

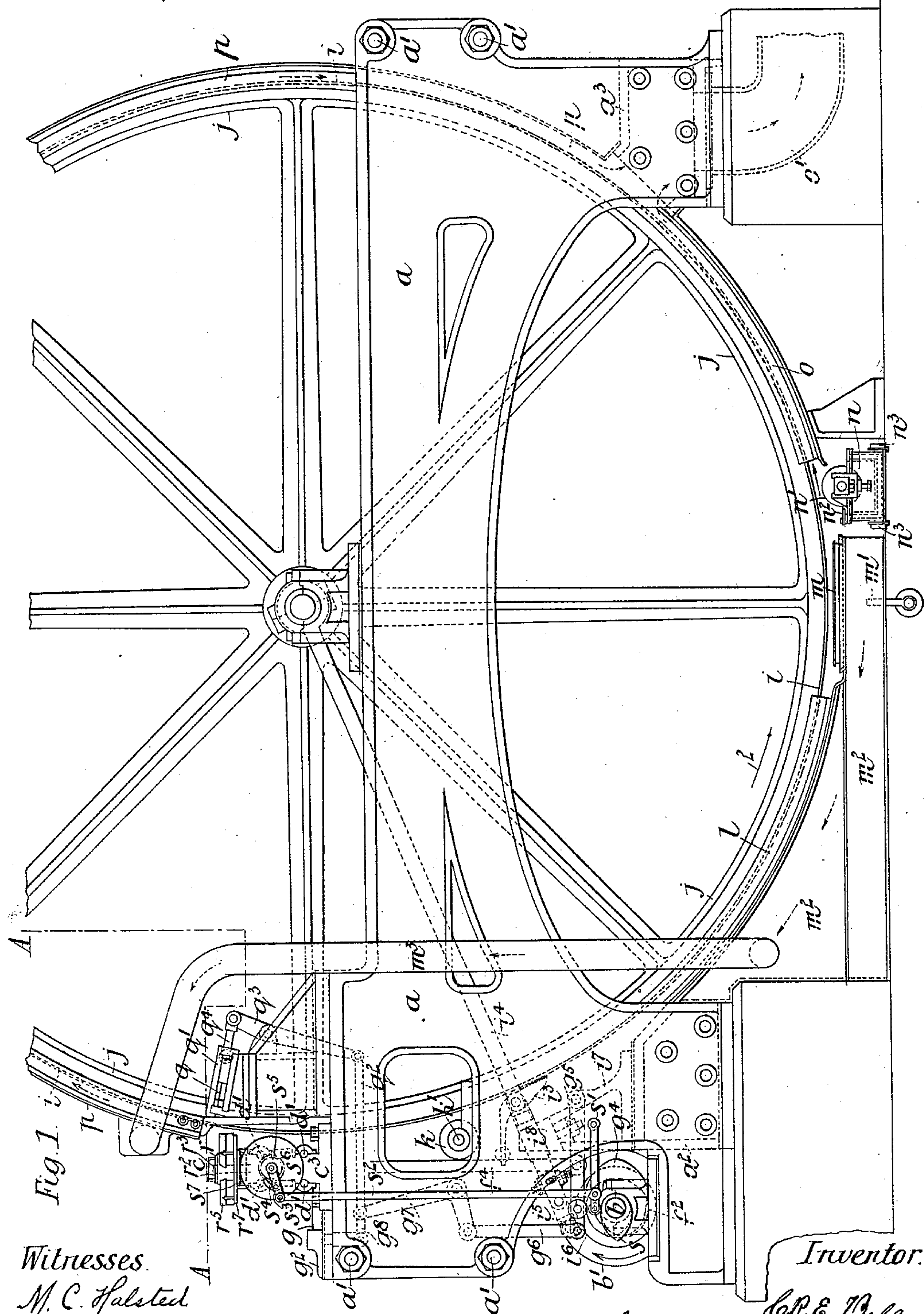
(No Model.)

7 Sheets—Sheet 1.

C. R. E. BELL.
MATCH MACHINE.

No. 447,931.

Patented Mar. 10, 1891.



