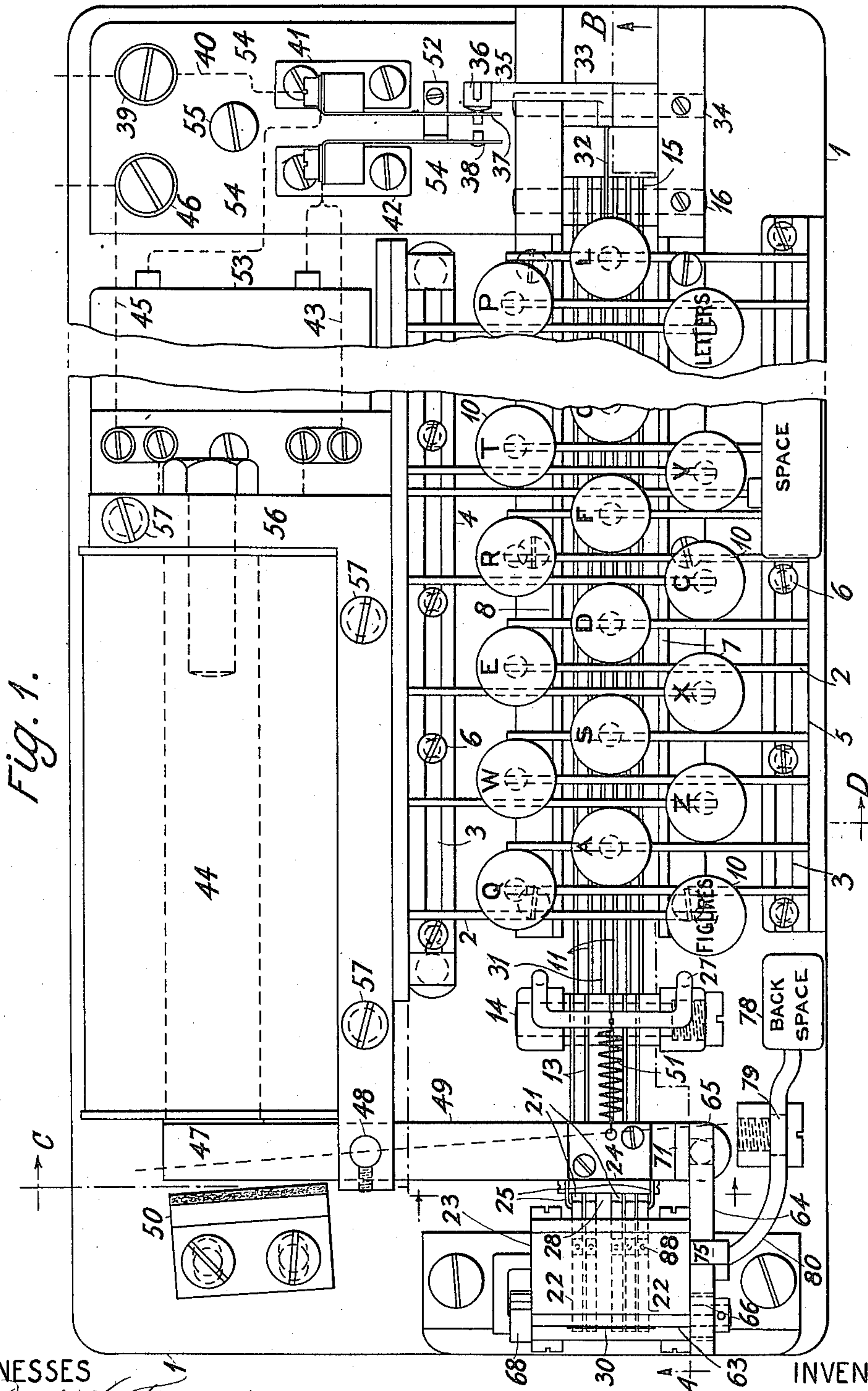


D. MURRAY.
KEYBOARD APPARATUS.
APPLICATION FILED NOV. 30, 1914.

1,170,556.

Patented Feb. 8, 1916.

