(No Model.) 12 Sheets—Sheet 1.

G. A. GOODSON.

COMPOSING MACHINE FOR TYPE CASTING AND SETTING MACHINES.

No. 606,007. Patented June 21, 1898.

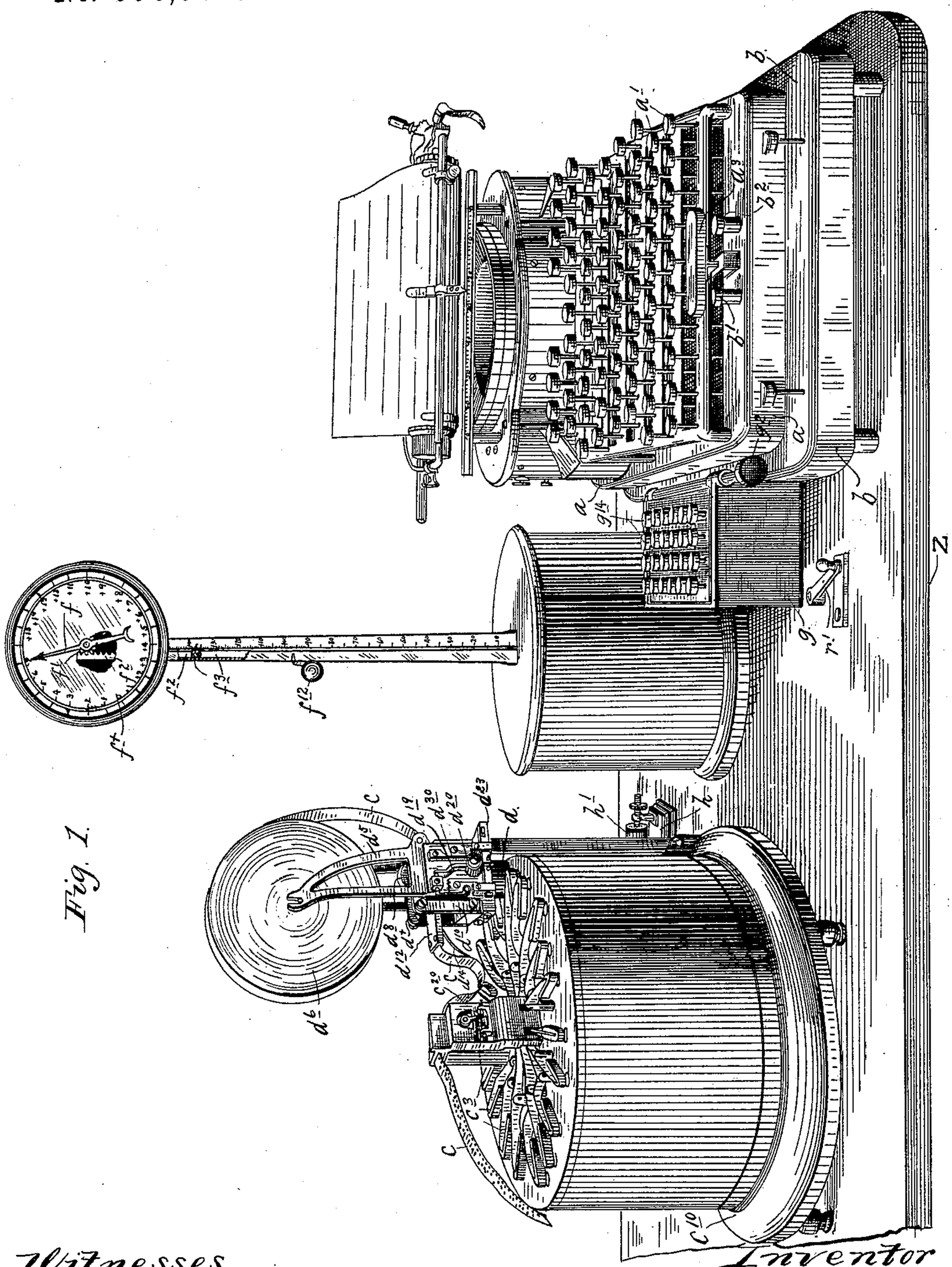

Fig. 1.

Witnesses
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Inventor
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Las. F. Williams

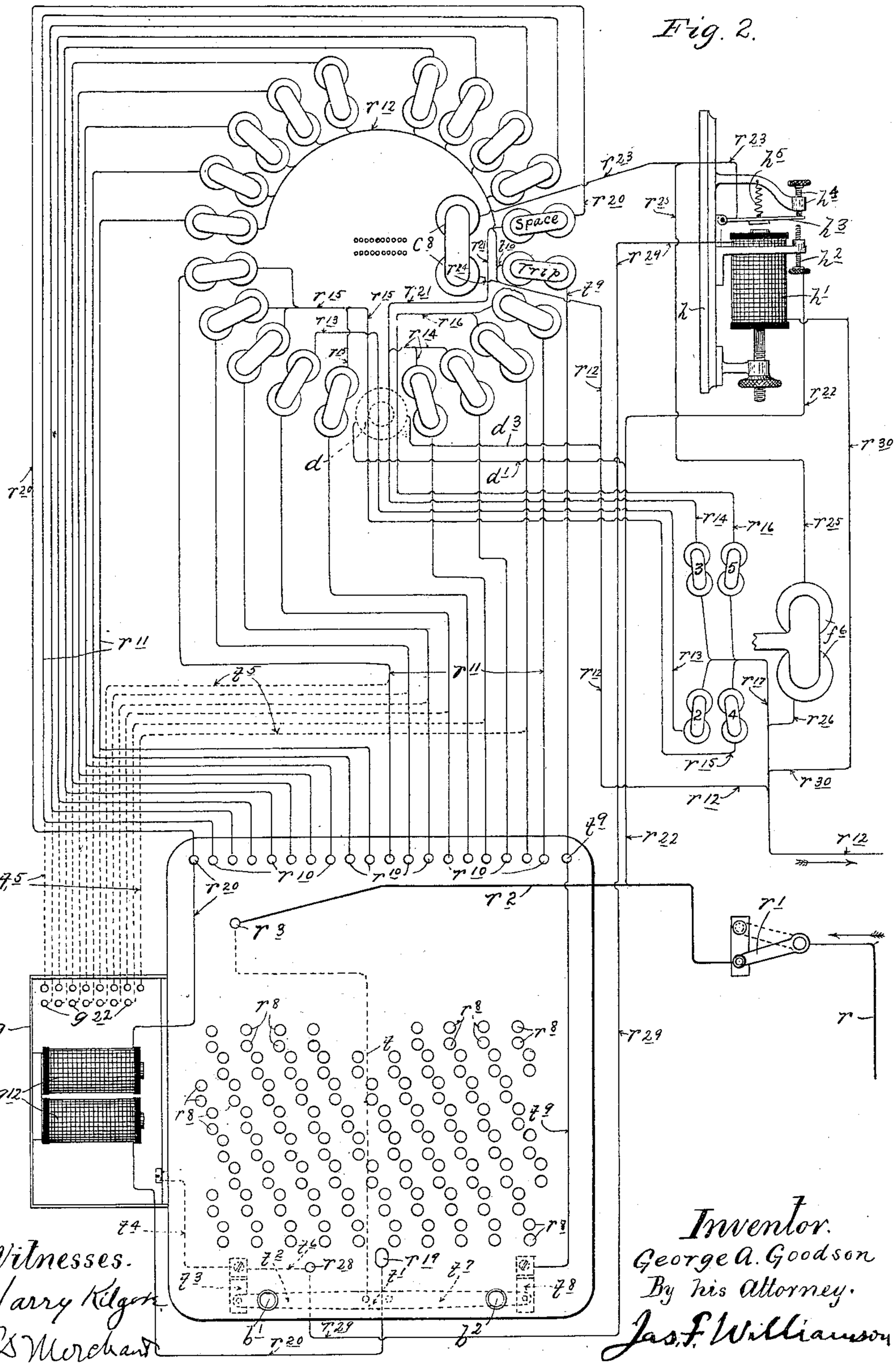
(No Model.) 12 Sheets—Sheet 2.

G. A. GOODSON.

COMPOSING MACHINE FOR TYPE CASTING AND SETTING MACHINES.

No. 606,007. Patented June 21, 1898.

Fig. 2.



Witnesses.
Harry Kilgore.
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(No Model.) 12 Sheets—Sheet 3.

G. A. GOODSON.

COMPOSING MACHINE FOR TYPE CASTING AND SETTING MACHINES.

No. 606,007. Patented June 21, 1898.

Fig. 3.

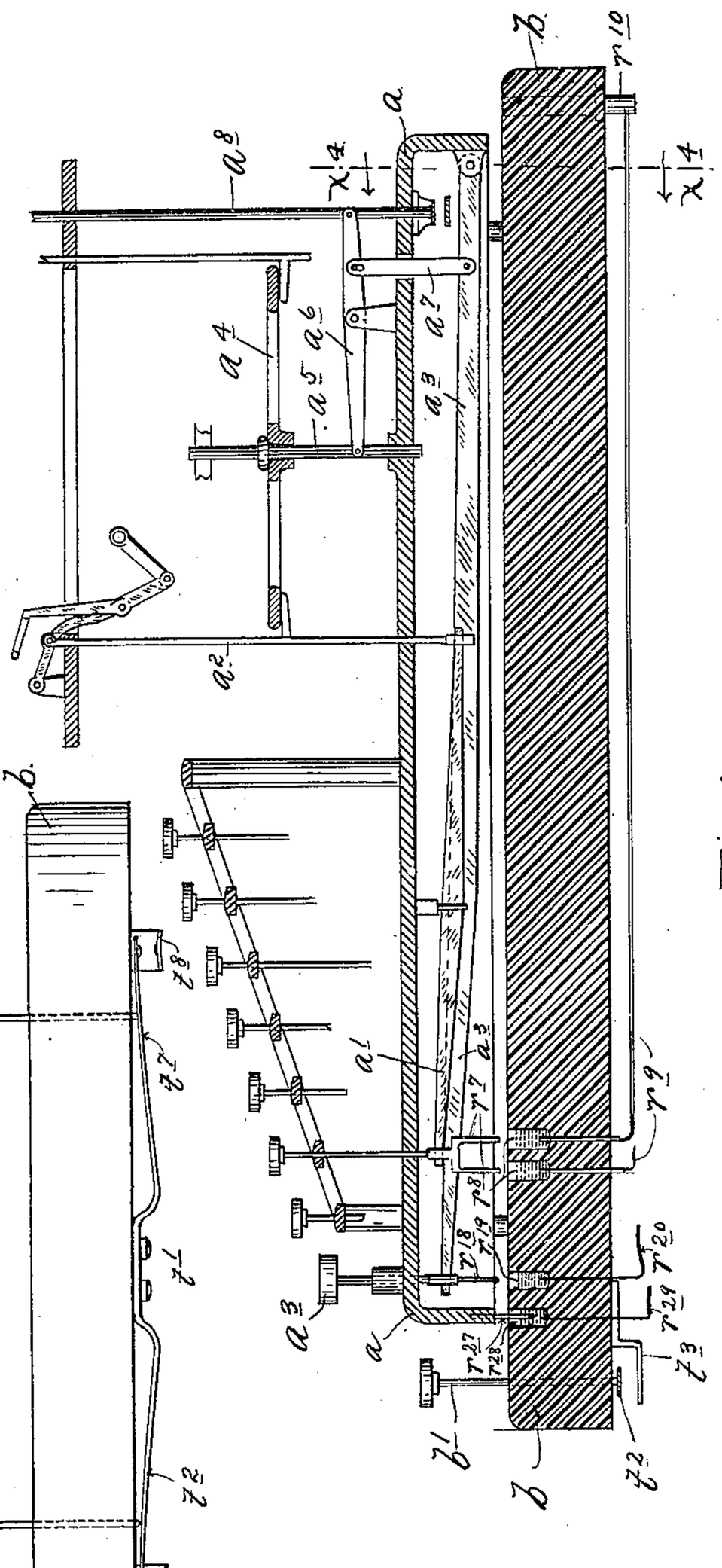


Fig. 4.