Witnesses.
M. C. Halsted
J. C. Shaw

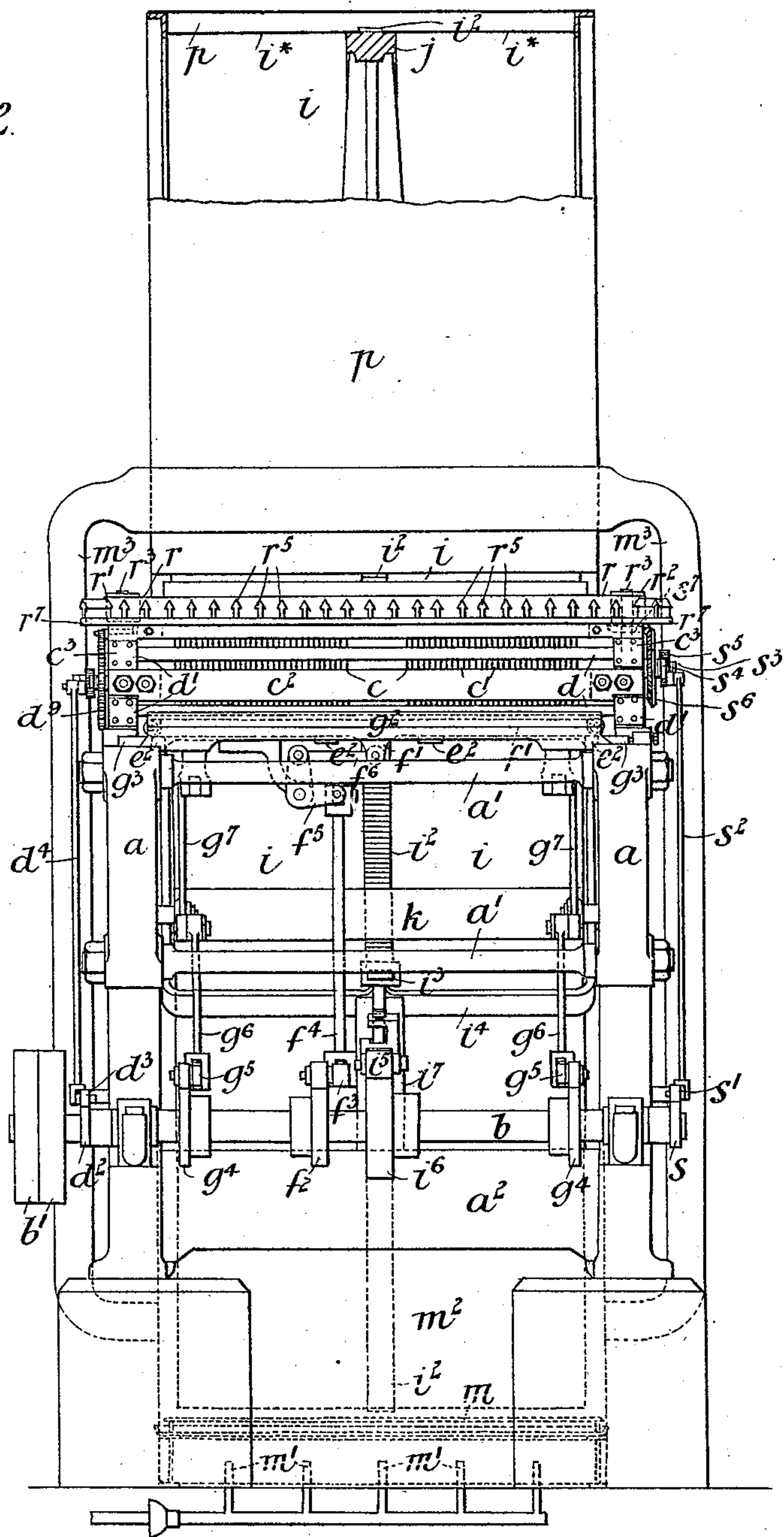
Inventor.
C. R. E. Bell
By John J. Halsted, for
his atty.

C. R. E. BELL.
MATCH MACHINE.

No. 447,931.

Patented Mar. 10, 1891.