3 SHEETS—SHEET 1.



WITNESSES

Paul H. Frank
BE Jeeley

INVENTOR

Donald Murray

BY his ATTORNEY

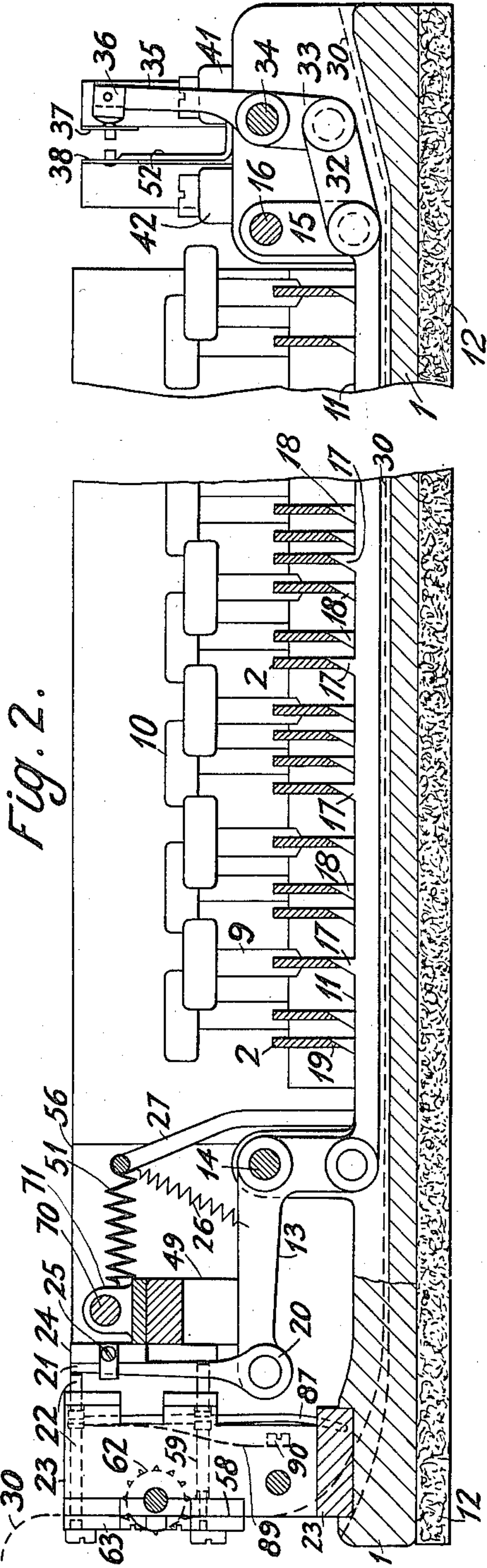
H. M. Marks

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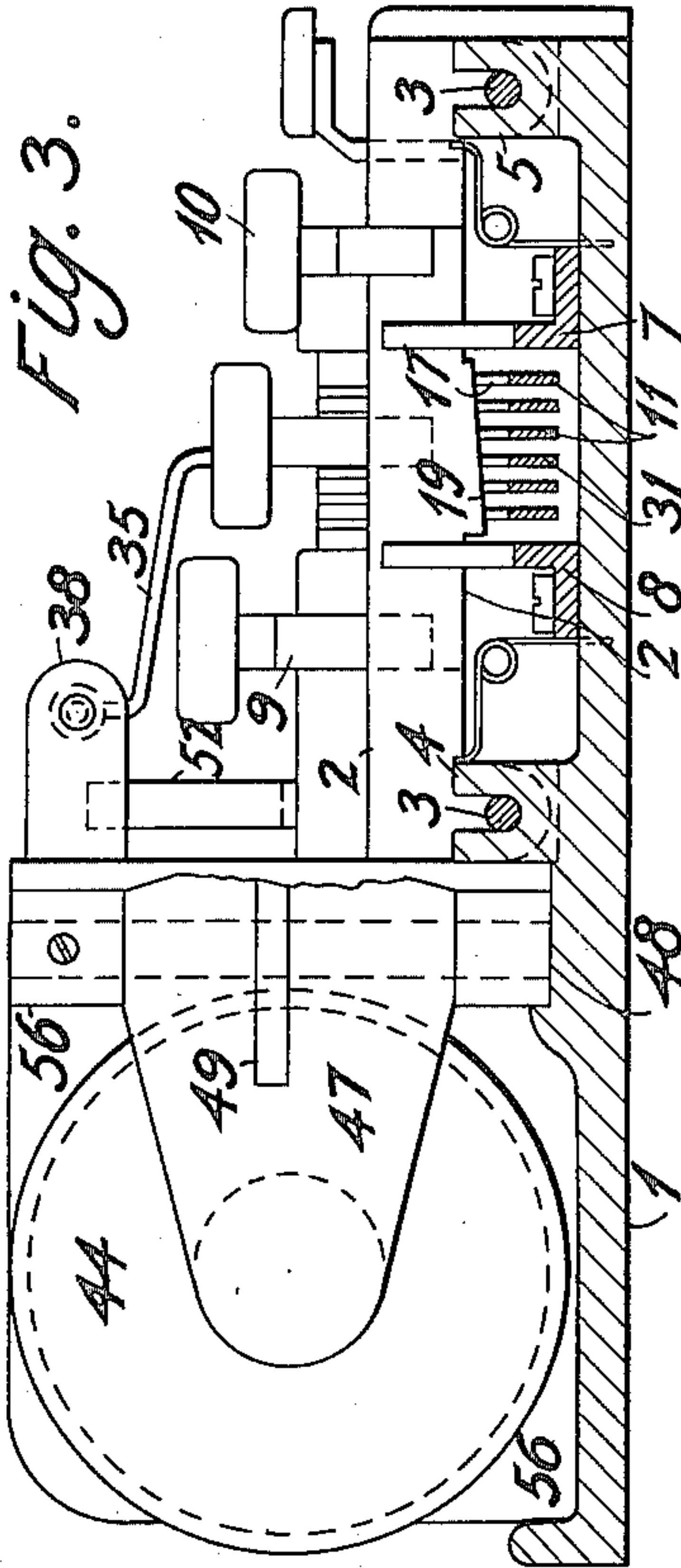
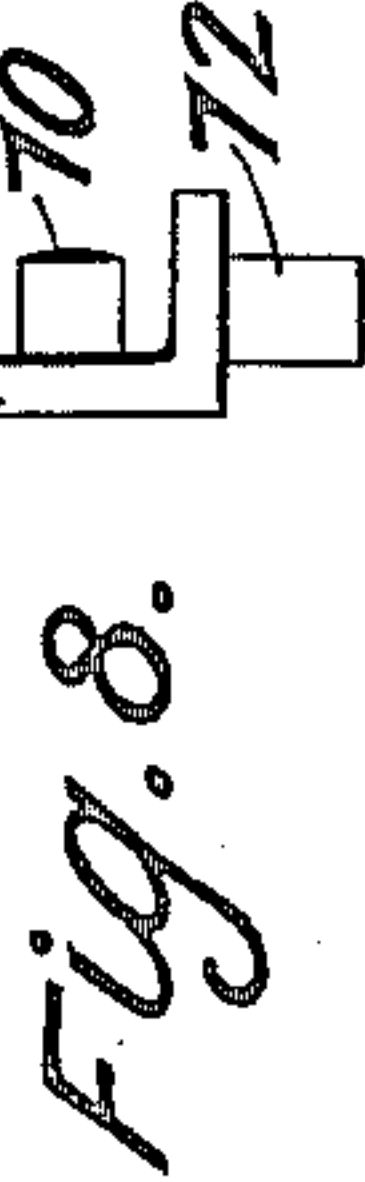
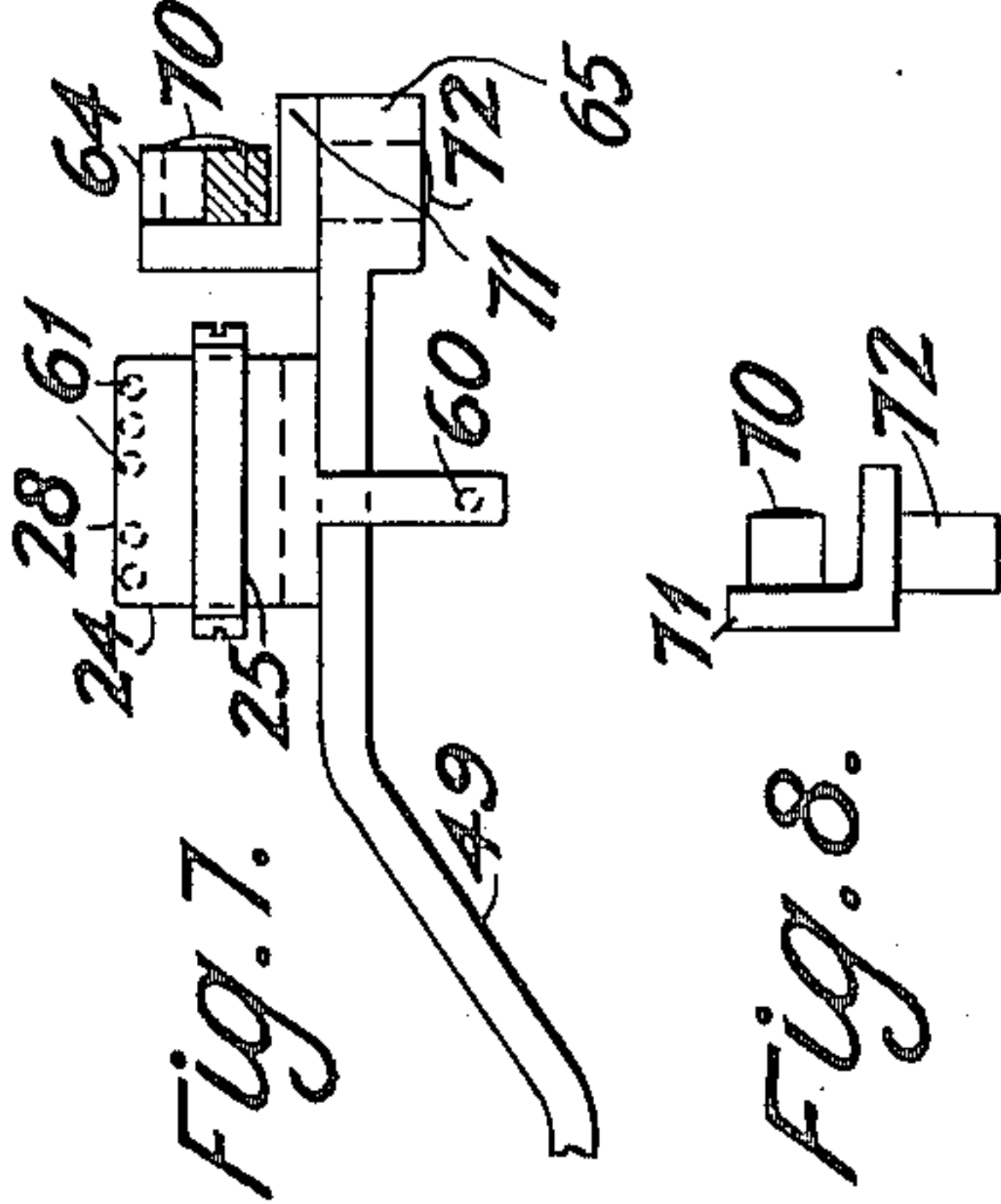
Patented Feb. 8, 1916.

