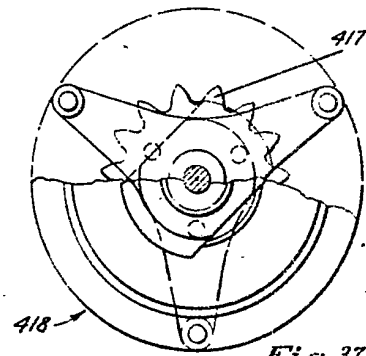


Fig. 37

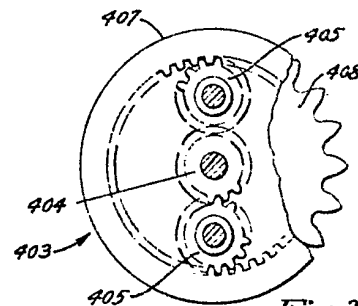


Fig. 38.

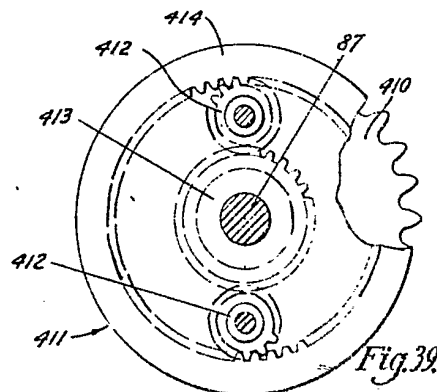


Fig. 39.