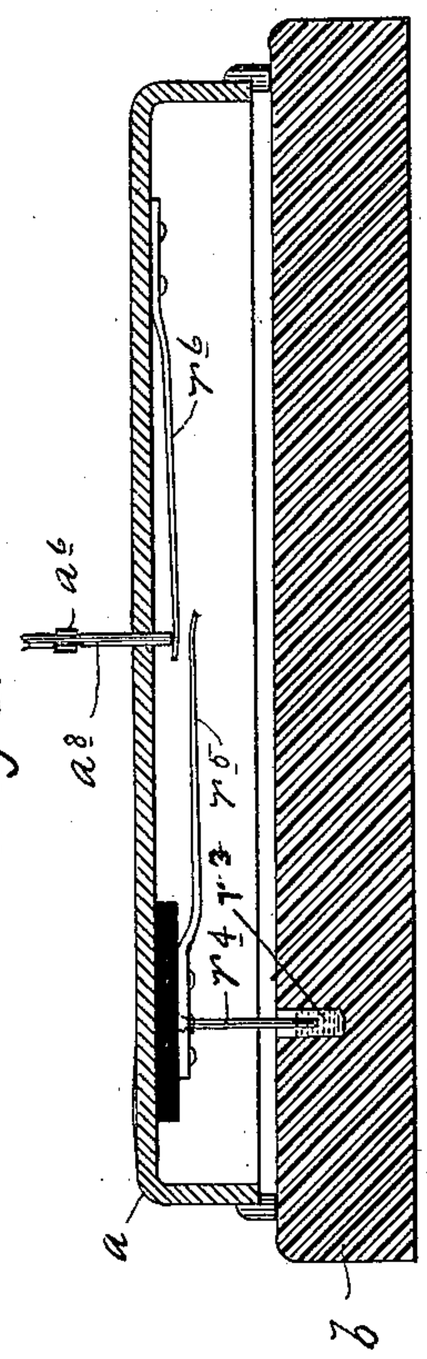
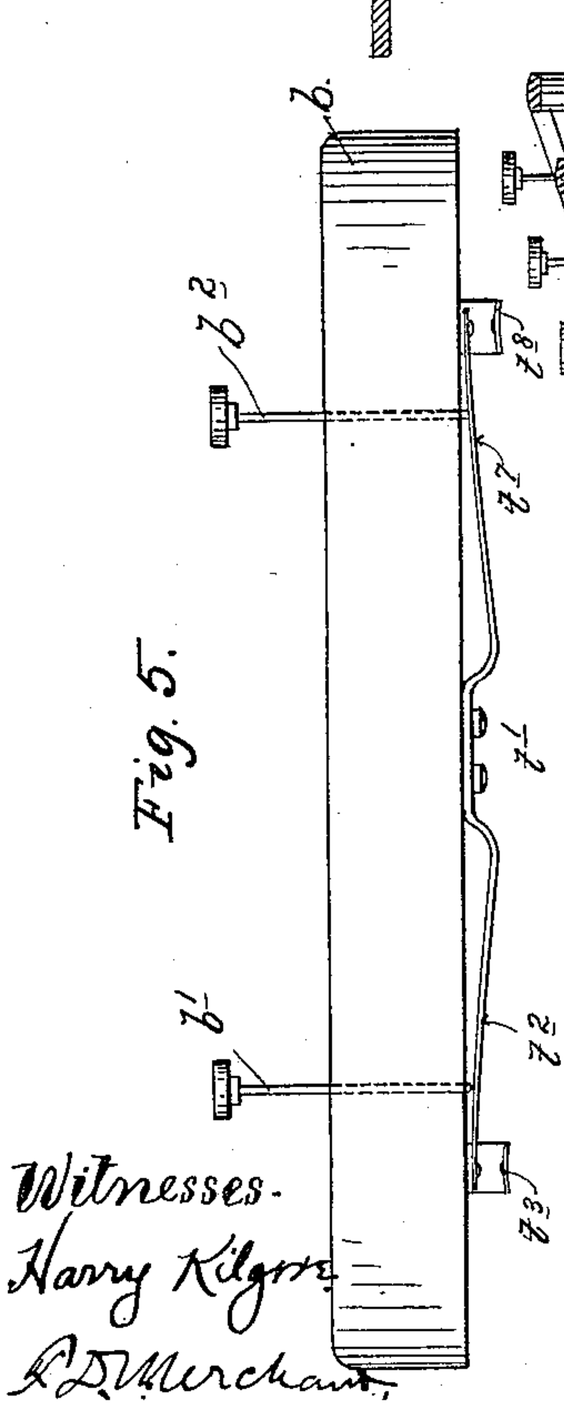


Fig. 5.



Witnesses-
Harry Kilgore.
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(No Model.) 12 Sheets—Sheet 4.

G. A. GOODSON.

COMPOSING MACHINE FOR TYPE CASTING AND SETTING MACHINES.

No. 606,007. Patented June 21, 1898.

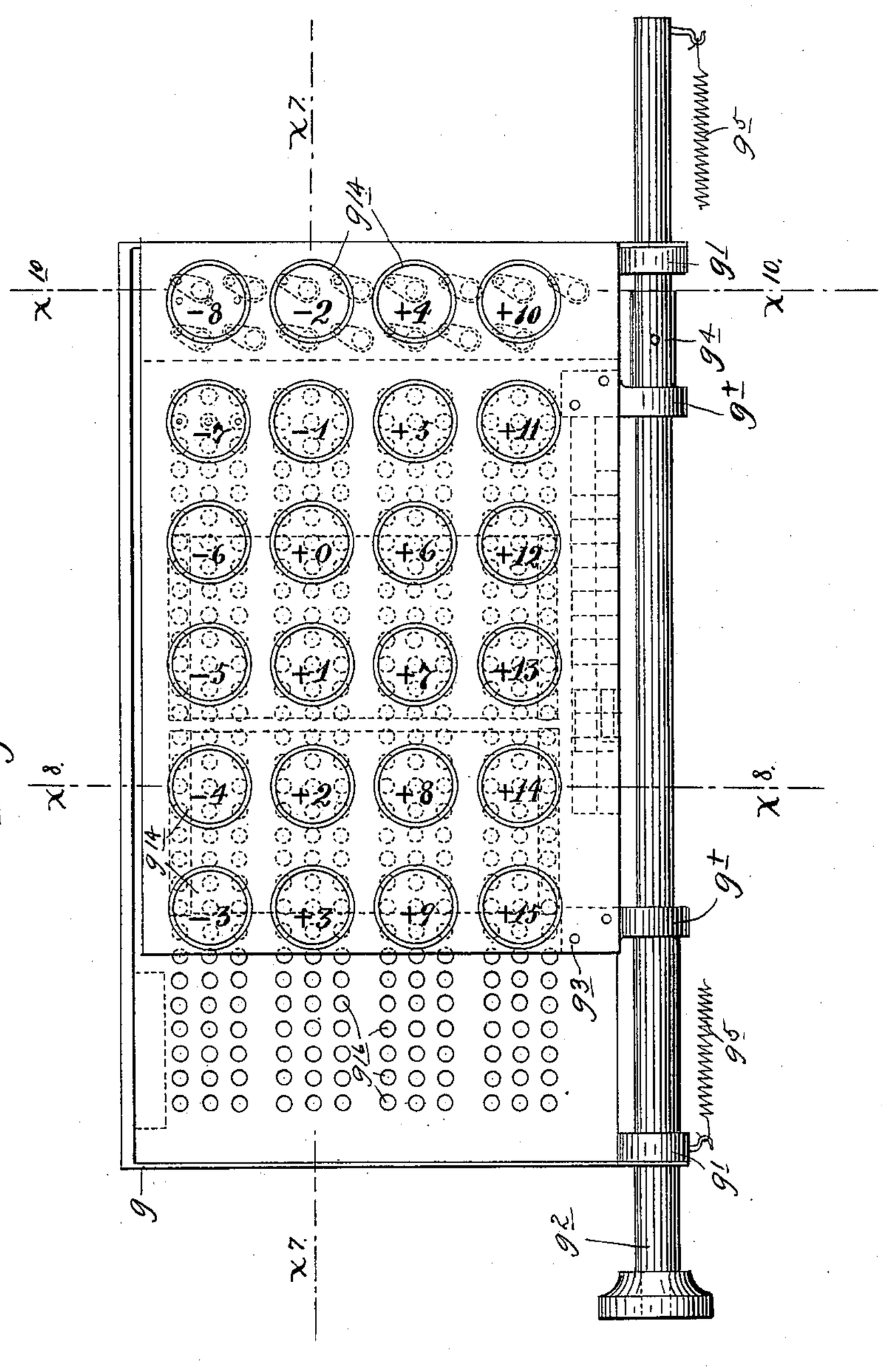

Fig. 6.

Witnesses.
Harry Kilgore.
K. D. Merchant.

Inventor.
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(No Model.) 12 Sheets—Sheet 5.

G. A. GOODSON.

COMPOSING MACHINE FOR TYPE CASTING AND SETTING MACHINES.

No. 606,007. Patented June 21, 1898.

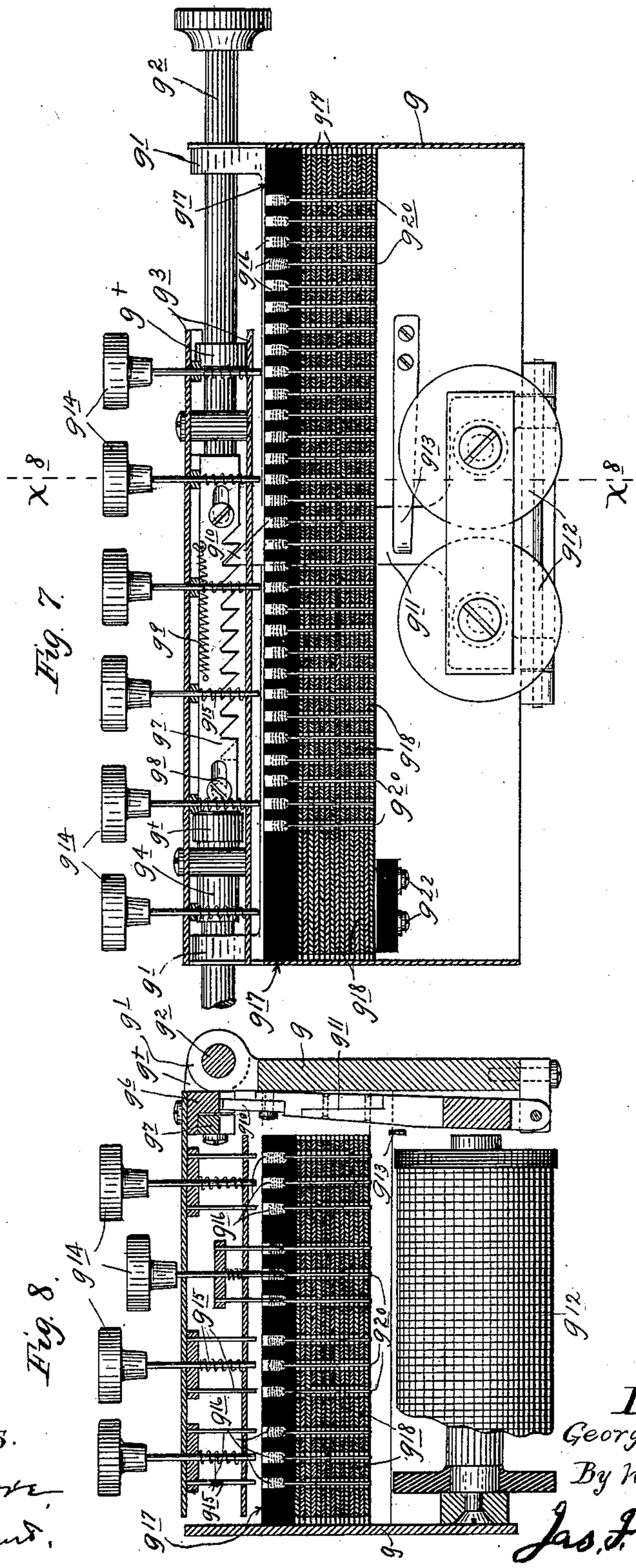

Fig. 7.

Fig. 8.

Witnesses.
Harry Kilgore
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(No Model.) 12 Sheets—Sheet 6.

G. A. GOODSON.

COMPOSING MACHINE FOR TYPE CASTING AND SETTING MACHINES.

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Fig. 9.

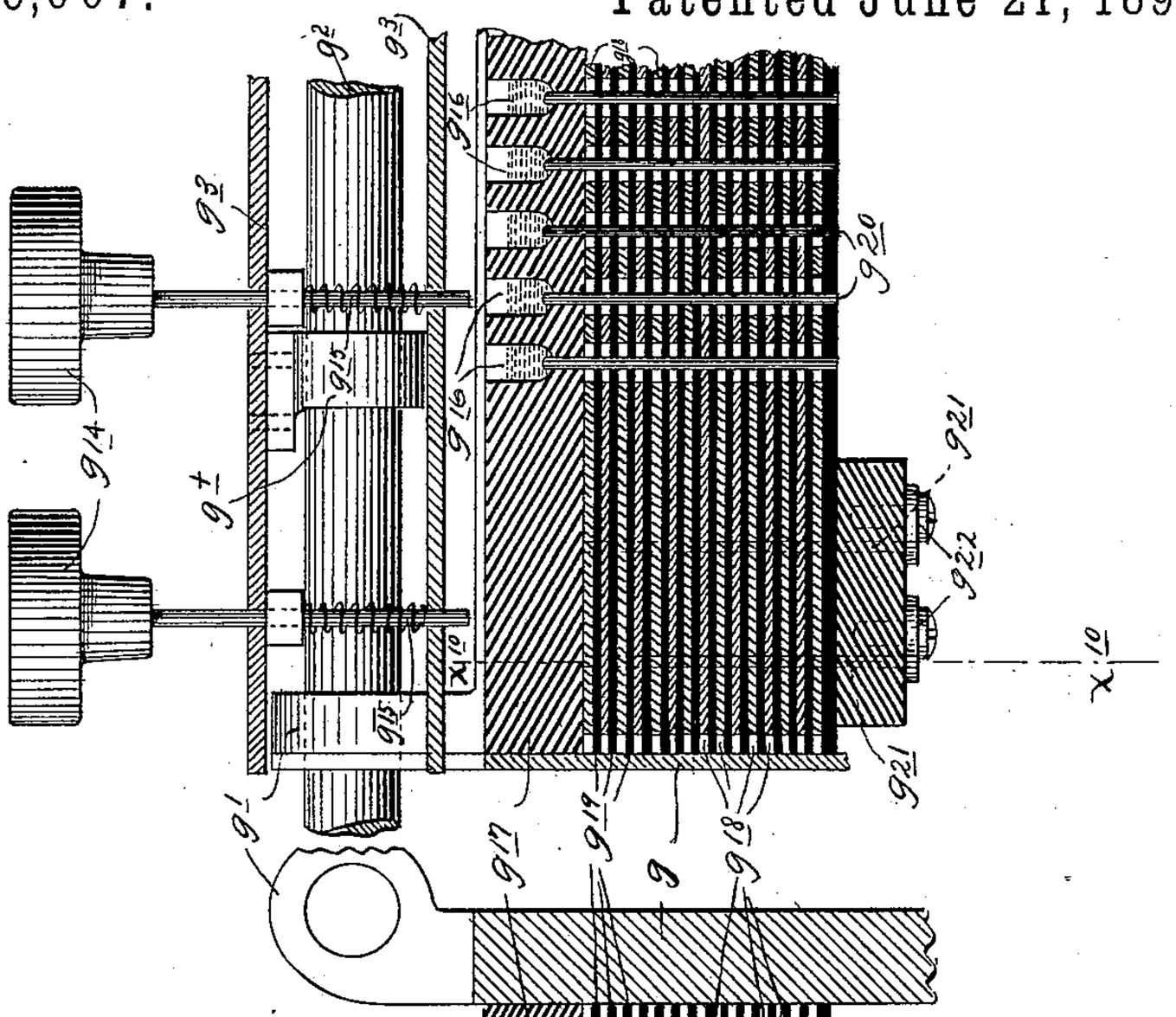


Fig. 11.