3 SHEETS—SHEET 2.



WITNESSES

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D. MURRAY.
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Patented Feb. 8, 1916.
3 SHEETS--SHEET 3.

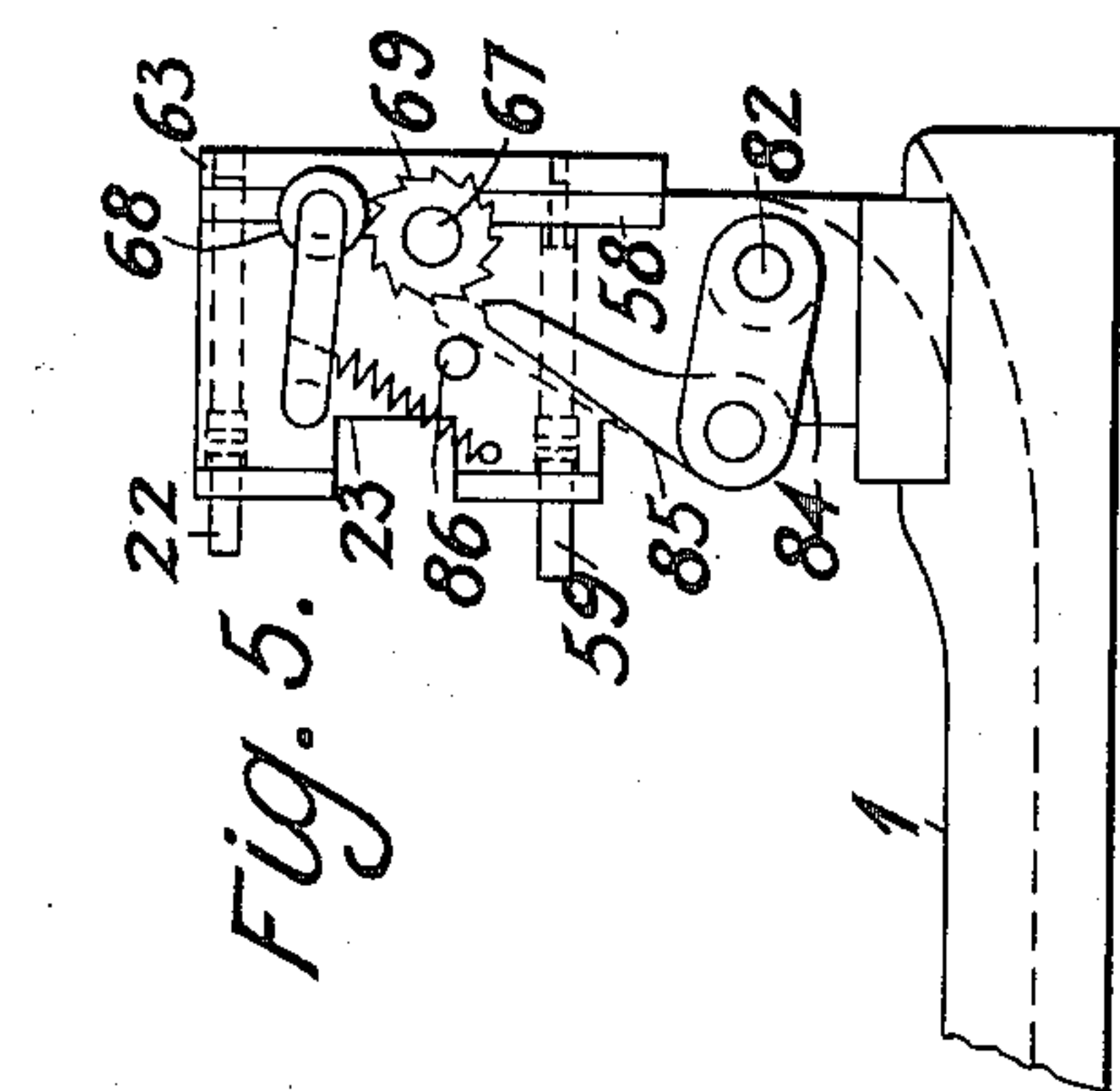


Fig. 5.