Fig. 2.



Witnesses

W. C. Halsted

J. C. Shaw

Inventor.

C. R. E. Bell

By
John J. Halsted for
his attys

(No Model.)

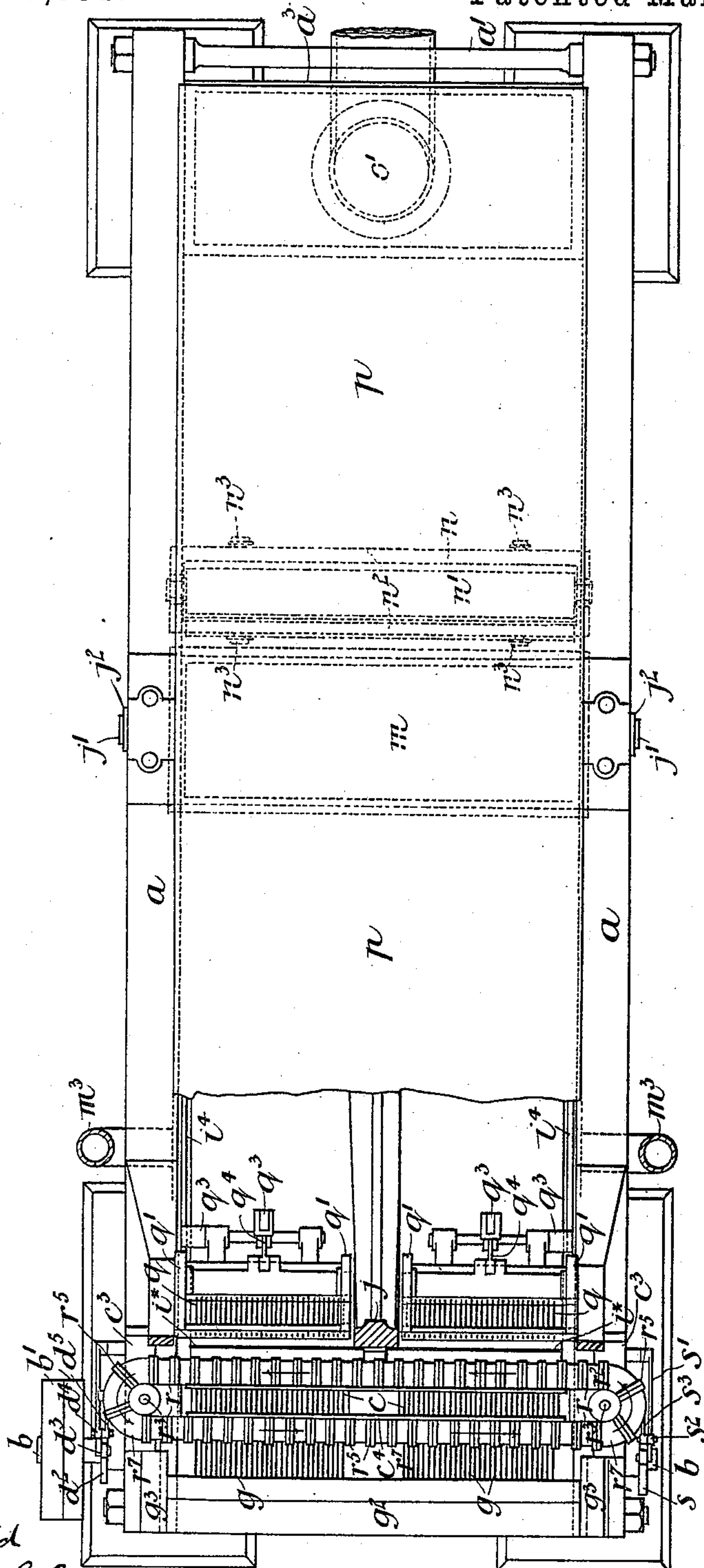
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Fig. 3.



Witnesses.

M. C. Halsted

J. C. Shaw.

Inventor.

C. P. & Lee

124 John J. Kauter & Son
his attys

(No Model.)