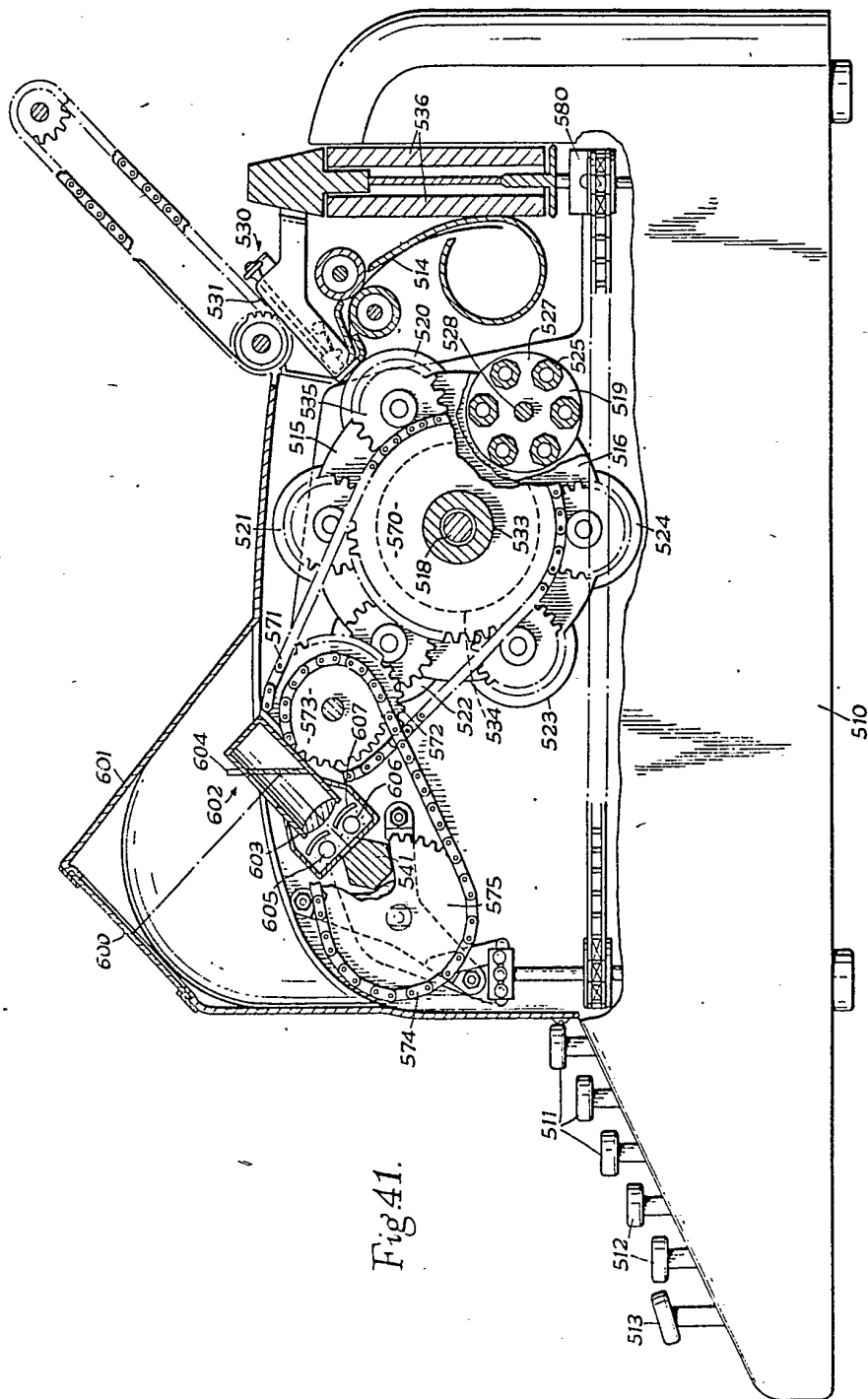