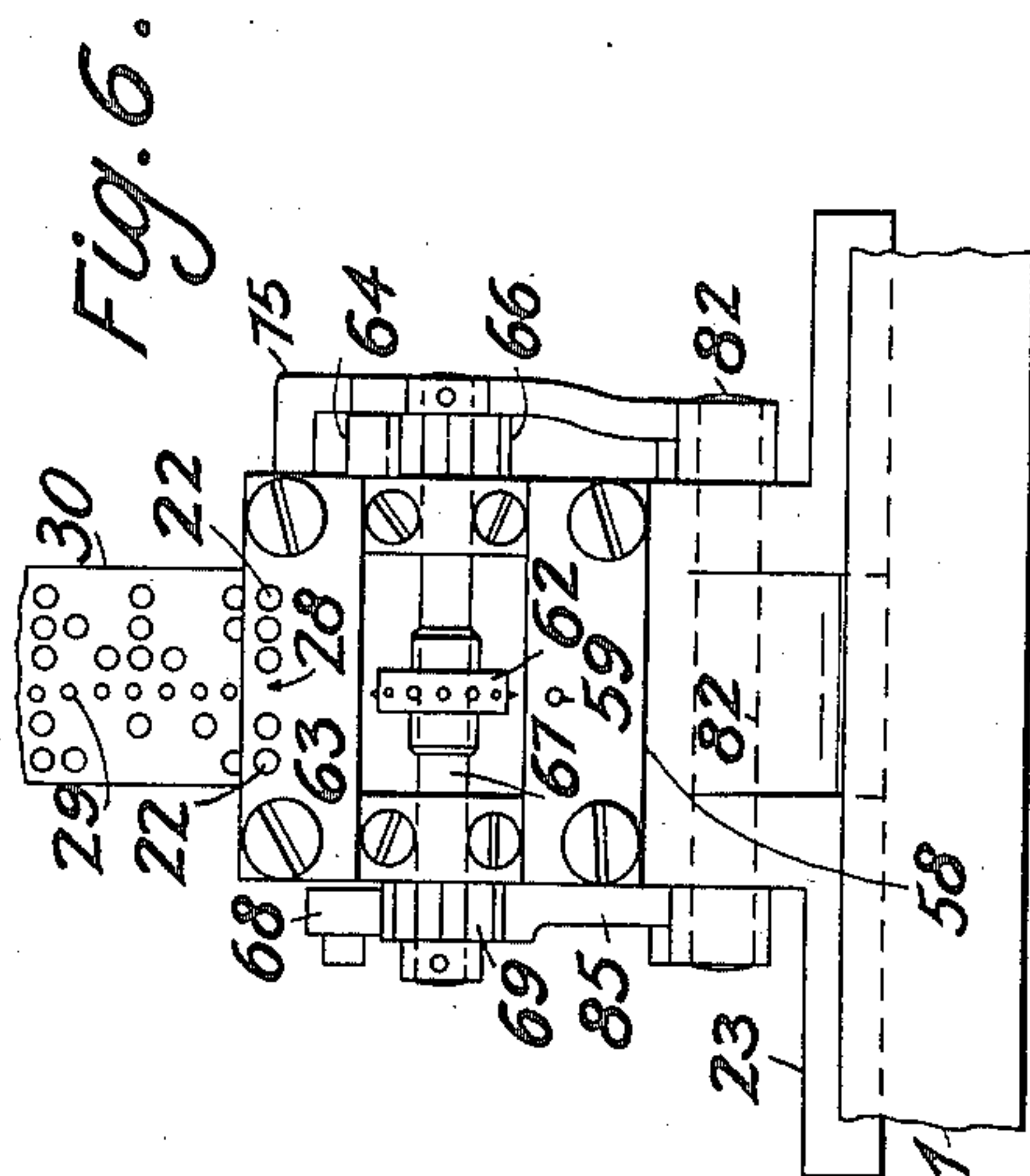


Fig. 6.

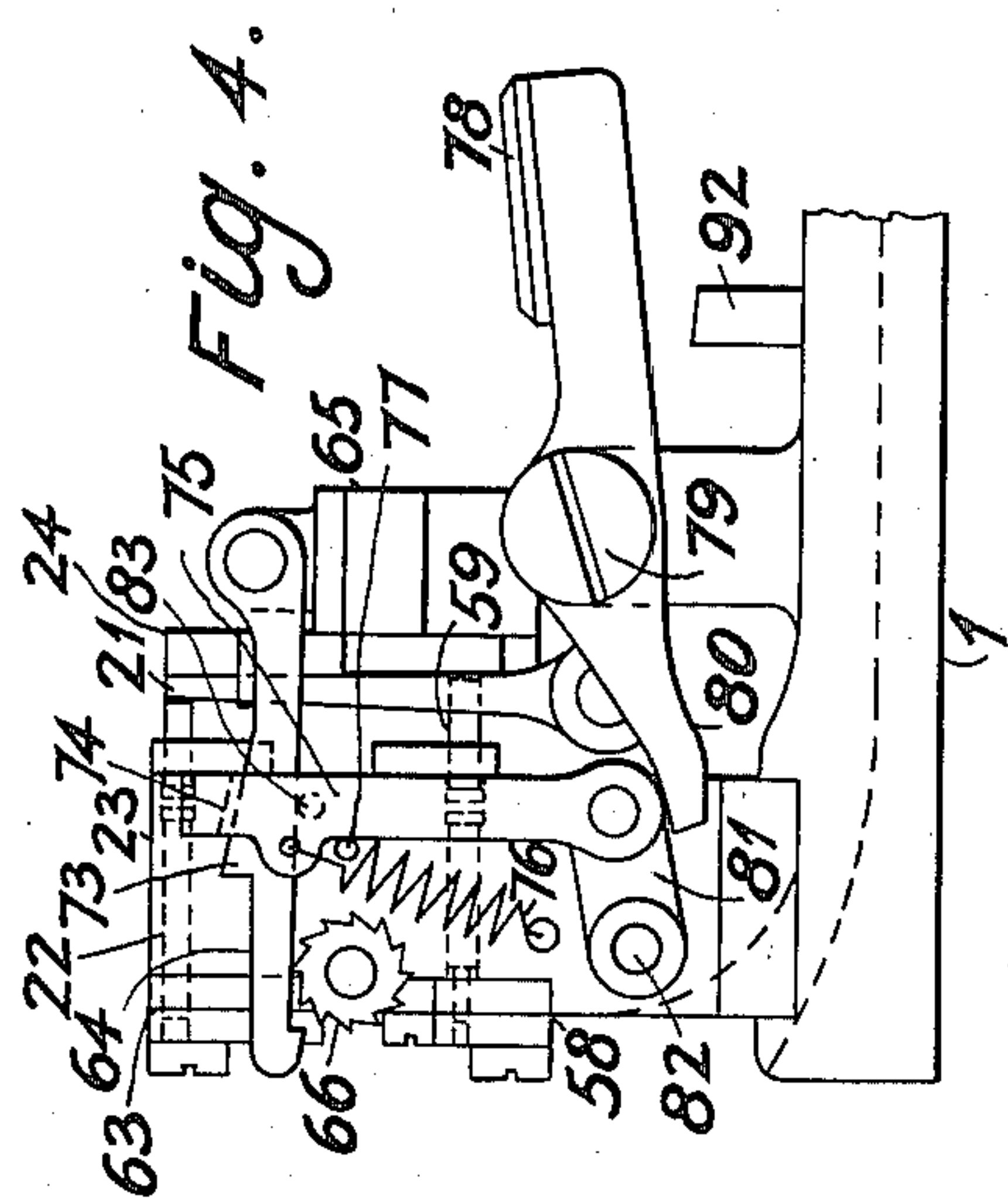


Fig. 4.

WITNESSES

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UNITED STATES PATENT OFFICE.

DONALD MURRAY, OF LONDON, ENGLAND, ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

KEYBOARD APPARATUS.

1,170,556.

Specification of Letters Patent.

Patented Feb. 8, 1916.

Application filed November 30, 1914. Serial No. 874,609.

To all whom it may concern:

Be it known that I, DONALD MURRAY, a British subject, and a resident of London, county of London, England, have invented certain new and useful Improvements in Keyboard Apparatus, of which the following is a specification.

My invention relates generally to keyboard instruments; for example, typewriters, typesetting machines, keyboard-operated telegraph transmitters, and, more particularly, tape perforators such as are employed for certain types of telegraph systems, certain types of type-setting machines, etc.

My invention comprises an improved arrangement of key levers in a keyboard apparatus, and improvements in perforating or tape marking mechanism and tape-feeding mechanism, and other features as hereinafter described and particularly pointed out in the appended claims.