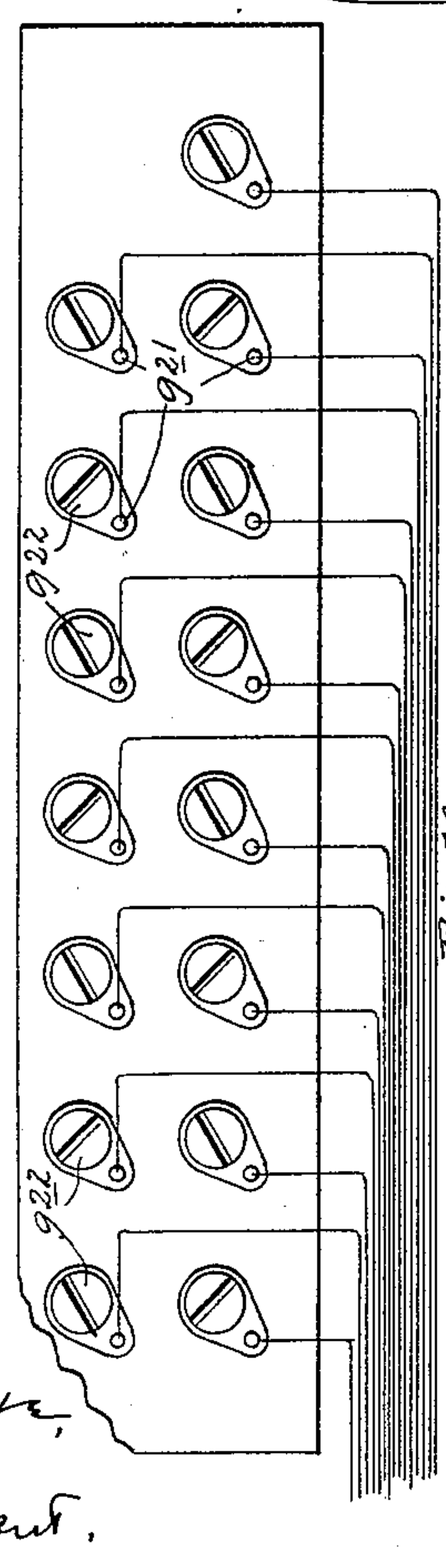
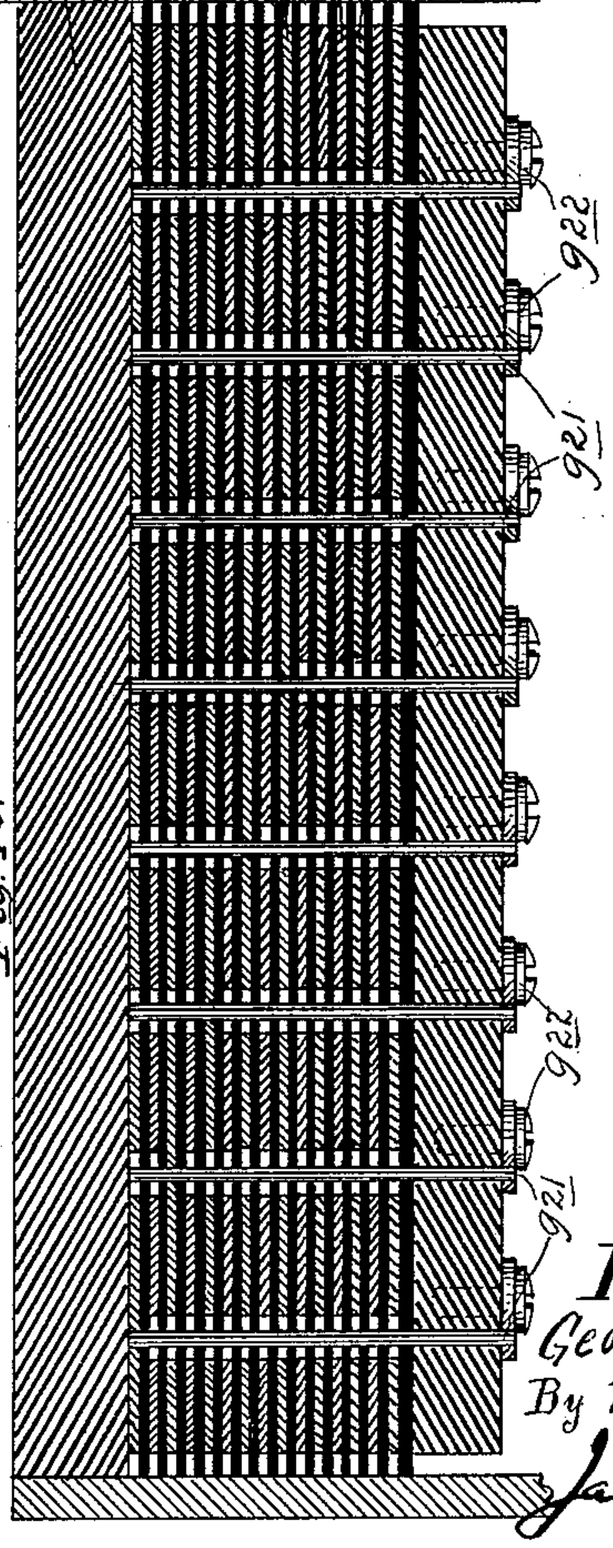


Fig. 10.



Witnesses.
Harry Kilgore,
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G. A. GOODSON.

COMPOSING MACHINE FOR TYPE CASTING AND SETTING MACHINES.

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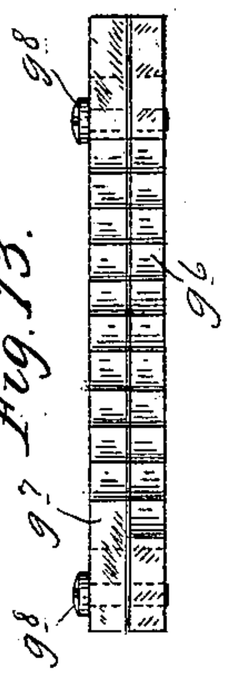

Fig. 13.

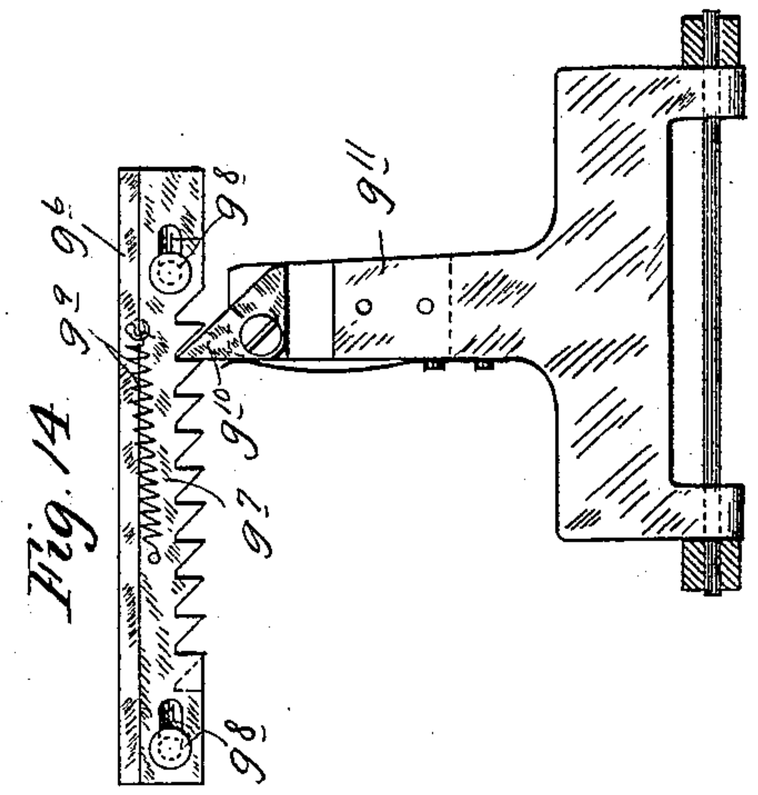

Fig. 14

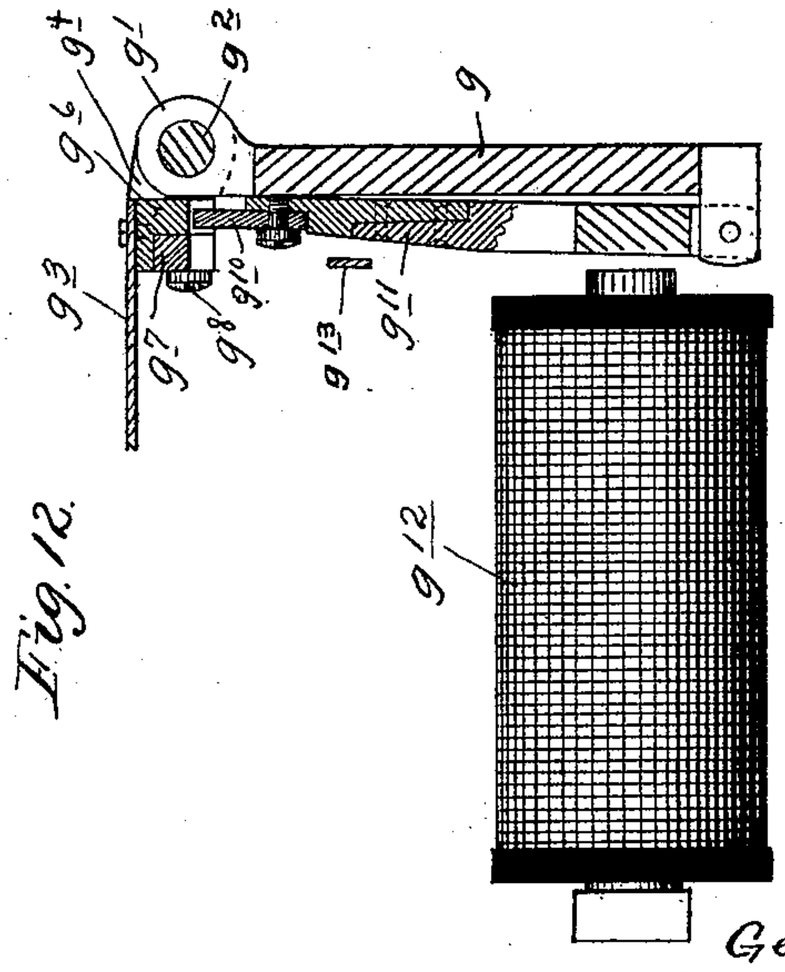

Fig. 12.

Witnesses.
Harry Kilgore,
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(No Model.) 12 Sheets—Sheet 8.

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COMPOSING MACHINE FOR TYPE CASTING AND SETTING MACHINES.

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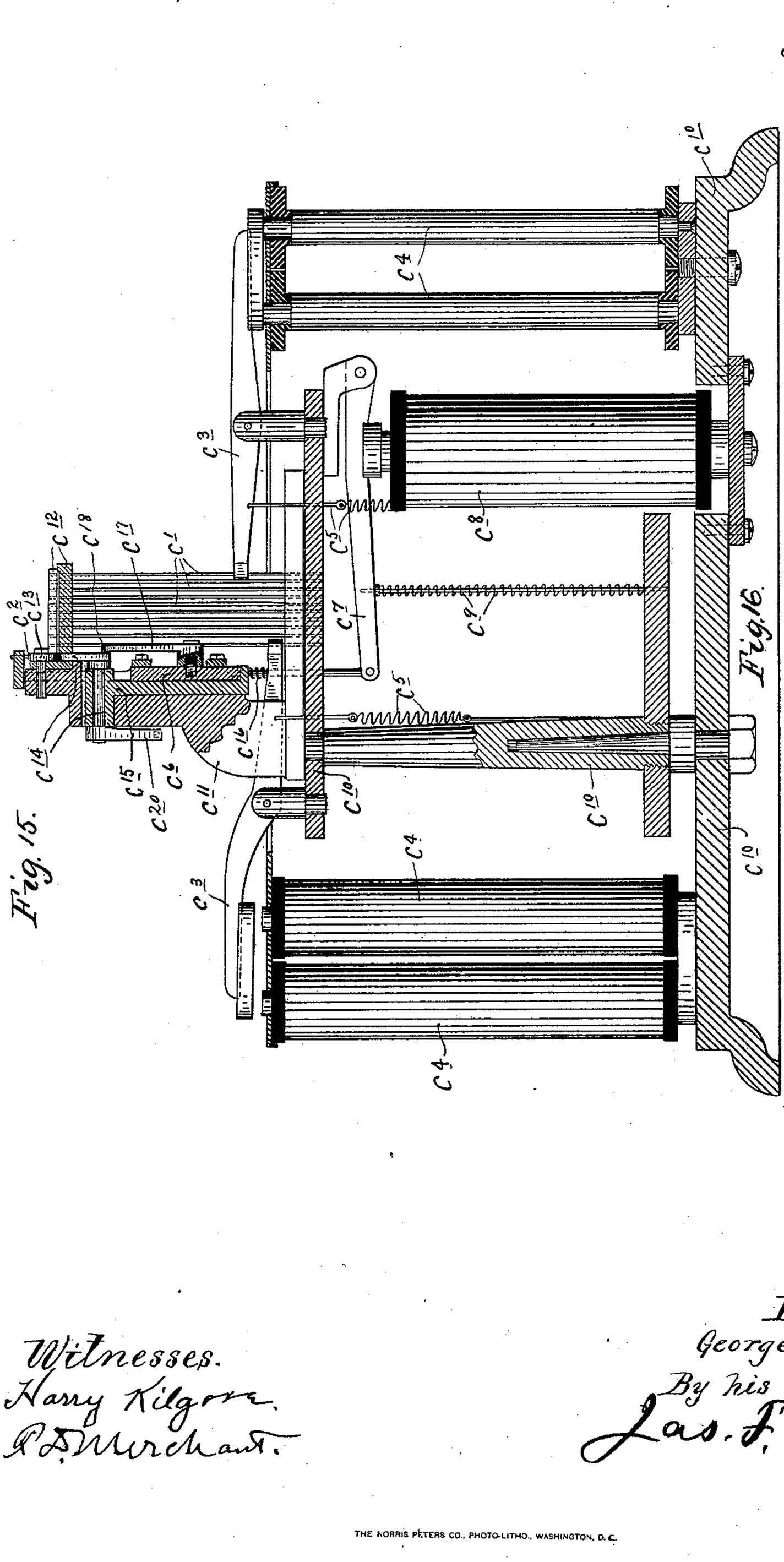

Fig. 15.