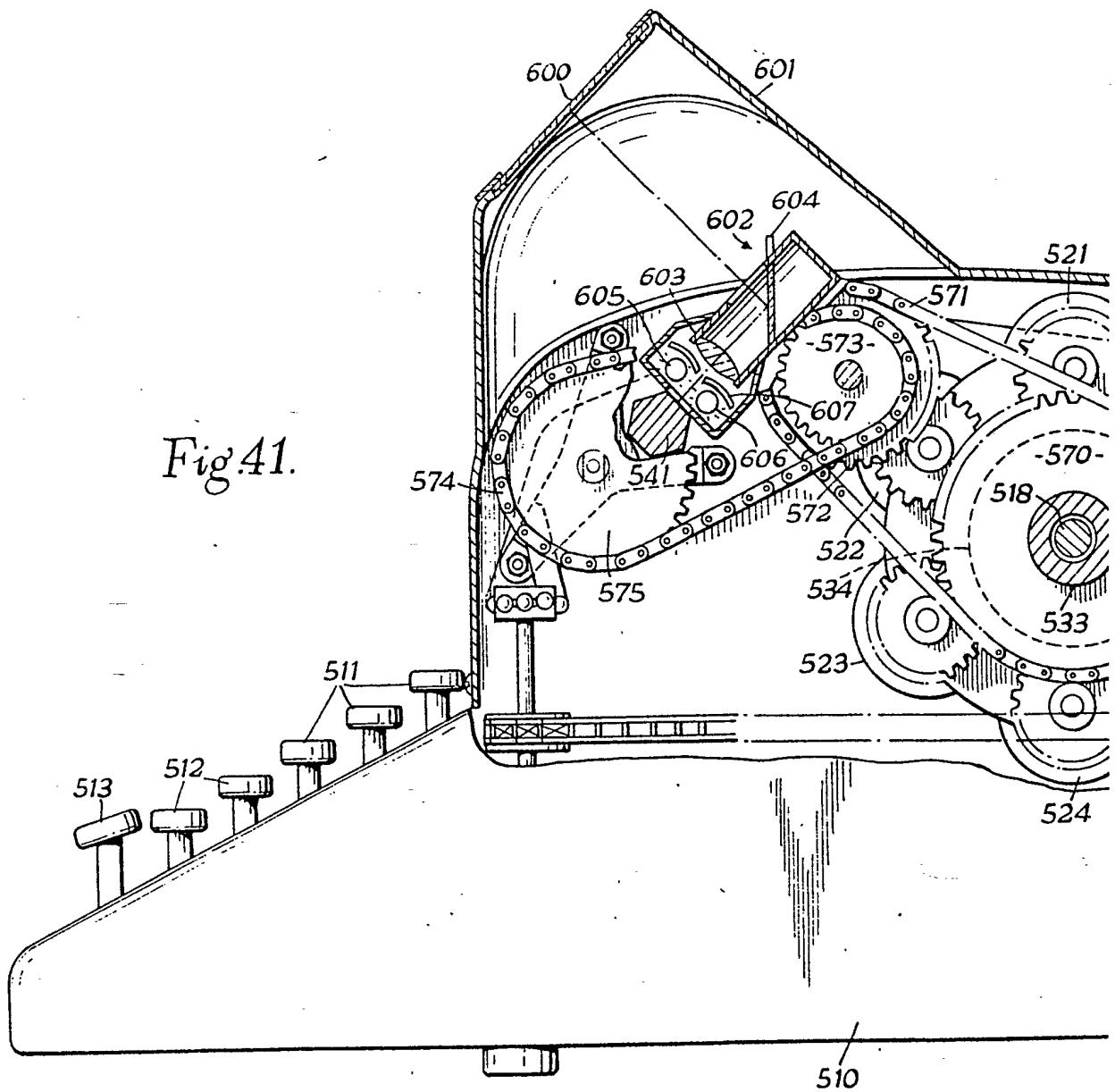