The particular keyboard-actuated perforating machine, in connection with which my invention is illustrated in the accompanying drawings, is particularly intended for use in connection with the Murray multiplex, Baudot multiplex and other printing telegraph systems using cross-perforated paper tape; that is to say, tape in which the letter groups of perforations are arranged transversely of the tape, instead of lengthwise thereon; but it should be understood, that in illustrating my invention in connection with this particular perforator, I do not thereby limit my invention to use in telegraph perforators, or to use in perforators which punch letter groups transversely of the tape; nor do I limit my invention to perforators, since various features of my invention are applicable to other types of apparatus. Moreover, it is well recognized that for some purposes the embossing or otherwise marking of a tape or sheet is equivalent to the perforating of such tape or sheet; and such embossing or other marking by mechanism operated as herein described, I regard as within my invention.

In various types of keyboard apparatus, extreme compactness of the keyboard, and of the apparatus as a whole, is desirable. The arrangement of key levers herein described avoids occasion for use of long levers

projecting a considerable distance beyond the keyboard proper, and thereby promotes compactness of the apparatus to a high degree. The tape perforated by telegraph perforating apparatus, is frequently led directly from the perforator to the automatic transmitter and in such cases it is generally desirable that a minimum amount of perforated tape shall intervene between the actual point of perforation of such tape, in the perforator, and the point at which such tape acts in the automatic transmitter, to cause the transmission of telegraph signals. It is often desirable that the groups of perforations produced in the tape by the operation of the perforator, shall be visible up to and including the last group or row of letter perforations, or the like, so that any possible error may be corrected at once, and so that the tape may be read readily right up to the last group of perforations. Particularly for telegraphic transmission, it is as desirable that the rows of perforations, right up to the last row, shall be visible to the operator, as, in the case of the typewriter, it is desirable that the written matter shall be visible right up to the last word written.

The objects of my invention are, therefore, to improve keyboard apparatus generally, and particularly keyboard perforators and other tape embossing or marking apparatus; to improve the arrangement of key levers of keyboard apparatus; in the case of tape perforating or other tape marking or embossing apparatus, to so arrange such apparatus that there may be a minimum amount of perforated, embossed, or otherwise marked tape intervening between the actual point of perforating embossing or marking of the tape, and the point at which such perforated, embossed or otherwise marked tape acts; to so arrange the machine that the last group or row of perforations, bosses, or other markings shall be visible to the operator immediately after the formation of such row or group of perforations, bosses or markings. Other objects are to form feed holes or the like in the tape by the machine itself, as the work progresses, instead of forming such feed holes beforehand, and in a separate machine; to secure a very quick and light action of the keys and an easy

"touch"; and, generally, to make the machine compact, simple, free from liability to derangement, and relatively inexpensive. Other objects of my invention will appear hereafter.

Since embossing or otherwise marking of tape or the like is well recognized as being, generally, equivalent to perforating of the tape, and since means for embossing or otherwise marking tape are well known, and it is generally known to those skilled in the art how such embossing or other marking mechanism may be substituted for perforating mechanism, hereafter in this specification I will refer merely to perforating mechanism, but it will be understood that the principles of the perforating mechanism herein illustrated and described are applicable to embossing and other tape marking mechanism, and that such other embossing or tape marking mechanism may be substituted for the perforating mechanism herein described, without departing from my invention.

I will now proceed to describe my invention with reference to the accompanying drawings, illustrating a telegraph tape-perforating machine constituting one embodiment of my invention, and will then point out the novel features in claims.

In said drawings, Figure 1 shows a top view of the machine, a portion of which has been broken away. Fig. 2 shows a vertical section of the machine on the irregular section line A—B of Fig. 1; *i. e.*, a section looking from the front of the machine. Fig. 3 shows a vertical section of the machine on the irregular section line C—D of Fig. 1, *i. e.*, a section looking from the left hand end of the machine. Fig. 4 shows a detail side elevation of the punch block and of portions of the paper feed mechanism. Fig. 5 shows a detail elevation of the punch block looking at the side opposite that shown in Fig. 4. Fig. 6 shows a front elevation of the punch block. Fig. 7 shows a detail elevation of the punching lever and associated parts. Fig. 8 is a detail elevation of the part 70—72 shown in Fig. 7.

Referring first to Figs. 1, 2 and 3, numeral 1 designates the base and frame of the machine, which is commonly made of cast iron, and is very compact, the actual machine, illustrated in the drawings, being only about 14 inches (350 mm.) long, about 6 inches (152 mm.) wide and about 2 $\frac{3}{4}$ inches (70 mm.) high, including the felt on which the base 1 rests. Numerals 2 designate the key levers. In most keyboard apparatus employing key levers, such key levers are rather long levers, all pivoted on one side (usually the rear) of the keyboard proper. In my improved apparatus herein illustrated and described, the key levers 2 are all short, the key levers for the

front row of keys being pivoted (as hereinafter described) just to the rear of the last row of keys, while the key levers for the last row of keys are pivoted just in front of the front row of the keys; the key levers for the intermediate row of keys being also pivoted (in the arrangement shown) just in front of the front row of keys; though in general it is immaterial whether the key levers for the intermediate row of keys be pivoted in front or in rear. In other words, the arrangement of the key levers is, in general, an alternate arrangement, some being pivoted just to the rear of the keys, others being pivoted just to the front of the keys. By this arrangement of the key levers I secure very short key levers; and because of the shortness of the key levers, and also because of the improved pivoting thereof, as hereinafter described, and the otherwise light action of the machine, I secure a very light "touch" and a very uniform "touch", which "touch" is furthermore of a character particularly satisfactory to the operator. The key levers 2 are pivoted to rods 3 (of which there are two rows, one at the back and one at the front of the keyboard), these rods 3 being located at the bottom of grooves in two channel bars 4 (at the back of the keyboard) and 5 (at the front of the keyboard) which bars 4 and 5 form part of the base of the machine. The pivot rods 3 are each of relatively short length, a number of such rods, placed end to end, being located in each of the channel bars 4 and 5, and said rods 3 are held in place in the channel bars by small countersunk screws 6 which are screwed into the bars 4 and 5 so that the heads of the screws hold the rods 3 down at the bottom of the grooves of the bars 4 and 5. Since the rods 3 are in short lengths and since the screws 6 are readily removable, it is an easy matter to take out any particular key lever and replace it. This novel arrangement of key levers (*viz.*—the arrangement wherein all of the key levers are short, some being pivoted in front of the keyboard, and others at the back of the keyboard) gives a very compact keyboard with very short key levers which have, in consequence, a very quick and light touch. Suppose, for example, that the key levers were all pivoted at the back of the keyboard, as in an ordinary typewriter. Then the keys of the rearmost row would be about three times harder to depress than the keys of the front row. In order to reduce this defect the key levers would have to be extended in front, making the machine less compact, and the keys heavier and slower acting. By pivoting some of the key levers to the rear, and others to the front, as shown, the touch of all the keys is made practically equal.

To prevent undue lateral play of the key

levers, slotted guide bars 7 and 8 are provided (see Fig. 3). The key levers are provided with the usual stems 9 and buttons or keys proper, 10.