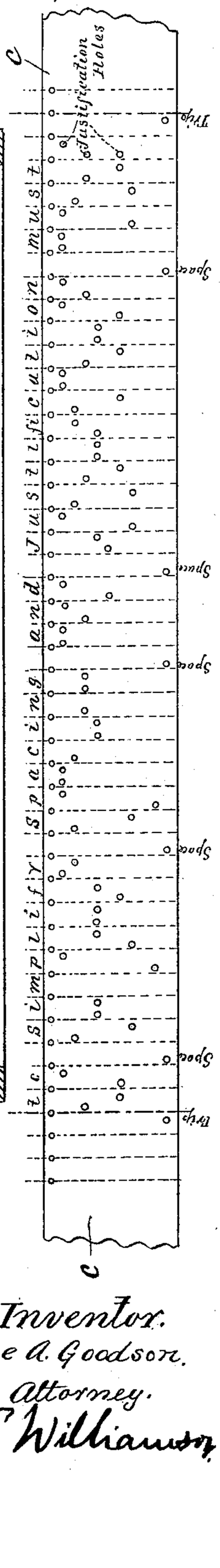

Fig. 16.

Witnesses.
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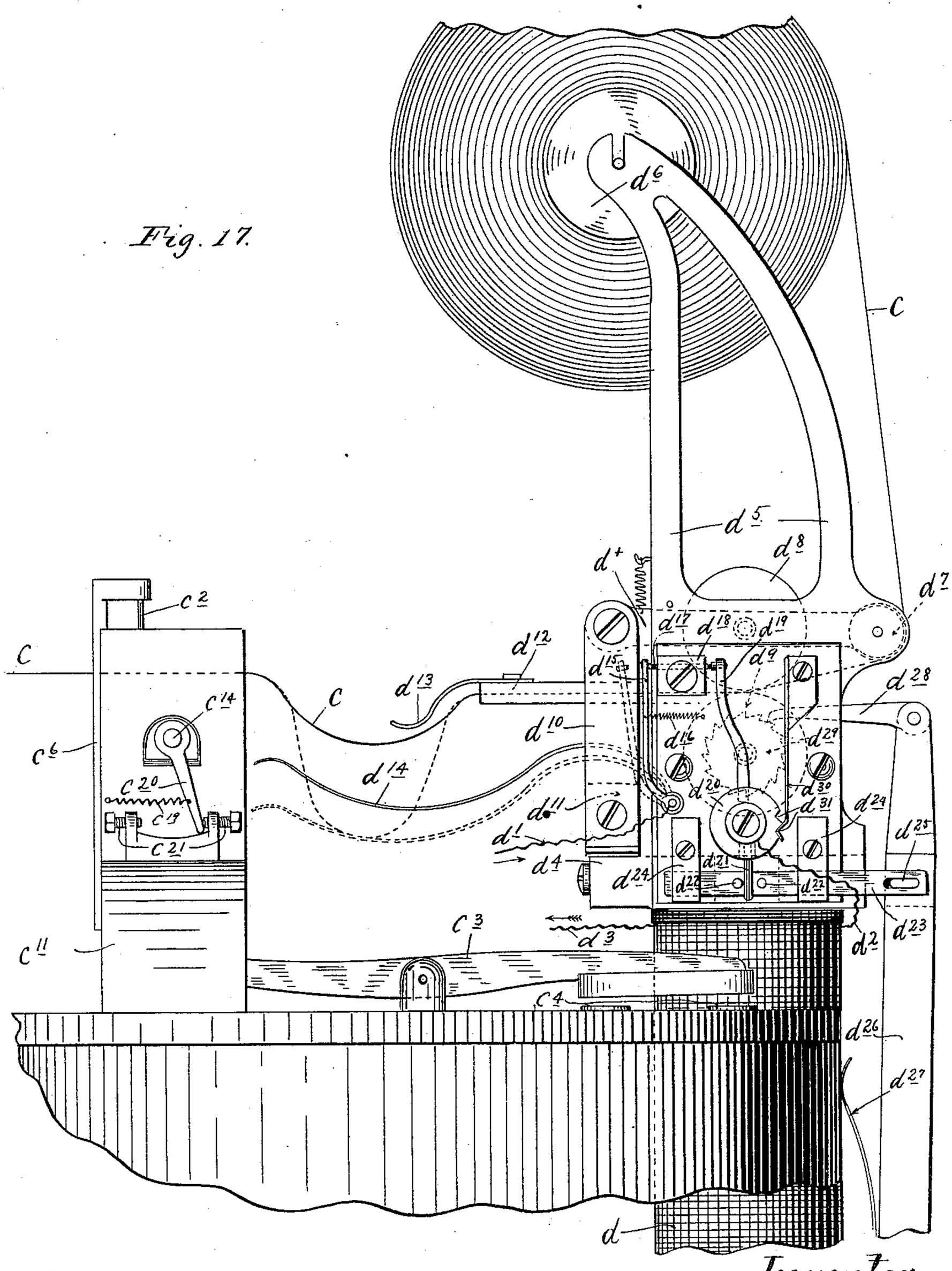
(No Model.) 12 Sheets—Sheet 9.

G. A. GOODSON.

COMPOSING MACHINE FOR TYPE CASTING AND SETTING MACHINES.

No. 606,007. Patented June 21, 1898.

Fig. 17.



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(No Model.) 12 Sheets—Sheet 10.

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COMPOSING MACHINE FOR TYPE CASTING AND SETTING MACHINES.

No. 606,007. Patented June 21, 1898.

Fig. 18.

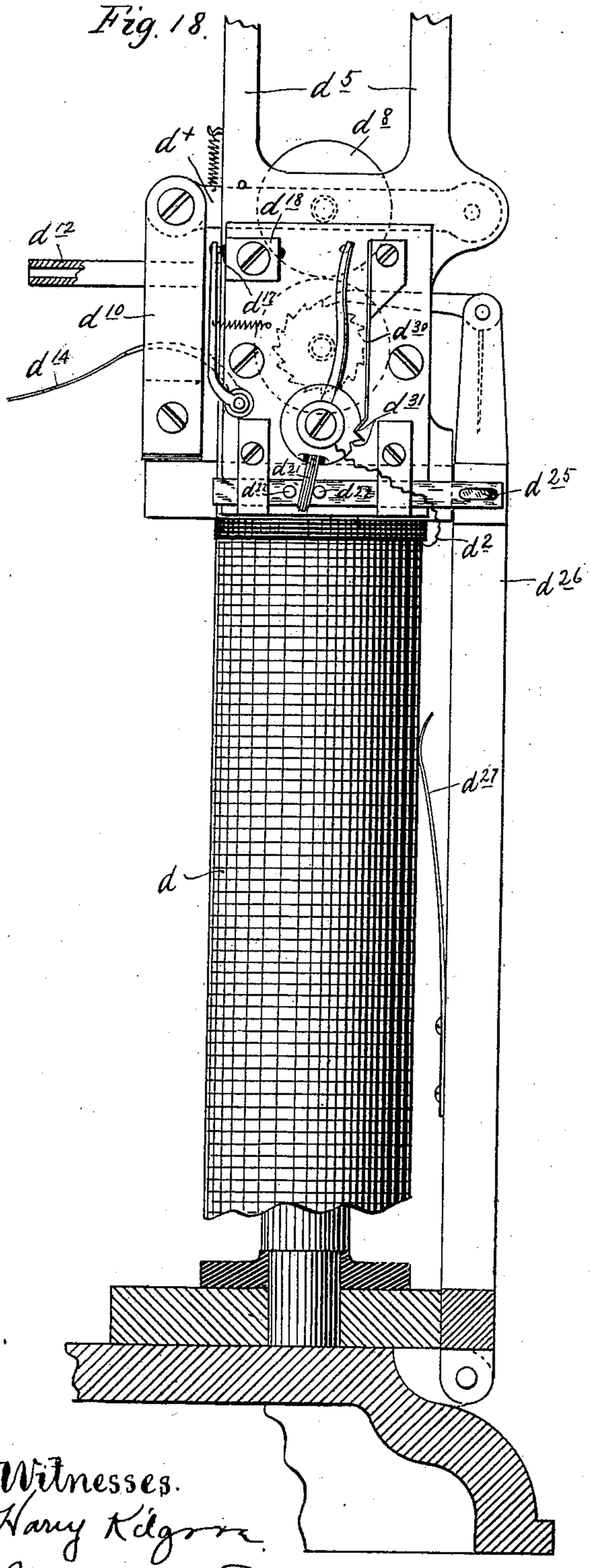


Fig. 19.

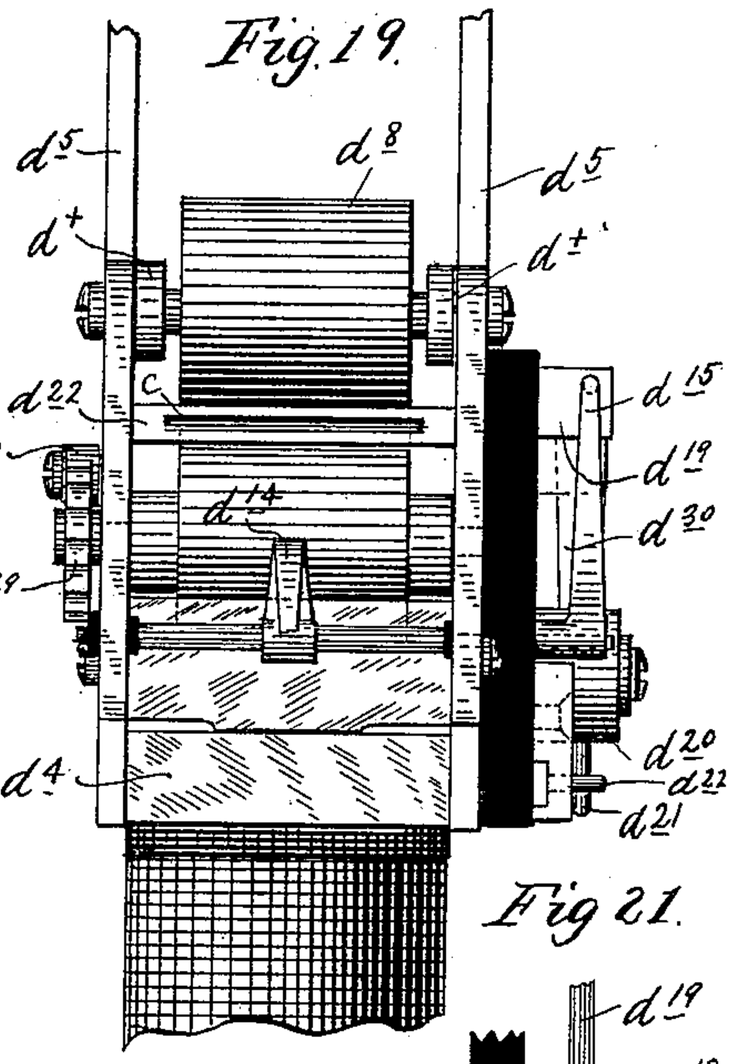


Fig 21.