Fig. 41.



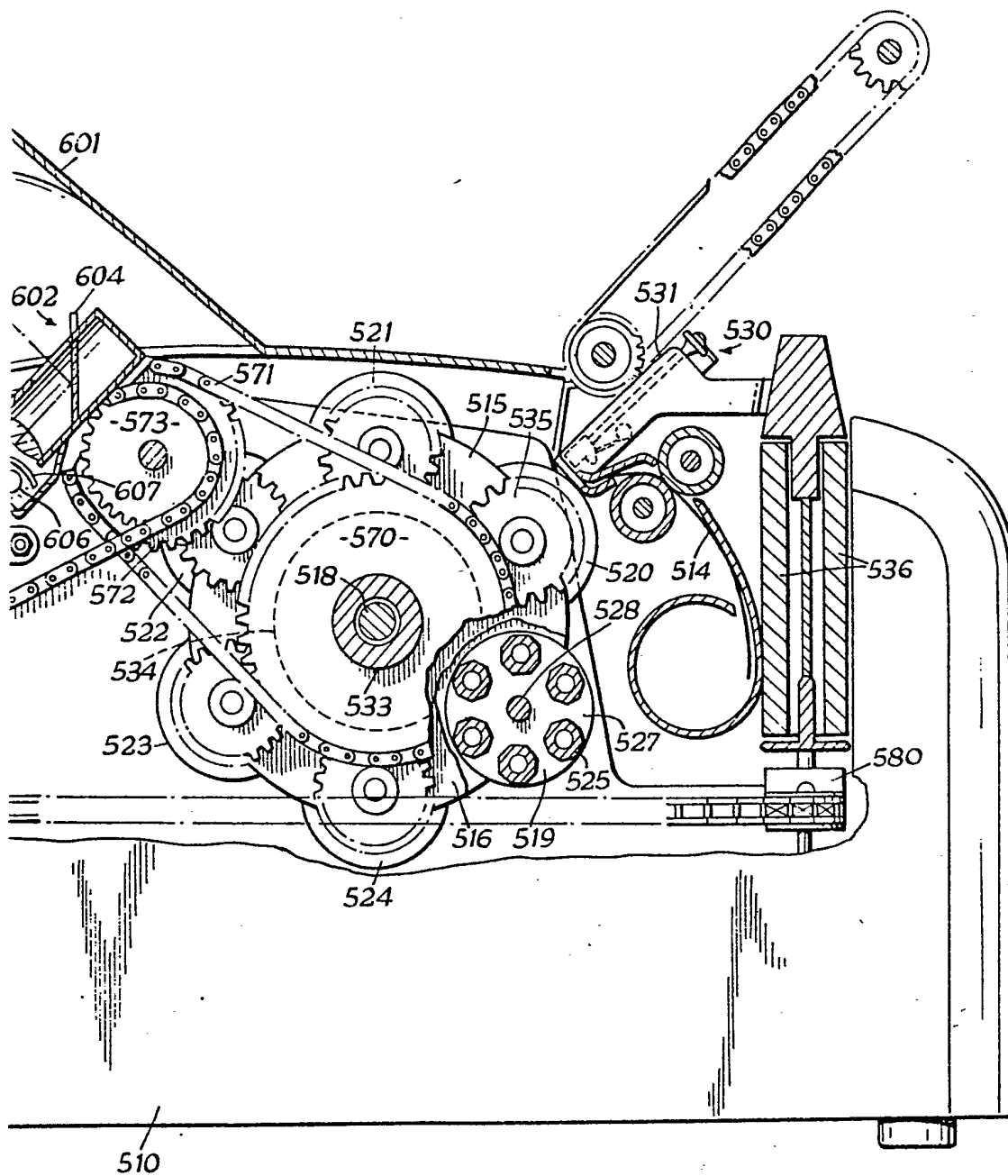
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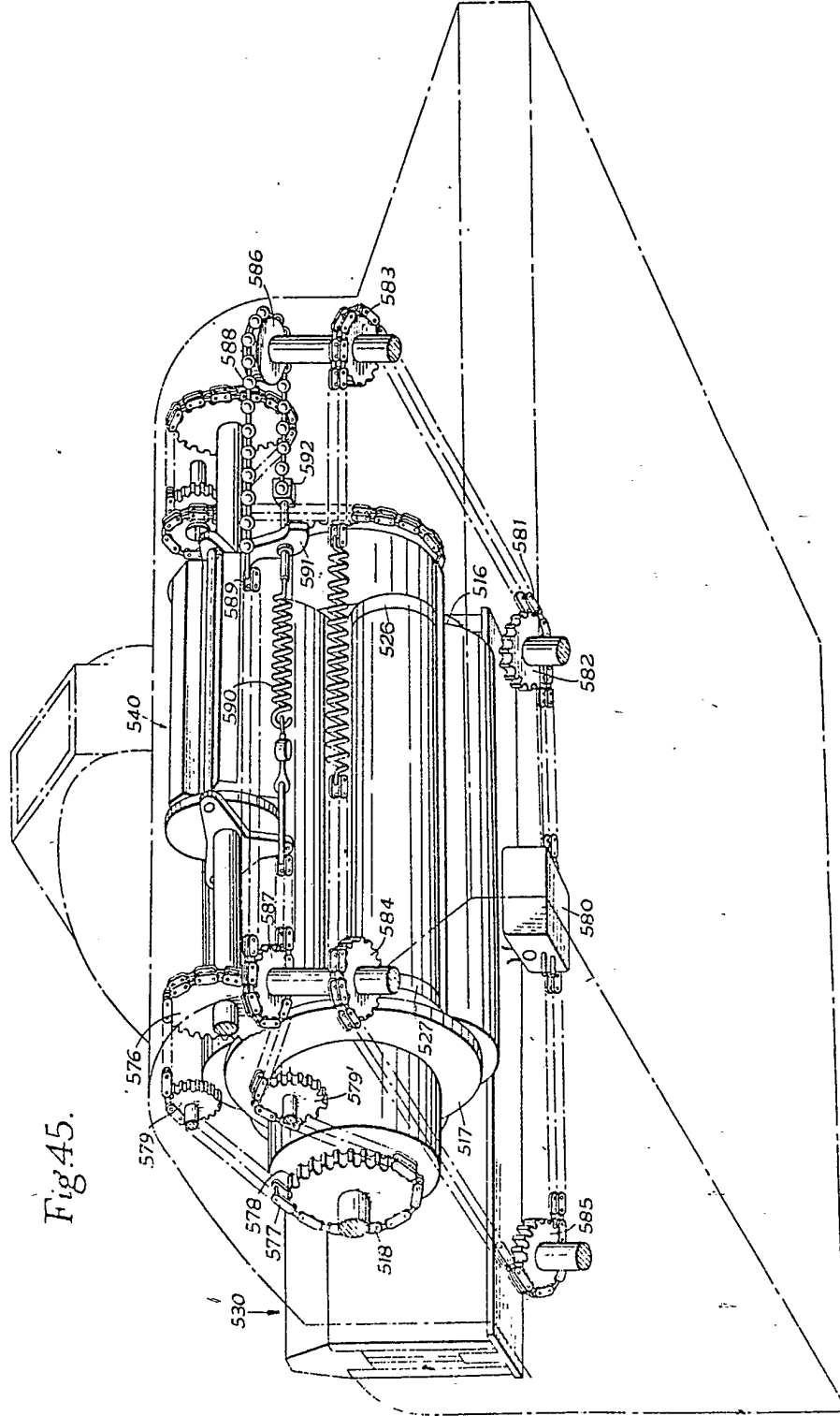