5 In the machine illustrated the several key levers operate a selecting mechanism comprising a group of selecting bars 11 (six such bars, in the construction shown) arranged transversely of the key levers and
15 beneath the key levers, as shown particularly in Fig. 2; numerals 11 designating the selecting bars. On one side of the machine, (the left hand side, in the construction shown) these bars 11 are pivoted, by means
15 of thin shouldered rivets, to the lower ends of corresponding bell crank levers 13, themselves mounted to oscillate on the pivot 14. At the other side of the keyboard the selecting bars 11 are pivoted to links 15 which
20 swing on the pivot 16. The selecting bars are provided with upwardly projecting wedge-shaped teeth 17, 18, shown most clearly in Fig. 2; these teeth 17, 18 being
25 arranged in the well known manner so that each key lever when depressed actuates one or more appropriate teeth, according to the code-signal corresponding to that key lever. In Fig. 2 the front selecting bar, 11, there
30 shown, is shown as provided with four such teeth, 17; the other teeth shown in that figure, and designated by numeral 18, belonging to selecting bars in rear, and which are hidden, except as to their teeth 18, by the front bar 11. The key levers, 2, are beveled
35 at the bottom, to engage the sloping sides of the teeth 17, 18. As a result of the arrangement shown, the depression of any key bar causes one or more (as the case may be) of the selecting bars 11 to move slightly to the
40 right; and it will be obvious that the effect of such movement to the right of the selecting bars 11 is to cause depression of the corresponding bell crank levers 13; various combinations of the levers 13 being de-
45 pressed, as various of the key bars 2 are depressed. Five of the selecting bars 11 are employed for the actuation of punches, to which end 5 of the bell cranks 13 have pivoted to their front ends, vertical interponent
50 rods 21, each of which is normally interposed between a corresponding punch 22 (mounted to slide in the punch block 23) and a hammer 24 mounted to slide in a bearing provided in the frame of the machine;
55 there being one hammer for the five interponent members 21. A guide strip 25 keeps the interponent rods 21 in proper loose connection with the hammer. Depression of any key, by depression of one or more of the
60 levers 13, draws down one or more of the interponent rods 21 so as to prevent their interposing between the punches 22 and the hammer 24. Hence, when the hammer blow is given, the hammer fails to reach some of
65 the punches, and message holes are perfo-

rated in the paper only in the case of punches whose interponent rods have not been withdrawn. The levers 13, with their interponent rods, are pulled up by the five
70 springs 26 attached to the bent rods 27.

It will be seen by inspection of Figs. 1 and 6 that for one of the intermediate selecting bars 11 there is no corresponding punch 22, or interponent rod 21. The space
75 28 in which such punch and interponent rod has been omitted, corresponds to the position of the central row of feed holes 29 in the tape 30, shown projecting up from the punch block in Figs. 2 and 6. This blank position is filled by the selecting bar 31,
80 (Fig. 1), similar to the other five, and pivoted to a link swinging on 14, (Fig. 2) but without any lever 13. At the other end, the selector bar 31 is pivoted to a link 15 like the other five selectors, but in addition it is
85 connected by a link 32 to the lever 33 oscillating on the pin 34. The upper end 35 of the lever 33 is bent over as shown in Figs. 1 and 3, so that the insulation block 36 on the end of the lever 33 comes opposite to two
90 contact springs 37, 38, Figs. 1, 2 and 3. Depression of any key moves selector bar 31, (Fig. 1), slightly to the right, and by means of the link 32, (Fig. 2) it oscillates the lever 33 so as to make it close the contacts 37, 38.
95 The current then flows from the battery or power circuit through terminal 39, (Fig. 1), wire 40, contact post 41, spring contacts 37 and 38, contact post 42, wire 43, magnet 44, wire 45 and terminal 46, back to the source
100 of power. The magnet 44 attracts its armature 47 from the back stop 50. The armature 47 is pivoted at 48, and projecting from the other end of the armature there is rigidly connected with it a bar 49, (Fig. 1) which carries the punch hammer 24.
105 This bar 49 and its hammer block 24 and the guide strip 25 for the interponent rods are shown in detail in Fig. 7. When the armature is attracted, the bar 49 moves in the
110 opposite direction and the hammer drives such of the punches through the paper tape as have not had their corresponding interponent rods withdrawn by the depression of any given key on the keyboard. The ham-
115 mer 24 and the bar 49 are retracted by the spring 51 when any given key that has been depressed on the keyboard is released so as to allow the contacts 37 and 38 to open and discharge the magnet 44. A small angle plate
120 52 limits the motion of the contact spring 38 and insures a quick break of contact. The contacts, which are preferably of tungsten, are protected from destructive sparking by the small spark condenser 53 connected to
125 the brass contact posts 41 and 42. These posts are screwed down to a block of ebonite or other suitable insulation material 54, which also carries terminal screws 39 and 46 and the angle plate 52. The insulation block 13,

54 is screwed to the base by the screw 55. 56 is the L-shaped yoke of the magnet 44, screwed to the base of the machine by the three screws 57.

5 Coming now more particularly to the punch block, the paper tape 30, (Fig. 2) enters at the right of the machine and passes along a groove on the base immediately under the selecting bars as shown by the dotted line and then on up through the punch block. It passes first up between the pair of die-plates 58, (Figs. 2, 4 and 5 and 6). At this point the feed hole is punched in the paper by the punch 59 each time the magnet is energized and the hammer strikes the punches. The hammer 24, (Fig. 7), reaches this feed hole punch by means of the downward projecting tongue 60, the small dotted circle showing where 60 strikes the feed hole punch. The points at which the message hole punches are struck by the hammer are indicated by the five small dotted circles 61 (Fig. 7). After the paper has been perforated by the punch 59, it passes up over the outside of the star-wheel 62 (Fig. 2) and then up between the upper pair of die-plates 63. Here the paper is perforated by one or more of the five message hole punches 22. It will be noticed that the message holes are punched in the tape almost at the top and close to the left hand end of the punch block, hence, as the tape moves up $\frac{1}{16}$ inch (2.5 mm.) for each letter immediately after being punched, the whole of the letter perforations are visible up to and including the last letter perforated. If paper tape prepared beforehand with a series of feed holes were used, there would be no need for the punch 59. It is, however, desirable, if possible to use plain unperforated paper as it is cheaper, and one of the novel features of this invention is the punching of the feed holes by the punch 59 before the paper passes on to the star-wheel 62, and punching the message holes afterward. It is this novel arrangement that enables the tape to be perforated with message holes at the extreme upper left hand corner of the machine. Also, as the tape is perforated at the extreme left hand end of the machine, it is possible to have minimum distance between the point where the messages are perforated on the tape and the point on an automatic tape transmitter at which transmission takes place.