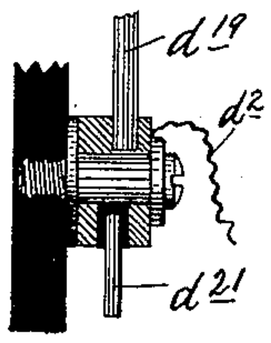
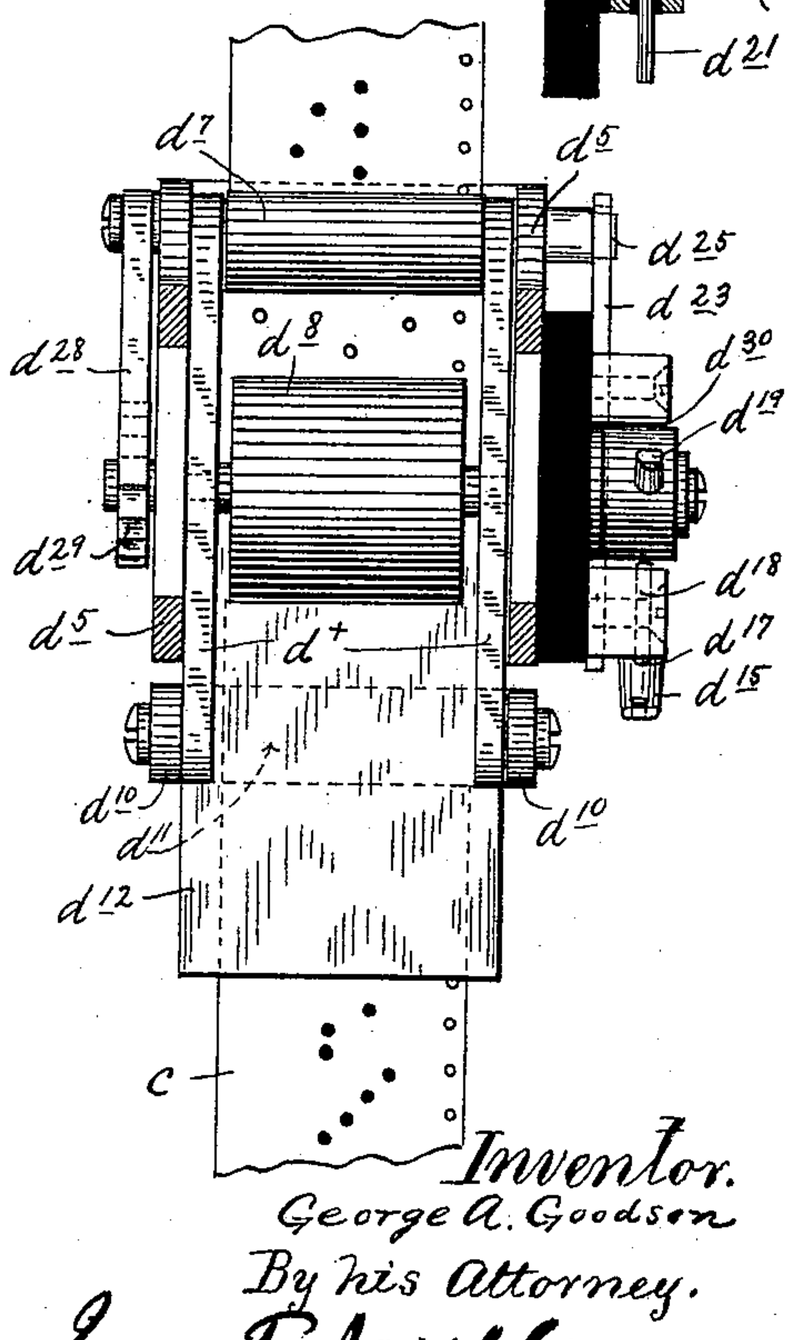


Fig. 20.



(No Model.) 12 Sheets—Sheet 11.

G. A. GOODSON.

COMPOSING MACHINE FOR TYPE CASTING AND SETTING MACHINES.

No. 606,007. Patented June 21, 1898.

Fig 23.

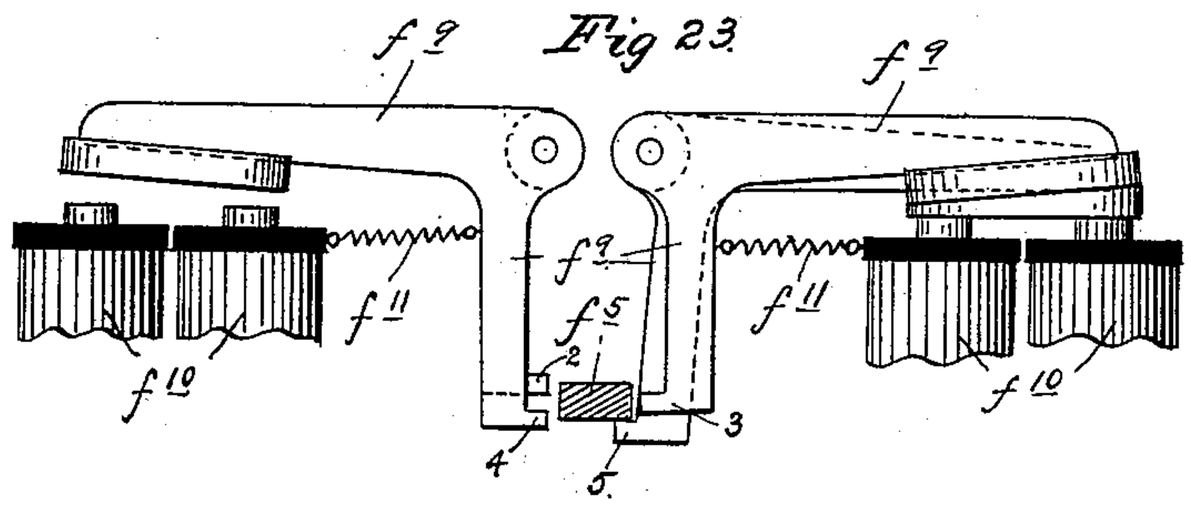
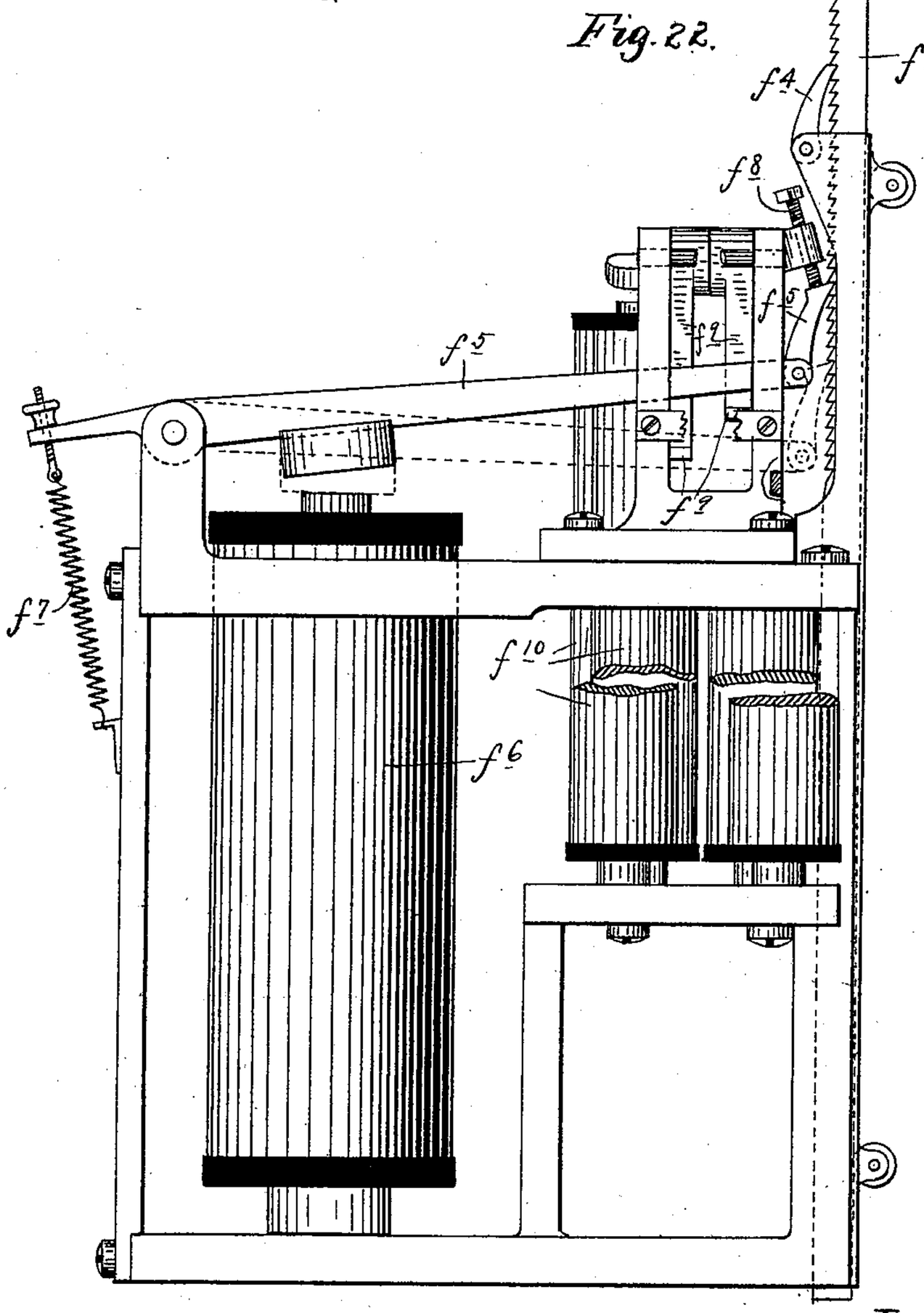


Fig. 22.



Witnesses
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Jas. F. Williamson

(No Model.) 12 Sheets—Sheet 12.

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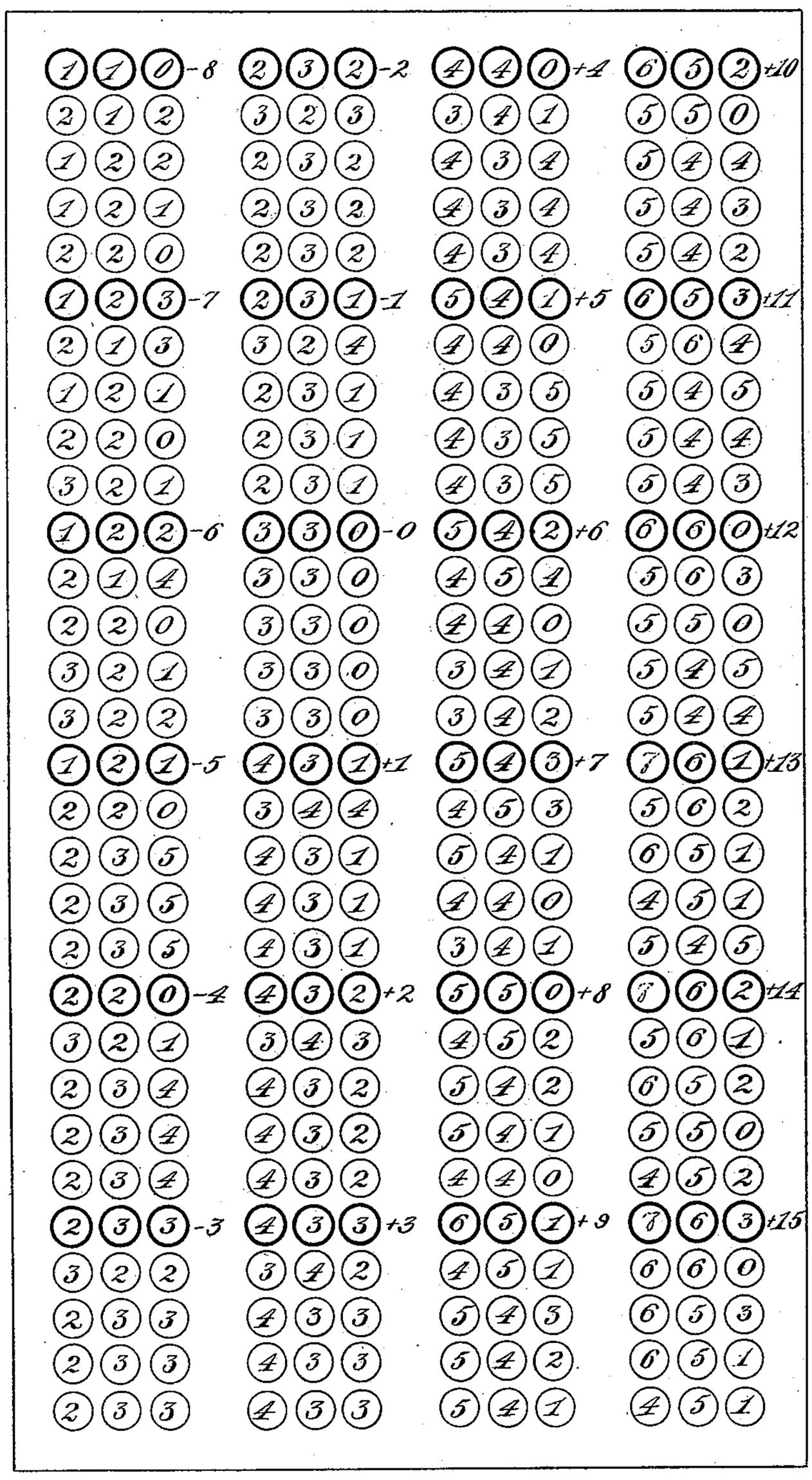
COMPOSING MACHINE FOR TYPE CASTING AND SETTING MACHINES.

No. 606,007. Patented June 21, 1898.

Fig. 24.



Witnesses.
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Inventor.
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Jas. F. Williamson.

UNITED STATES PATENT OFFICE.

GEORGE ARTHUR GOODSON, OF MINNEAPOLIS, MINNESOTA.

COMPOSING-MACHINE FOR TYPE CASTING AND SETTING MACHINES.

SPECIFICATION forming part of Letters Patent No. 606,007, dated June 21, 1898.

Application filed September 27, 1897. Serial No. 653,168. (No model.)

To all whom it may concern:

Be it known that I, GEORGE ARTHUR GOODSON, a subject of the Queen of Great Britain, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Composing-Machines for Type Casting and Setting Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to composing-machines for type casting and setting machines, and has for its especial object to provide a composing-machine adapted to the improved type casting and setting machine which is disclosed in my companion application, filed of even date herewith, Serial No. 653,167.