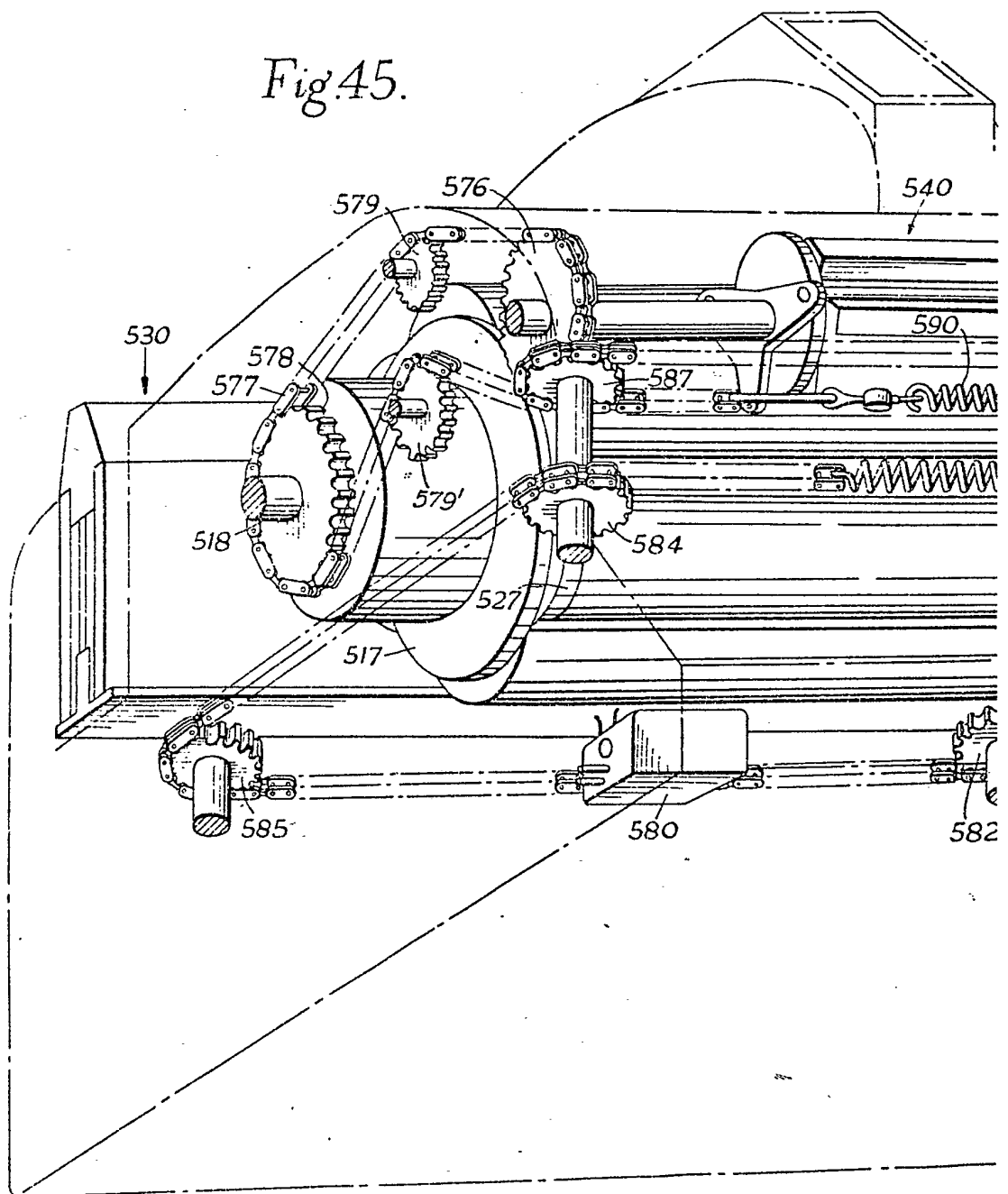


Fig.45.



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SHEET 24