The tape has to be fed up $\frac{1}{16}$ inch (2.5 mm.) for each letter perforated. The method of feeding tape forward letter by letter is best seen by referring first to Fig. 1 and then to Figs. 4, 5, 6, 7 and 8. Pivoted on the free end 65 of the lever 49 there is a pawl 64, which, acting on the teeth of a ratchet wheel 66, feeds the tape forward one letter space each time the magnet 44 is discharged, and the spring 51 retracts the bars

49. When the magnet 44 has attracted its armature the pawl 64 is thrust forward into the position it occupies in Fig. 4. When the magnet is discharged, the pawl 64 moves to the right and pulls the ratchet wheel around the distance of one tooth. The star wheel 62, (Fig. 6), that engages with the feed holes in the paper tape and feeds the tape upward, is fixed on the same spindle 67 as the ratchet wheel 66. In order to locate the star-wheel accurately each time the pawl 64 acts on the ratchet wheel, the small jockey roller 68 is provided. This presses between two adjoining teeth of a second ratchet wheel 69 and so holds the star-wheel and therefore the paper tape in the correct position for perforation. Referring to Fig. 7, the pawl 64, shown partly in section, is pivoted on a horizontal pin 70, forming part of a piece 71 carrying also a vertical pin 72, which fits into a hole in the end 65 of the hammer bar 49. This hammer bar 49, (Fig. 7) is part of the bar 49 that is pinned and brazed into the armature 47 (Fig. 3). This arrangement gives the pawl 64 the universal motion necessary under this arrangement. The motion of the end 65 of the bar 49 is so small that a slight slackness between the pawl 64 and the punch block 23 is sufficient to secure satisfactory operation. In addition to the jockey roller 68, over-feeding of the tape is prevented by a locking wedge 73 on the pawl 64, (Fig. 4). When the pawl has been drawn inward so as to pull the ratchet wheel 66 around one tooth, the wedge 73 locks under the inclined plane shown in dotted outline at 74 of the vertical piece 75, (see also Fig. 6). The spring 76 (Fig. 4), holds 75 in place against the pin 77 in the punch block, (Fig. 4).

In the use of the perforator herein illustrated and described, if a keyboard operator perforates a wrong letter or letters, he can move the tape back letter by letter and punch it full of holes so as to obliterate the wrong letter, and as tape full of holes is equivalent to no tape at all, no trace of the correction, not even a blank space, will appear in the printed message at the other end of the line. For the purpose of rapid and easy correction of errors in this way, a back-spacing key 78, pivoted at 79, is provided. Depression of this key down to the stop 92 raises the end 80 which extends under the short link lever 81. This lever is pinned to the spindle 82 which passes through the punch block, (see Fig. 6). The vertical piece 75 (Fig. 4), is pivoted on the free end of the lever 81. The raising of the lever 81 by the depression of the key 78 raises 75, and the pin 83 projecting inward from 75 raises the pawl 64 free from the teeth of the ratchet wheel 66. The spindle 82, being rotated, raises the corresponding lever 84 on the other side of the punch block (Fig. 5). At-

5 tached to the free end of this lever 84, there is a pawl 85, which on rising thrusts the star wheel 69 around one tooth at a time. The pin 86 locks the pawl 85 and prevents the ratchet wheel 69 from turning more than one tooth at a time. It will be noticed that the ratchet wheel 69 (Fig. 5) is reverse to the ratchet wheel 66 (Fig. 4). Consequently, when the back-spacing key 78 is depressed so as to free the pawl 64 from the ratchet wheel 66 (Fig. 4) and cause the pawl 85 (Fig. 5) to rotate the ratchet wheel 69 one tooth, the star wheel, and therefore the paper tape, is moved back one letter space. In this way the paper tape can be moved back any desired number of letter spaces. Depression of the "letter" key, (Fig. 1) which punches five message holes, obliterates any erroneous letter perforations.

20 The punches of the punch block are retracted by steel wire springs 87, (Fig. 2) one for each punch, fastened at one end in the lower part of the punch block and the other end passing into an eyelet 88 (Fig. 1) in each punch. In addition to the separate springs for each punch, there is a piece of flat clockspring shown in dotted outline at 89, (Fig. 2), secured by a couple of screws at 90 and its upper end pressing against the upper part of all the five separate punch springs. The advantage of this combined arrangement of springs is that the maximum retracting tension is obtained on the punches with the minimum amount of spring tension, on the average, per letter.

It will be seen by inspection of the portion of tape shown in Fig. 6, that there are five rows of message holes on the tape and one row of feed holes. The row of feed holes is the third from the top edge of the tape, looking at the tape lengthwise, two rows of message holes coming above and three below. In this way the right side up of the tape can be distinguished instantly. Similarly the feed holes are punched with a slight "lead," that is to say, slightly to the left of each letter group of message holes, when looking at the tape in the way in which it should be read. In this way it is easy to note which is the beginning and which the end of any fragment of the tape. This is a matter of considerable practical importance in handling and reading the tape. This advance or lead of the feed holes is obtained by adjustment of the punch-plates and star wheel in the punch block.

In certain of the following claims I have used the term "tape marking means" as a term to include generically tape perforating means, tape embossing means, and other means for marking or otherwise imposing code characters or the like on tape.

What I claim is:—

65 1. A keyboard apparatus comprising a plurality of rows of keys and pivoted key

levers for such keys, certain of said key levers pivoted immediately in rear of the rows of keys and extending forwardly to their respective keys, others of said key levers pivoted immediately in front of the rows of keys and extending rearwardly to their respective keys.

2. A keyboard apparatus comprising a plurality of rows of keys and pivoted key levers for such keys, certain of said key levers pivoted immediately in rear of the rows of keys and extending forwardly to their respective keys, others of said key levers pivoted immediately in front of the rows of keys and extending rearwardly to their respective keys, the forwardly extending key levers alternating with the rearwardly extending key levers.

3. Keyboard apparatus comprising three rows of keys and pivoted key levers therefor, the key levers for the front row of keys pivoted in rear of that row and extending forwardly to their respective keys, the key levers for the rear row pivoted in front of that row and extending rearwardly to their respective keys.

4. Keyboard apparatus comprising three rows of keys and pivoted key levers therefor, the key levers for the front row of keys pivoted in rear of that row and extending forwardly to their respective keys, the key levers for the rear row pivoted in front of that row and extending rearwardly to their respective keys, the forwardly extending key levers and the rearwardly extending key levers being alternated.

5. Keyboard apparatus comprising three rows of keys and pivoted key levers therefor, the key levers for the front row of keys pivoted in rear of that row and extending forwardly to their respective keys, the key levers for the rear row pivoted in front of that row and extending rearwardly to their respective keys, the key levers for the intermediate row being pivoted at points beyond the keys of another of said rows.

6. Keyboard apparatus comprising a key, a key lever therefor, a grooved bar extending transversely with respect to said key lever, and a pivot rod for said key lever, resting in the groove of such grooved bar, and means for holding such rod in place.

7. Keyboard apparatus comprising a key, a key lever therefor, a grooved bar extending transversely with respect to said key lever, and a pivot rod for said key lever, resting in the groove of such grooved bar, and a headed screw engaging such grooved bar and covering a portion of the groove thereof and serving to hold such pivot rod in place.

8. Keyboard apparatus comprising in combination a plurality of keys arranged in a row, key levers for such keys, a grooved bar extending transversely with respect to

said key levers, pivot rods for said key levers located in the groove of said bar, and means for holding such pivot rods in place, each pivot rod having mounted upon it less
 5 than the whole number of such key levers, whereby one or more of such key levers may be removed without removal of certain of the remaining key levers.