In what is known as the "Goodson" system for the production of justified lines of individual type the type casting and setting machine operates automatically under the control of a perforated representative strip. The said strip is produced by a composing-machine, which in turn involves the coöperation of a type-writer, a differential letter-space indicator, and a perforator. The type produced are of the self-spacing variety, measurable on the unit principle of face and the point principle of body.

The general relations of the composing-machine and the type casting and setting machine are disclosed in my British Patent No. 23,684 of 1894. The type casting and setting machine in its original form is disclosed in my United States Patent No. 530,481, of December 4, 1894. The original composing mechanism is disclosed in my pending application, Serial No. 493,115, filed December 8, 1893. My improved feed for the strip on the perforator is disclosed in my pending United States application, Serial No. 620,612, filed January 25, 1897, and my improved letter-space indicator is disclosed in my pending United States application, Serial No. 620,615, filed January 25, 1897, and allowed April 9, 1897. The mechanisms disclosed in my said two applications filed January 25, 1897, as far as they go are identical with the corresponding mechanisms disclosed in this application.

In the Goodson type casting and setting machine the matrices are arranged on the matrix-block in rows in two directions on a bi-factored principle to permit the block to be brought into casting position for any given matrix by a two-way movement of the block. Otherwise stated, there are ten rows of ten matrices each. The matrices are also grouped according to size of face, or, otherwise stated, any given row in one direction on the matrix has matrices all of a common size. There are several rows with matrices of the same size. The matrix-block is intercepted by two series of stops, operated by corresponding magnets, for positioning the matrix-block as required to cast the desired type. Nine magnets answer for each series, because the tenth stop in each series may be a stationary stop, as it measures the extreme movement of the matrix-block in each direction. The mold-plunger is variably intercepted by a series of six stops corresponding to the different sizes of type-face, including quads as type, and four of these stops are operated by magnets which are connected up in series with the corresponding row-selecting stop-magnets of the matrix-block. At word-spaces the matrix-block assumes its extreme positions in each direction, and the connections to the proper mold-plunger magnets are made through a justifier, which is adapted to be variably set to produce quads of the required sizes to justify the line. After a line is cast the cast line must be delivered to the galley, and this is done by devices operated by a normally-idle cam-wheel, which may be thrown into gear by a suitable clutch under the control of an electric trip. When started, this normally-idle cam delivers the line of type last cast and moves the parts of the justifier which require to be set into an extreme or initial position against suitable retracting-springs and then releases the said parts, thereby permitting the same to be variably intercepted by suitable stops, operated by magnets, for properly setting the same for the next line. All of these electric devices are controlled by the perforated strip, which coöperates for that purpose with a bank of twenty thrust-pins forming parts of the electric connections on the type casting and setting machine. In the circuit connections of the type casting and setting machine is also located a two-

way switch adapted in one position of its movable part to establish what are called the "working-circuit connections" from said bank of thrust-pins and in another position to establish what are called the "setting-circuit connections" for said bank of thrust-pins. By the "working circuit" is meant that which is used while the type is being cast for a given line, and by the "setting-circuit" is meant that which is used for setting the parts of the justifier. The working circuit has a branch through the escapement-magnet of the justifier, which is energized at the word-space hole in the strip. There is also a trip-circuit for tripping the clutch and the normally-idle cam-wheel into action. Hence on the strip which is produced by the composing-machine there must be what may be called the "working holes," including under that name the holes for characters and word-spaces. There must be also what may be called the "justification-holes" for setting the different parts of the justifier, and, finally, there must be what may be called the "trip-hole" for tripping the clutch and the normally-idle cam-wheel of the type casting and setting machine into action. These general features are common to the strip produced by the composing-machine shown in this application and those disclosed in my prior patents and application. In my prior patents, however, the justifier was designed to effect the distribution always among the first four spaces from the end of the line, as read in print, according to an arbitrary predetermined scheme of distribution, and thereafter to make the remaining quads, if any, of the normal size. This might and frequently did involve three sizes of quads.

In my improved type casting and setting machine shown in my companion application a justifier is disclosed wherein the justification-space is distributed among all of the word-spaces of any line within the predetermined range according to an arbitrary prearranged scheme of distribution designed to secure the most even distribution possible. Otherwise stated, on my improved type casting and setting machine there never can be but two sizes of quads, and these will differ from each other only by one unit. The quads may of course all be of the same size. Provision is made on the type casting and setting machine for the justification of lines ranging from four to eight word-spaces or from five to nine words and for the distribution within that range of from one to eight units by way of subtraction or negative justification and from one to fifteen units by way of addition or positive justification. The normal quad on that machine has three units of face. In order to accomplish this result, the justifier on said improved type casting and setting machine has three parts which require to be variably set by three corresponding series of stops and stop-magnets, and hence there must be three corresponding justification-holes properly located in the strip which is produced by the composing-machine herein disclosed.

The chief object of my present invention, therefore, is to provide a device which will make the said justification-holes and which for convenience may also be called the "justifier." Another and minor object is to provide an improved automatic slack-provider.

To these ends my invention consists of the novel devices and combinations of devices, which will be hereinafter described, and defined in the claims.

With the foregoing general statements in mind it is thought that it will be easy to follow the detailed description which will now be given.

The invention is illustrated in the accompanying drawings, wherein like notations refer to like parts throughout the several views.

Figure 1 is a perspective view of the composing-machine. Fig. 2 is a diagram view for showing the electric connections under the control of the type-writer and the justifier. Fig. 3 is a vertical longitudinal section through the type-writer and the hard-rubber base-block with some parts removed and others broken away to show the relation of the type-writer to the electric connections. Fig. 4 is a cross-section on the line $x^4\,x^4$ of Fig. 3 with some parts removed. Fig. 5 is a front end elevation of the hard-rubber base with the type-writer removed therefrom. Fig. 6 is a plan view of the justifier detached. Fig. 7 is a vertical longitudinal section through the justifier on the line $x^7\,x^7$ of Fig. 6. Fig. 8 is a cross-section on the line $x^8\,x^8$ of Figs. 6 and 7. Fig. 9 is a vertical section showing some of the same parts as in Fig. 7, but on a much larger scale, the same being double full size. Fig. 10 is a cross-section on the line $x^{10}\,x^{10}$ of Figs. 6 and 9, some parts being broken away. Fig. 11 is a bottom plan view of the parts shown in Fig. 10. Figs. 12, 13, and 14 are details illustrating the escapement for the justifier. Fig. 15 is a vertical section through the perforator crosswise of the strip's travel, approximately at the center of the feed devices, with some parts removed and others broken away. Fig. 16 is a plan view of a specimen strip, illustrating the product of the machine, full size. Fig. 17 is a side elevation of the upper part of a portion of the perforator for showing the slack-provider, some parts being broken away. Fig. 18 is a view in side elevation, showing some of the same parts as in Fig. 17, but in a different position relative to each other. Fig. 19 is a left end elevation of the parts shown in Fig. 18. Fig. 20 is a plan view of the parts shown in Fig. 19. Fig. 21 is a detail of one of the circuit-breakers shown in Figs. 17 to 20. Fig. 22 is a side elevation illustrating the feed mechanism of the letter-space indicator, with some parts removed and others broken away.

Fig. 23 is a detail of some of the parts shown in Fig. 22. Fig. 24 is a plan view of the justification-chart.

The type-writer, (see Figs. 1 to 5.)—The type-writer may be of any suitable kind, but is preferably one having a separate key for each character. The Yost machine answers these conditions and is the one shown in the drawings. For the purposes of this case it will be sufficient to distinguish frame a, the character-keys and key-levers a', with their rods a^2, the space-key and key-bail a^3, the feed-ring a^4 and the stem a^5 operated thereby, the feed-lever a^6, the link a^7, connecting the space-bail a^3 to the feed-lever a^6, and the rod a^8, which operates the escapement of the type-writer.

The type-writer rests on a base-board b, of hard rubber or other suitable insulating material, which is provided with a pair of special keys b' b^2. The other parts immediately connected to the type-writer and the said base-board b relate to the electric connections and will later be detailed under that heading.

The strip-punches and feed devices of the perforator, (see Figs. 1, 2, 15, and 17.)—At the perforator the strip c is subject to a bank of twenty punches c', arranged in two rows or series of ten each, as best shown in Figs. 2 and 15, for making the working holes, and to a punch c^2 for making the marginal feed-holes in the strip c. The punches c' for making the working holes are carried by armature-levers c^3, which are subject to magnets c^4 and springs c^5. The feed-hole punch c^2 is carried on the upper end of a plunger c^6, the stem of which is attached below to an armature-lever c^7. The armature-lever c^7 is subject to a magnet c^8 and a spring c^9. This plunger c^6, magnet c^8, and spring c^9 not only operate the feed-punch c^2, but also operate the feed devices for the strip. The said several parts c' to c^9, inclusive, so far noted and other parts to be noted are supported from the main frame c^{10} and an upper bracket c^{11}.

The strip c passes between the pair of die-blocks c^{12} for the punches c' and c^2 and is subject to a resistance-roller c^{13} and a four-motion feed-disk c^{14}, as best shown in Fig. 15. For its up-and-down motion said feed-disk c^{14} is supported by a carrier c^{15}, which is pulled down by the plunger c^6 and thrown up by a spring c^{16}. For its rocking motion said feed-disk c^{14} is subject to a finger c^{17}, carried by the plunger c^6, adapted to act on a stud c^{18}, projecting from said disk, and to a retracting-spring c^{19}, applied to a stop-arm c^{20}, depending from the arbor of said disk and playing between adjustable stops c^{21}, as best shown in Fig. 17. Under the coöperation of these feed devices said strip c is first yieldingly clamped between the roller c^{13} and the disk c^{14}, and then the disk is rocked forward in the line of feed by the plunger-finger c^{17}, thereby imparting one step of feed movement to the strip. The plunger then moves downward and in the final part of its downward travel pulls with it the carrier c^{15}, and when the disk is clear from the strip its retracting-spring c^{19} will rock the same backward in the line of feed, so as to be ready for the next action. During the initial part of the downstroke of the plunger c^6 the strip c is held in a stationary position by the resistance-roller c^{13} and feed-disk c^{14} under the action of the carrier-spring c^{16}, and during this time the feed-punch c^2, carried by the plunger, makes the feed-hole. During that same time, also, the proper working-hole punches c' are thrown up by the proper magnets c^4 under the control of the type-writer or justifier, as will later appear. This brief statement of the feed devices for the strip is deemed sufficient for this case. These feed devices for the strip act on a slack section of the strip, supplied by an automatic slack-provider, which includes a magnet d, (shown in Figs. 1 and 2,) together with numerous other parts, (shown best in Figs. 17 to 27, inclusive,) which will be described later to avoid confusion from details in considering the main features of the case.

The letter-space indicator, (see Figs. 1, 2, 22, and 23.)—A pointer f moves over a suitable graduated dial f^+ and is subject to the action of a pinion f' and a divided rack f^2 f^3. (Best shown in Figs. 1 and 22.) The lower rack-section f^3 is subject to a retaining-pawl f^4 and to a feed pawl and lever f^5. The said lever f^5 is subject to a magnet f^6 and a spring f^7. Under the feed stroke of the lever f^5 the spring-pawl on the end thereof moves the rack upward until intercepted by a banking-stop f^8, adapted to engage with the head of the pawl. If the said feed-lever f^5 is pulled downward to its limit, it will impart to the rack f^3 its longest stroke, which would represent six units, as measured on the indicator. The said feed-lever f^5 may, however, be intercepted in any one of four other positions by suitable stop-levers f^9, of bell-crank form, which are subject to four corresponding magnets f^{10} and springs f^{11}. The inner or depending arms of these bell-crank levers f^9 are of different lengths, and the feed-lever f^5 works between the same, as best shown in Fig. 23. By energizing the proper member of the magnets f^{10} any required one of said stop-levers f^9 may be thrown into the path of the feed-lever f^5 on its downward stroke, and thereby be made to determine the amount of feed movement which will be imparted to the rack f^3 by said lever f^5 when the said lever makes its upward or feeding throw under the action of the spring f^7. Hence by these devices the rack f^3 may be variably fed, as required, to represent five different amounts of feed, ranging from two to six units, as represented on the indicator. The short or depending arms of the bell-crank stop-levers f^9 are marked with numerals ranging from "2" to "5" to represent the corresponding amounts of feed movement controlled thereby, as expressed on the indicator. The upper rack-section f^2 (shown in Fig. 1) is not operated on

by the lower section f^3 until the range of justification-space is reached on the line, when it will begin to move with the section f^3, and so continue throughout the rest of the rack's travel, thereby causing the pointer f to indicate the units of shortage or excess on the dial of the indicator. A bell f^{12} (shown in Fig. 1) sounds when the upper rack-section f^2 and the pointer f begin to move.