9. Keyboard apparatus comprising a plurality of keys, key levers therefor, some of
 10 which extend rearwardly with respect to their keys and others of which extend forwardly with respect to their keys, grooved bars extending transversely with respect to
 15 said key levers, pivot bars located in the grooves of said grooved bars, and means for holding said pivot rods in place within said groove.

10. Keyboard apparatus comprising in
 20 combination a plurality of keys, key levers therefor, some of which extend rearwardly with respect to their keys and other of which extend forwardly with respect to their keys, a base provided with grooved bars extend-
 25 ing transversely with respect to said key levers, pivot rods for said key levers located in the grooves of said bars, and means for holding said pivot rods in place.

11. Keyboard apparatus comprising in
 30 combination a plurality of keys, key levers therefor, a base provided with a grooved bar extending transversely with respect to said key levers, a pivot rod for such key levers located in the groove of said bar, and means
 35 for holding such pivot rod in place.

12. Tape perforating apparatus comprising tape guiding means, a feed member adapted to engage perforations in a tape guided by such guiding means, and to feed
 40 such tape, feed-hole-forming means for such tape, arranged to act upon the tape in advance of the action of such feeding means thereon, and tape-marking means arranged to act upon such tape after the action thereof
 45 of such feed-hole-forming means.

13. Tape perforating apparatus comprising tape-guiding means, a feed member adapted to engage perforations in a tape guided by such guiding means, and to feed
 50 such tape, feed-hole-forming means for such tape, arranged to act upon the tape in advance of the action of such feeding means thereon, and tape-marking means positioned beyond the point of action of the feed-hole-
 55 forming means on the tape, with reference to the direction of feed of the tape, and arranged to act upon such tape after such feed-hole-forming means has acted thereon.

14. Tape perforating apparatus comprising
 60 ing tape-guiding means, a feed member adapted to engage perforations in a tape guided by such guiding means, and to feed such tape, feed-hole-forming means for such tape, arranged to act upon the tape in ad-
 65 vance of the action of such feeding means

thereon, and tape marking means arranged to act upon such tape after the action thereon of such feeding means.

15. Tape perforating apparatus comprising tape-guiding means, a feed member
 70 adapted to engage perforations in a tape guided by such guiding means, and to feed such tape, feed-hole-forming means for such tape, arranged to act upon the tape in advance of the action of such feeding means
 75 thereon, and tape marking means positioned beyond such feeding means with reference to the direction of feed of the tape, and arranged to act on such tape after the action thereon of such feeding means. 80

16. Tape perforating means comprising tape guiding means, feed-hole-forming means for such tape, tape marking means arranged to act upon such tape after the action thereon of such feed-hole-forming
 85 means, and feeding means for the tape arranged to engage the latter at a point intermediate the points of action of the feed-hole-forming means and the tape marking means. 90

17. Tape perforating apparatus comprising tape guiding means and feed-hole-forming means for such tape, feeding means for such tape, and tape marking means, arranged to act upon the tape successively and
 95 in the order named, the tape guiding means terminating immediately beyond the point of action of the tape marking means on the tape, whereby the markings on the tape are visible immediately beyond the point of
 100 action of the marking means thereon.

18. Tape perforating apparatus comprising feed-hole-forming means and tape-marking means, the feeding means arranged to feed tape successively, the marking means
 105 arranged to mark the tape successively in successive positions on the tape, the feed hole forming means arranged to form said holes in the tape slightly out of registry with the corresponding markings on the tape, and
 110 thereby to indicate the proper direction of feed of the tape.

19. Tape perforating apparatus comprising feed-hole-forming means and tape-marking means, the feeding means arranged to feed tape successively, the marking means
 115 arranged to mark the tape successively in successive positions on the tape, the feed hole forming means arranged to form feed holes in the tape slightly in advance of the
 120 corresponding markings on the tape, and thereby to indicate the proper direction of feed of the tape.

20. Tape perforating apparatus comprising
 125 ing a keyboard, tape guiding means located to one side of and in immediate proximity to the keyboard, feeding means arranged to engage tape held by such guiding means, and tape marking means arranged to mark
 130 the tape immediately prior to the issuance

of such tape from such guiding means, whereby a minimum length of the tape intervenes between the point of marking and the point at which such tape leaves the guiding means.

21. Tape perforating apparatus comprising guiding means for the tape, feed-hole-perforating means comprising a hammer-actuated perforating member, tape-marking means comprising hammer-actuated marking means adapted to act upon the tape, and to act upon such tape after the action thereon of the feed-hole-forming means, and a single hammer arranged to act upon both the feed-hole-forming means and the tape marking means.

22. A keyboard tape marking apparatus comprising a keyboard, and tape marking means controlled by said keyboard and located at one extreme lateral edge of the apparatus, and with the point of issuance of the tape in close proximity to such extreme edge of the apparatus, and with the direction of issuance of the tape lateral, in order that the tape may leave the apparatus close to the extreme edge thereof and in a direction convenient for reception of the tape in other apparatus.

23. A keyboard tape marking apparatus comprising a base, keyboard mechanism mounted thereon, tape marking means located to one side of such keyboard mechanism and arranged to be controlled thereby, and a tape passage extending from one side of the apparatus through the said base and underneath the keyboard to the tape marking apparatus, whereby a clear lead is provided for the tape to the tape marking apparatus.

24. A keyboard tape marking apparatus comprising a keyboard, tape marking apparatus controlled thereby and comprising feed mechanism for the tape, and back spacing means for feeding the tape backward for correction, said tape marking means and keyboard together comprising means for the effective obliteration on the tape of incorrect markings.

25. A keyboard tape perforator comprising in combination tape feeding means and tape marking means, the latter arranged to act upon the tape after the action of the feeding means thereon, a keyboard control-

ling the action of such feeding and marking means, power-actuated means for driving the tape marking means, and arranged to be controlled by the keyboard.

26. A keyboard tape perforator comprising in combination tape feeding means and tape marking means, the latter arranged to act upon the tape after the action of the feeding means thereon, a keyboard controlling the action of such feeding and marking means, a magnet and means operated thereby for driving the tape marking means, and means operated by the key board controlling such magnet.

27. Keyboard tape marking means comprising tape guiding means, tape feeding means arranged to act upon the tape guided by such guiding means, tape marking means arranged to act upon the tape immediately prior to the issuance of the tape from such guiding means, keyboard mechanism controlling the tape feeding and marking means, and back spacing mechanism arranged when operated to pull the tape back into position for further action of the tape marking means thereon, said tape marking means and the keyboard comprising means for the effective obliteration of wrong markings on the tape.

28. Keyboard tape marking means comprising a keyboard having keys and key levers, selecting bars beneath said key levers, said key levers and the selecting bars provided, the one with selecting means and the other with means adapted to engage such selecting means to operate the selecting bars selectively, pivoted links supporting said selecting bars, tape marking means adapted to be hammer-actuated, a hammer adapted to actuate such marking means, and interponent means connected to certain of the selecting-bar-supporting links for the selective withdrawal of certain of said interponent means from between the hammer and the tape marking means.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

DONALD MURRAY.

Witnesses:

H. D. JAMISON,
R. MILLIAM.