The justifier, (see Figs. 1, 2, and 6 to 14, inclusive.)—The action of the justifier can be best understood after describing the wiring; but its parts can be most conveniently specified here in order to better locate the wires. Directly to the left of the hard-rubber base-board b for the type-writer and preferably secured thereto or to the table z, on which all the machines rest, is located a suitable small box-like casing g, which on account of its function may be conveniently called the "connection-box" or "contact-box" of the justifier. This box is provided with guide-lugs g' for a push-rod g^2, which has pivoted thereto the guide-plates g^3 of a traveling keyboard. The hinge-rod g^2 is shouldered to engage with the forward member of the hinge-lugs g^+ of said keyboard for moving the keyboard to its rearmost or initial position and setting under tension a suitable retracting-spring g^5, and said rod g^2 has a collar g^4, which engages with the rear member of said hinge-lugs g^+ for returning said keyboard under the action of said spring g^5, as permitted by a suitable escapement. This escapement includes a pair of racks g^6 g^7, with the member g^7 mounted for a slip motion on the member g^6 and the member g^6 made fast to the keyboard g^3. The member g^7 has slot-and-pin connection with the member g^6, as shown at g^8, and is subject to a light spring g^9 for imparting the slip motion thereto. With the said racks coöperates a spring-held pivoted dog g^{10}, carried at the upper end of an armature-lever g^{11}, pivoted to the fixed box g. The armature-lever g^{11} is subject to a magnet g^{12} and a spring g^{13}. The magnet g^{12} is energized at word-spaces through connections under the control of the type-writer keyboard, as will presently appear. Hence when the traveling keyboard is pushed rearward to its limit it will be held by the said escapement, but will be permitted to move forward one step at a time whenever a word-space is struck on the type-writer. Otherwise stated, the armature-lever g^{11} and the dog g^{10} carried thereby, under the coöperation of the magnet g^{11} and the spring g^{13}, vibrate transversely to the racks, thereby shifting from one to the other and permitting the escapement action in a manner which must be obvious from an inspection of Figs. 12 to 14. The purpose of pivoting the spring-held pawl g^{10} to the armature-lever g^{11} is to permit the traveling keyboard, with the said escapement-racks, to be pushed rearward into its initial or starting position. In this rearward movement of the said traveling keyboard the pivoted dog g^{10} turns on its pivot against its spring, thereby permitting the racks to pass.

In the guide-plates g^3 of the justifier-keyboard are spring-seated a series of keys g^{14}, sufficient in number to represent all possible amounts of justification-space, both negative and positive, for the distribution of which provision is made on the type casting and setting machine. By inspection of Fig. 6 the disposition of these keys and the amounts of justification-space which they represent may be seen. Each of these keys g^{14} is provided with three contact-pins g^{15}, which, if the keyboard be in proper position, are adapted, when the key is depressed, to dip into three corresponding mercury-wells g^{16}, formed in a hard-rubber block or plate g^{17}, forming the face of the contact or connection box g. Directly under the said hard-rubber plate g^{17} is a stack of fifteen contact-plates g^{18}, insulated from each other by corresponding intervening plates g^{19} of insulating material. Contact-pins g^{20} connect the proper plate of the stack with the proper members of the mercury-cells g^{16} in the hard-rubber face-plate g^{17}, passing in their course through all the other plates which have holes of sufficient size to prevent contact therewith, as best shown in Fig. 9. The said contact-plates g^{18} are connected by correspondingly-disposed pins g^{21}, each to one of fifteen binding-posts g^{22}, as best shown in Figs. 10 and 11.

The further features and actions of the justifier may be best understood after describing the wiring, which will now be done.

The wiring, (see Figs. 1 to 5, inclusive.)—The feed-circuit for the perforator and the letter-space indicator is controlled by a relay. (Shown in Figs. 1 and 2.) The parts of this relay are shown in Fig. 2 and are marked h h' h^2 h^3 h^4 h^5. Most of the wiring can be traced on the diagram view Fig. 2. From any suitable source the current can pass over the supply-wire r to the turn-button r' of a circuit maker and breaker, and thence to a wire r^2, which leads to a mercury-cell r^3, formed in the hard-rubber base b. The type-writer is provided with a contact-pin r^4, which, when the parts are in working position, dips constantly into the mercury-well r^3, as best shown in Fig. 4. Said contact-pin r^4 is carried by an insulated spring-contact r^5 on the type-writer frame a, with which coöperates another spring-contact r^6, fixed to but not insulated from said type-writer frame a. Said spring-contacts r^5 r^6 overlie each other at their free or spring ends and are normally separated, thereby normally opening the circuit at that point. These spring-contacts r^5 r^6 directly underlie the escapement-rod of the type-writer, and the upper member r^6 of said spring-contacts is subject to said escapement-rod a^8 at every key action of the type-writer. Hence whenever this occurs current can reach the metallic frame and key-levers of the type-writer. The character-keys a' are each provided with a pair of contact-pins r^7 at the

lower end of the key-stem which, when the key is depressed, dip into corresponding mercury-wells r^8, formed in the hard-rubber base-board b. From the pair of wells r^8 extend a corresponding pair of wires r^9 to the proper pair of eighteen binding-posts r^{10} in the hard-rubber base-board b. From the binding-posts r^{10} eighteen corresponding wires r^{11} extend to the punch-magnets c^4 of the perforator. Nine of said wires r^{11} go to nine magnets which operate nine out of the front row of the bank of punches c', and the other nine go to the nine magnets which operate the nine punches out of the rear row of the bank. The front row makes the holes which control the stops on the type casting and setting machine for selecting the row of the matrix-block, and the rear row or series of punches makes the holes which control the stops on the type casting and setting machine for selecting the individual matrix out of the row. Hence the front series of punches c', as best shown on the diagram-sheet, may conveniently be called the "row-punches" and the rear series be called the "individual" punches, and their corresponding magnets may be distinguished in the same way. This bifactored arrangement affords $9 \times 9 = 81$ combinations for making the required character-holes in the strip c.

The return-wires from the individual punch-magnets all unite to a common wire r^{12}, which leads directly back to source, and for convenience will be distinguished as the final return-wire.

The return-wires from the row-magnets are grouped into four sets, which respectively connect by four corresponding wires r^{13} r^{14} r^{15} r^{16} with the four corresponding letter-space magnets f^{10} of the indicator, according to the units of face represented thereby. From these magnets f^{10} of the indicator the return-wires all unite into a single wire r^{17}, which taps the final return-wire r^{12}.

Otherwise and briefly stated the row-magnets of the perforator are grouped like the rows on the matrix-block, according to sizes of face, and are connected up in series with the unit-magnets of the letter-space indicator.

The word-space key a^3 is provided with a contact-pin r^{18}, which, when the key is depressed, dips into a mercury-well r^{19} in the base-board b. From said well r^{19} sections of a wire r^{20} lead through the escapement-magnet g^{12} of the justifier, and a binding-post marked with the same reference as the wire, to that member of the punch-magnets c^4 which is devoted to the purpose of making the word-space holes on the strip. This is located in the rear series of the bank and the magnet is marked with the word "Space" on the diagram view. From said space-magnet the return-wire r^{21} joins the three-unit return-wire r^{14} from the row-magnets, and, by way of the same, leads to the three-unit member of the indicator-magnet f^{10}.

From the section r^2 of the supply-wire a branch wire r^{22} extends to the contact h^2 of the relay, and from the other contact h^3 of the relay a wire r^{23} extends to the feed-magnet c^8 of the perforator, whence the return-wire r^{24} joins the individual and final return-wire r^{12}. From the feed-wire section r^{23}, controlled by the relay, a branch wire r^{25} extends to the feed-magnet f^6 of the indicator, whence a return-wire r^{26} taps the return-wire r^{17} from the unit-magnets of the indicator and reaches the final return-wire r^{12}. These feed-circuit connections for the perforator and the indicator are therefore controlled by the relay. The relay in turn has a special circuit. For this purpose the type-writer frame has a contact-pin r^{27}, which constantly dips into a mercury-well r^{28} in the rubber base-board b. From said well r^{28} a wire r^{29} leads to the relay-magnet h', whence the return-wire r^{30} joins the return-wire r^{17}, which taps the final return-wire r^{12}. Every time a key action occurs on the type-writer the type-writer frame a is charged, as hitherto noted, and hence the circuit through the relay-magnet h' will be closed over the said connection r^{27} to r^{30}, inclusive, above noted, and when said relay-magnet h is thus energized the relay-contacts h^2 h^3 will be brought together, thereby closing the feed-circuit over the wires r^{22} to r^{26}, inclusive, and energizing the feed-magnet c^8 of the perforator and the feed-magnet f^6 of the indicator. In this way the feed for the strip at the perforator and the feed for the racks at the indicator are effected at every key action from the character or space keys of the type-writer.

With the connections so far described the holes on the strip c or characters, word-spaces, and for the feed can be made. The additional connections for making the justification-holes and trip-hole will next be noted.

From the constantly-charged mercury-well r^3 in the hard-rubber base-board b a wire t leads to a contact-strip t', fixed at its center to the under surface of said board b, near the front end of the same, as best shown in Figs. 3 and 5. Hence this contact-strip t' is constantly charged. The spring ends or fingers of said contact-strip t' underlie the two special keys b' b^2 of said hard-rubber base-board and by their spring action hold the said two keys in their uppermost or normal position. Upon depressing the special key b', which may be distinguished as the special "feed-key," the finger-contact t^2 may be made to engage with the contact t^3, fixed to the hard-rubber block b. From the said fixed contact t^3 a wire t^4 extends to a part of the metallic frame of the justifier—such, for example, as to one of the lugs g' of the box g. Thence the current can reach the traveling keyboard of the justifier. Under the key action of the justifier-keyboard the current passes over the proper members of the contact-plates g^{18} and proper pins g^{20} g^{21} to the proper binding-post g^{22} in the connection-box g. From said fifteen binding-posts g^{22} extend fifteen corresponding

wires t^5. (Shown in dotted lines in the diagram views.) Of said fifteen justifier-wires t^5 nine thereof tap the nine members of the wires r^{11} which lead to the individual magnets of the perforator, and the other six tap the other nine wires r^{11} which lead to the row-magnets of the perforator. This factored arrangement affords all the combinations which are necessary to produce the required justification-holes on the strip. From the fixed contact t^8 a short wire t^6 leads to the relay mercury-cell r^{28}. Hence whenever the special feed-key t' is depressed to charge the justifier-keyboard the relay-circuit will also be closed, thereby in turn closing the feed-circuit for effecting the feed of the strip at the perforator. The special feed-key b' is struck with one hand whenever a key on the justifier-keyboard is struck with the other. When the other special key b^2, which may be distinguished as the "trip-key," is depressed, the other spring-finger t^7 of the constantly-charged contact t' on the rubber board b will be brought against a fixed contact t^8 on said base-board. From said contact t^8 a wire t^9 extends through a binding-post marked with the same reference to that member of the punch-magnets c^4 which is devoted to the special purpose of producing the trip-hole on the strip. From this trip-magnet the return-wire t^{10} taps the common return-wire r^{12}, leading back to source. The special feed-key b' and the trip-key b^2 are both operated at the same time, thereby securing the proper feed for the strip at the perforator when said trip-hole is made.

The wiring so far noted and marked with the reference-letter r and its powers is the wiring which is used for making the character and word-space holes on the strip and such of the marginal feed-holes as correspond to said character and space holes, and these control what has been called the "working-circuit connections" on the type casting and setting machine. The wiring so far noted and marked with the reference-letter t and its powers is used to make the justification-holes and the trip-holes on the strip, together with such of the feed-holes as coöperate with said justification and trip holes, and these control what has been called the "setting-circuit connections" on the type casting and setting machine for delivering the last previously-cast line of type and setting the justifier for the next line of type, as hitherto noted.

The principle and action of the justifier.—As already stated in the introduction, provision is made on the type casting and setting machine for the justification of lines ranging from four to eight word-spaces or from five to nine words and for the distribution within that range of from one to eight units of justification-space by way of subtraction and from one to fifteen units by way of addition. Hence the traveling keyboard of the justifier is provided with eight possible steps of travel from its initial to its final position under the control of the escapement-magnet g^{12}, which is energized, as hitherto noted, every time that the word-space key is struck on the typewriter. As no provision is made for the justification of lines having only four words or three spaces, the said traveling keyboard of the justifier has three idle steps of movement before bringing its keys into position for establishing connections through the contact-box g when depressed. Thereafter the traveling keyboard will occupy an operative position at every word-space and will move for five steps after thus becoming operative, thereby bringing the contacts carried by its keys into that many different positions in respect to the mercury-cell face-plate on the connection-box. The connections in this contact or connection box g of the justifier are sufficient in number and are arbitrarily prearranged to make the holes on the strip for the distribution of all the possible amounts of justification-space represented on the keyboard, negative or positive, among the range of word-spaces before noted. Otherwise stated, there are five positions of the traveling keyboard in which any desired three members of the wires t^5, fifteen in number, must be available. Hence it is convenient to use the said stack of fifteen plates with the pins properly disposed to establish the proper connections from any of the cells of the hard-rubber face-plate in the connection-box g when any of the keys of the justifier-keyboard are depressed in any one of the five possible operative positions of said traveling keyboard.

The scheme of distribution having once been predetermined, the wiring is arranged to accomplish this result. In this respect this justifier for making the three justification-holes in a single feed-space of the strip corresponds exactly to the wiring from the fixed member of the switchboard on the type casting and setting machine to the magnets which set the three series of stops on that machine for variably setting the three parts of the justifier which is used on that machine.

The scheme of distribution is shown on the chart illustrated in Fig. 24. With the exception of the numbers thereon this chart might be regarded as representing the mercury-cell face-plate of the connection-box g of the justifier. By an inspection of this chart it will be seen that it contains four columns of circles with three rows in each column. The columns are further divided into sets of fifteen circles each, marked at the head of each set with three heavy-line circles. It will also be noticed that there are six of these sets in each column, corresponding in this respect with the number of keys in each of the four rows lengthwise of the traveling keyboard. Hence every one of the said sets of circles may be said to be devoted to a particular key on the justifier-keyboard and that the said key with its three contacts can coöperate with three of said circles or the

corresponding cells on the face-plate of the justifier in its possible five different operative positions under the traveling movement of the keyboard. Hence the possible amounts represented by each key may be distributed from five different sets of three connections each, and this represents the range of from four to eight word-spaces, which is indicated by the numbers on the left margin of the chart. The numbers adjacent to the heavy line row of circles at the head of each set represent the amount of justification-space or the key on the keyboard to which that set is appropriated.

Reading crosswise of each column the number in the third circle represents the number of quads which will be made to the right or from the end of the line as read before the shift will be made, if any, to the other size of quads. The first circle represents the sizes of the said quads to the right, expressed in units of face, and the intermediate circle represents the sizes of the quads to the left or those which will be made after the shift, if any, takes place. With this explanation the distribution for any line within the predetermined range can be read on the said chart, and the connections from the contact-box g must be so disposed as to produce the justification-holes in the strip.

The specimen strip shown in Fig. 16 and the justification-chart shown in Fig. 24 are identical with those shown in certain views of the drawings of the type casting and setting machine disclosed in the companion case, Serial No. 653,167, filed of even date herewith.

From the foregoing statement it is thought that the principle and the actions of the justifier must be distinct.

When the operator reaches the point where it is necessary to stop the line of composition on the type-writer, he observes the shortage or excess as shown on the indicator, and he then strikes the special feed-key b' and the proper member of the justifier-keys, which will have the effect of making the proper holes in the separate feed-face of the strip, as required for purposes of justification. He then strikes the trip-key b^2 and also the special feed-key b', thereby producing the trip-hole in the last feed-space on the strip for that line. The line is then ready for use on the type casting and setting machine. The operator then pushes the rod g^2 and the traveling keyboard of the justifier back to its initial position with his left hand at the same time that he throws the type-writer carriage to its initial position with his right hand. While the strip is being punctured at the perforator for the given line, a type-written proof of the line is produced on the type-writer.

The automatic slack-provider for the strip, (see Figs. 1, 2, and 17 to 21.)—When considering the punch devices and the strip-feed devices of the perforator, it was noted that the said feed devices always operated on a slack section of the strip and that this slack section was supplied by an automatic slack-provider which included as an element thereof the magnet d. The other details of this slack-provider will now be noted. The current reaches the magnet d over wire-sections d' d^2, which are separated by an automatic circuit-controller, which is in turn controlled by the strip c itself. From the magnet d the return is made over a wire d^3, which is shown on the diagram view, Fig. 2, as tapping the final return-wire r^{12}. The wire d' is shown on said diagram view as a branch from the feed-wire section r^{22}, and hence is always available. The said magnet d is provided with a pole-piece d^4, which is laterally extended beyond the top of the magnet at each end. To this pole-piece d^4 are fixed the side plates of a supporting-bracket d^5, which constitutes the framework for the slack-provider. In the upper ends of the said side frames of this bracket d^5 is mounted the spool d^6, from which the strip c is unwound. The strip c passes under a guide-roller d^7 and thence between a pair of friction-rollers d^8 d^9. The roller d^8 is carried by a pair of horizontal arms $d^\times$, which at their inner ends have depending arms d^{10}, to the lower ends of which is fixed a soft-iron cross-bar or armature d^{11} for cooperation with the pole-piece d^4 of the magnet d. The strip c, after passing between the rollers d^8 and d^9, moves through a fixed guide d^{12} and under a spring-finger d^{13}. Directly under the path of the strip c when moving from the guide d^{12} toward the feed devices of the perforator is positioned a long spring-finger d^{14}, forming a part of a rocker pivoted to the bracket d^5 and having an upwardly-extended contact-arm d^{15}. The arm d^{15} is subject to a spring d^{16}, which normally holds the upper end of the same against a contact d^{17}, carried by a hard-rubber block d^{18}, fixed to one of the bracket-plates d^5. With the other end of the contact d^{17} coöperates a contact-arm d^{19}, which is carried by a disk d^{20}, pivoted to the bracket d^5. From said disk d^{20} a branch wire d^2 leads directly to the magnet d. Said disk d^{20} has a downwardly-projecting arm d^{21}, which is insulated from the disk and works between a pair of pins d^{22} on a slide d^{23}. The slide d^{23} is held by guide-keepers d^{24}, fixed to one of the bracket-plates d^5, and at its outer end has slot-and-pin connection, as shown at d^{25}, to a lever d^{26}, which is pivoted below to a part of the perforator-framework and is subject to a spring d^{27}, working opposite to the pole-piece d^4 of the magnet d. At its upper end the said lever d^{26} carries a gravity-pawl d^{28}, which engages with a ratchet d^{29} on the lower roller d^9. A depending spring-pawl d^{30} is adapted to engage with either of two notches d^{31} in the disk d^{20} to hold the said disk under slight friction in whatever position it may be set. With this construction the action is as follows: When the slack section in the strip c has been used up by the feed devices at the perforator, so as to relieve the spring-finger

d^{14}, the spring d^{16} will draw the contacts d^{15} against the contact d^{17}, as shown in Fig. 17 in full lines, thereby closing the circuit to the magnet d and starting the slack-provider. As quick as the magnet d is energized its pole-piece d^4, acting on the soft-iron bar d^{11}, will pull down the upper roller d^8, so as to clamp the strip c against the feed-roller d^9 with sufficient friction for the purpose required. At the same time the pole-piece d^4 will make the pull on the armature-lever d^{26} and cause the pawl d^{28} to act on the ratchet d^{29} and move the roller d^9 forward one step, thereby pulling that much slack in the strip c. As the lever d^{26} reaches the final part of its inward movement under the pull from the pole-piece d^4 one of the pins d^{22} will act on the arm d^{21} and thereby rock the disk d^{20} from the position shown in Fig. 17 into the position shown in Fig. 18. This will break the circuit between the contacts d^{17} and d^{19}. As quick as the magnet d is energized the spring d^{27} will throw the lever d^{26} outward again to its limit, and all the parts will be brought back into the position shown in Fig. 17, thereby again closing the circuit through the magnet d. These actions will be repeated until the strip c has accumulated sufficient slack to drop onto the long spring-finger d^{14}, and when this occurs under the weight from said slack section the said spring-finger d^{14} and the contact-arm d^{15}, forming a part of the same rocker, will be thrown down into the position shown in dotted lines in Fig. 17 against the tension of the light spring d^{16}, thereby opening the circuit between the contacts d^{15} and d^{17}. This will stop the action of the slack-provider until that particular slack section in the strip has been used up, and thereupon the slack-provider will again be started into action as before. This device is therefore entirely automatic under the control of the strip itself, and I have found the same entirely reliable for supplying the required slack in the strip for the action of the feed devices on the perforator. In principle it is similar to corresponding electric slack-providers disclosed in some of my prior patents and applications, but differs therefrom in its details.

All the parts of the composing-machine have been specified so far as it is deemed necessary for the purpose of this case. The specific action of the different parts has also been given, and the general operation was made clear when describing the electric connections and the action of the justifier. It will be understood, of course, that changes might be made in the details of construction without departing from the spirit of my invention. It will of course be understood that by the term "connection or contact box" as used in this case is meant to be included any and all dispositions which could be made of the necessary contacts for coöperation with the keys of the traveling keyboard of the justifier.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. The combination with a perforator, under the control of an ordinary keyboard having character and space keys, of a justifier comprising a connection-box, having connections to the perforator for the possible amounts of justification-space in lines of the possible number of spaces, according to an arbitrary predetermined scheme of distribution, and a traveling keyboard having a step-by-step movement, in respect to said box, at word-spaces, and provided with keys representing the different amounts of justification-space, for coöperation with said box, to produce the justification-holes required, substantially as described.

2. The combination with an electrically-controlled perforator, and an ordinary keyboard controlling the connections thereto for characters and word-spaces, of a justifier comprising a contact-box having contacts with wires to the perforator, for the possible amounts of justification-space, in lines of the possible number of spaces, according to an arbitrary predetermined scheme of distribution, and a traveling keyboard having a step-by-step movement, in respect to said box, at word-spaces, and provided with contact-keys representing the different amounts of justification-space, for coöperation with said box, substantially as described.

3. The combination with a perforator, under the control of an ordinary keyboard having character and space keys, of a justifier comprising a connection-box, with connections to the perforator, for the possible amounts of justification-space, in lines of the possible number of spaces, according to a predetermined scheme of distribution, a traveling keyboard with contact-keys representing the different amounts of justification-space, for coöperation with said box, and an escapement, under the control of the space-key of the ordinary keyboard, and adapted to impart a step-by-step movement to said traveling keyboard, at word-spaces, substantially as and for the purposes set forth.

4. The combination with the perforator and the ordinary keyboard, of the justifier comprising the connection-box with connections to the perforator for the possible amounts of justification in lines of the possible number of word-spaces, according to an arbitrary predetermined scheme of distribution, a traveling keyboard representing the different amounts of justification-space, the escapement, for said traveling keyboard, controlled by the space-key of the ordinary keyboard, strip-feeding devices on the perforator, under the control of said ordinary keyboard, for characters and spaces, and a special feed-key, for charging the justifier-keyboard and operating said strip-feed devices, substantially as described.

5. The combination with the electrically-controlled perforator, the ordinary keyboard

and the justifier, as described, of the feed-circuit connections for the perforator, the relay-circuit connections for controlling the feed-circuit, with said relay connections arranged to be operated at every key action on the ordinary keyboard, and a special feed-key for closing said relay-circuit, at will, as required for coöperation with the justifier or other purposes, substantially as described.

6. The combination with the electrically-controlled perforator having the bank of punches and punch-magnets, arranged on a bifactored principle, one set for making the row-selecting holes in the strip and the other set for making the holes to select the individual type from the row, as described, of an ordinary keyboard having character and space keys, circuit connections from said keyboard to said punch-magnets, arranged on a bifactored principle for coöperation with said sets of punch-magnets, and an electrically-controlled differential letter-space indicator, having the unit-magnets thereof connected up in series, with said row-selecting punch-magnets, substantially as and for the purposes set forth.

7. The combination with the electrically-controlled perforator and the ordinary keyboard, of the differential letter-space indicator, electrically controlled, the strip-feeding devices on the perforator, the feed-magnet for the indicator, the feed-circuit connections for said perforator and said indicator, with the latter connected up in multiple with the former, a relay, in said feed-circuit, and relay-circuit connections controlled by the ordinary keyboard, for controlling said feed-circuit, all substantially as described.

8. The combination with the electrically-controlled perforator, the ordinary keyboard and the justifier-keyboard, of the circuit connections to the punch-magnets of the perforator, controllable by the keys of both of said keyboards, the electric escapement for the traveling keyboard of the justifier, controlled by the space-key of the ordinary keyboard, the feed-circuit connections for the strip-feeding devices of the perforator, the relay and its circuit connections for controlling said feed-circuit, with said relay connections arranged to be operated at every key action of the ordinary keyboard, the special feed-key for charging the justifier-keyboard and closing said relay-circuit, when a justifier-key is to be struck, and the electrically-controlled differential letter-space indicator, with circuit connections for the same, controlled by the key action of the ordinary keyboard, substantially as described.

9. The combination with the perforator and the type-writer, as described, of the justifier comprising the contact-box g, with the stack of insulated contact-plates g^{18} and the hard-rubber face-plate g^{17}, with mercury-wells g^{16}, the contact-pins g^{20} and g^{21}, disposed as described, the separate wires from said several plates to the corresponding punch-magnets of the perforator, the traveling keyboard with the keys g^{14} having the contacts g^{15}, the escapement for said keyboard, including the magnet g^{12}, with circuit connections controlled by the space-key of the type-writer and the special key b', for charging the justifier-keyboard and controlling the feed-circuit of the perforator, all substantially as and for the purposes set forth.

10. The combination with the electrically-controlled perforator and an ordinary keyboard, of the trip-hole punch and punch-magnet on the perforator, the trip-circuit connections for the same, the special trip-key, feed-circuit connections for the perforator and a special feed-key for operating the same, in coöperation with said trip-key, when required, substantially as described.

11. A slack-provider, for a strip of flexible material, comprising a magnet, a spring-held feed-lever subject to said magnet, a feed-roller subject to said lever, a resistance-roller subject to said magnet, for frictionally clamping said strip against the feed-roller, and circuit connections for said magnet controlled by the slack section in the strip to start the action when the slack is used up and stop the same when a new slack section is accumulated, substantially as described.

12. A slack-provider, for a strip of flexible material, comprising a magnet, a spring-held feed-lever subject to said magnet, a feed-roller subject to said lever, a resistance-roller subject to said magnet for clamping the strip against the feed-roller, and circuit connections for said magnet, including a circuit-closer, subject to a spring for closing the circuit and subject to the weight of the accumulated slack section of the strip, for opening the circuit, to stop the action, substantially as described.

13. The combination with a magnet, of a resistance and a feed roller, between which passes a strip of flexible material, with said resistance-roller subject to said magnet, for frictionally clamping the strip against the feed-roller, a spring-held feed-lever, subject to said magnet and adapted to act on said feed-roller, and a circuit maker and breaker, in the connections for said magnet, operated at the opposite limits of said feed-lever's throw, for making and breaking the circuit, as required, to keep up the motions of said feed-lever, substantially as described.

14. A slack-provider, for a strip of flexible material, comprising a magnet, a spring-held feed-lever, subject to said magnet, a feed-roller subject to said lever, a resistance-roller, subject to said magnet, for clamping the strip against the feed-roller, and circuit connections for said magnet, comprising a circuit-controller, subject to a spring for closing the circuit, and subject to the accumulated slack section for opening the circuit, and a circuit maker and breaker, subject to said feed-lever, at the opposite limits of its strokes, for making and breaking said circuit, to maintain

the action of said feed-lever until the circuit is opened by the weight of the slack, acting on said circuit-controller, substantially as described.

15. The combination with the strip-holding spool, of the magnet d, the spring-held feed-lever, subject to said magnet, the feed-roller subject to said lever, the resistance-roller carried by the arms, which are subject to said magnet, and the circuit connections for said magnet, comprising the controller d^{14} d^{15} d^{16}, operating as described, under the control of the strip, and the circuit maker and breaker d^{19} d^{20}, subject to the action of said feed-lever, by means of the parts d^{21}, d^{22}, d^{23} and d^{25}, all substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE ARTHUR GOODSON.

Witnesses:

JAS. F. WILLIAMSON,

LILLIAN C. ELMORE.