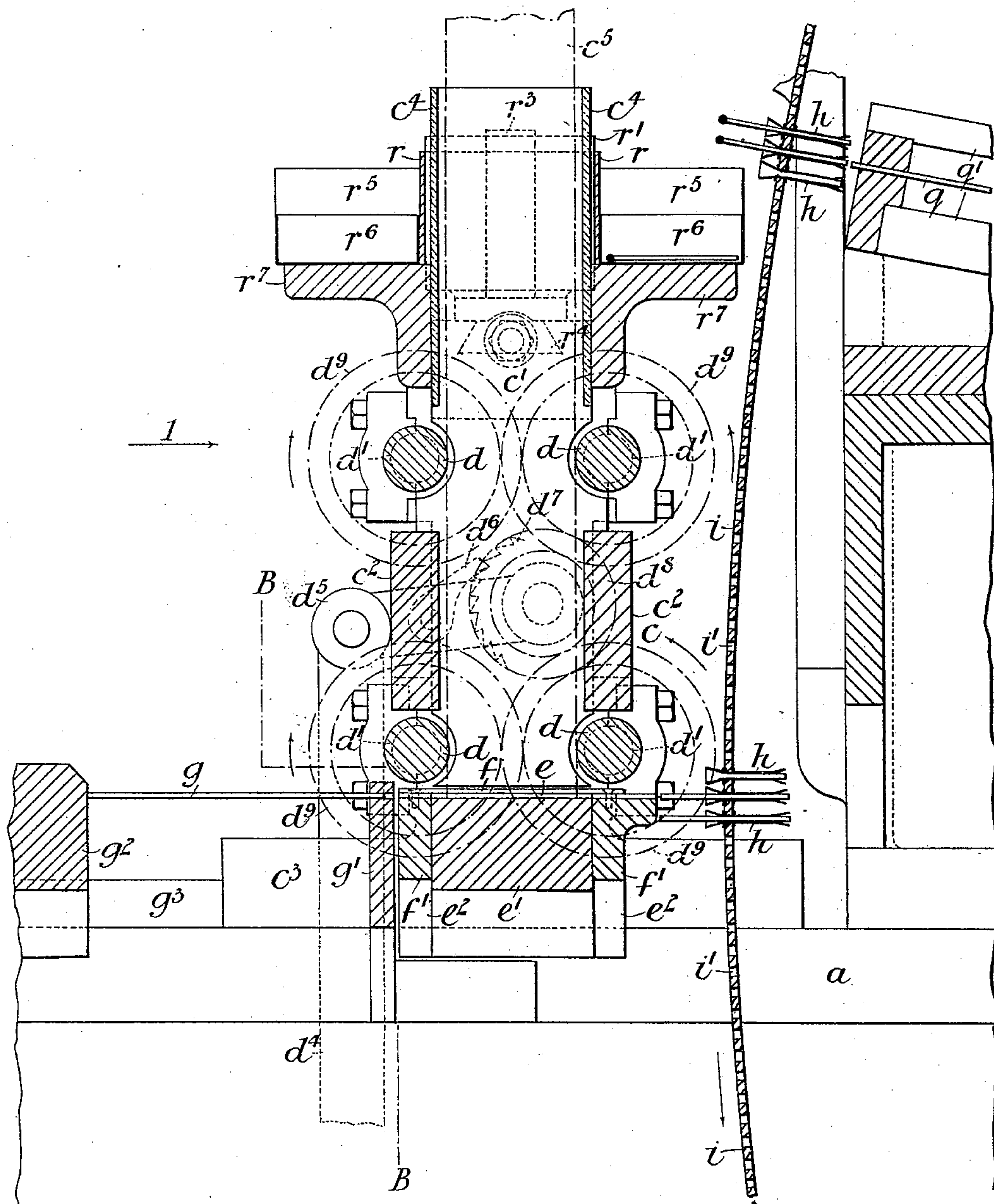
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C. R. E. BELL.
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Fig. 4.



Witnesses.

M. C. Halsted
J. C. Shaw.

Inventor.

C. R. E. Bell
By John J. Halsted, for
his Attys

C. R. E. BELL.
MATCH MACHINE.

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Fig. 5.

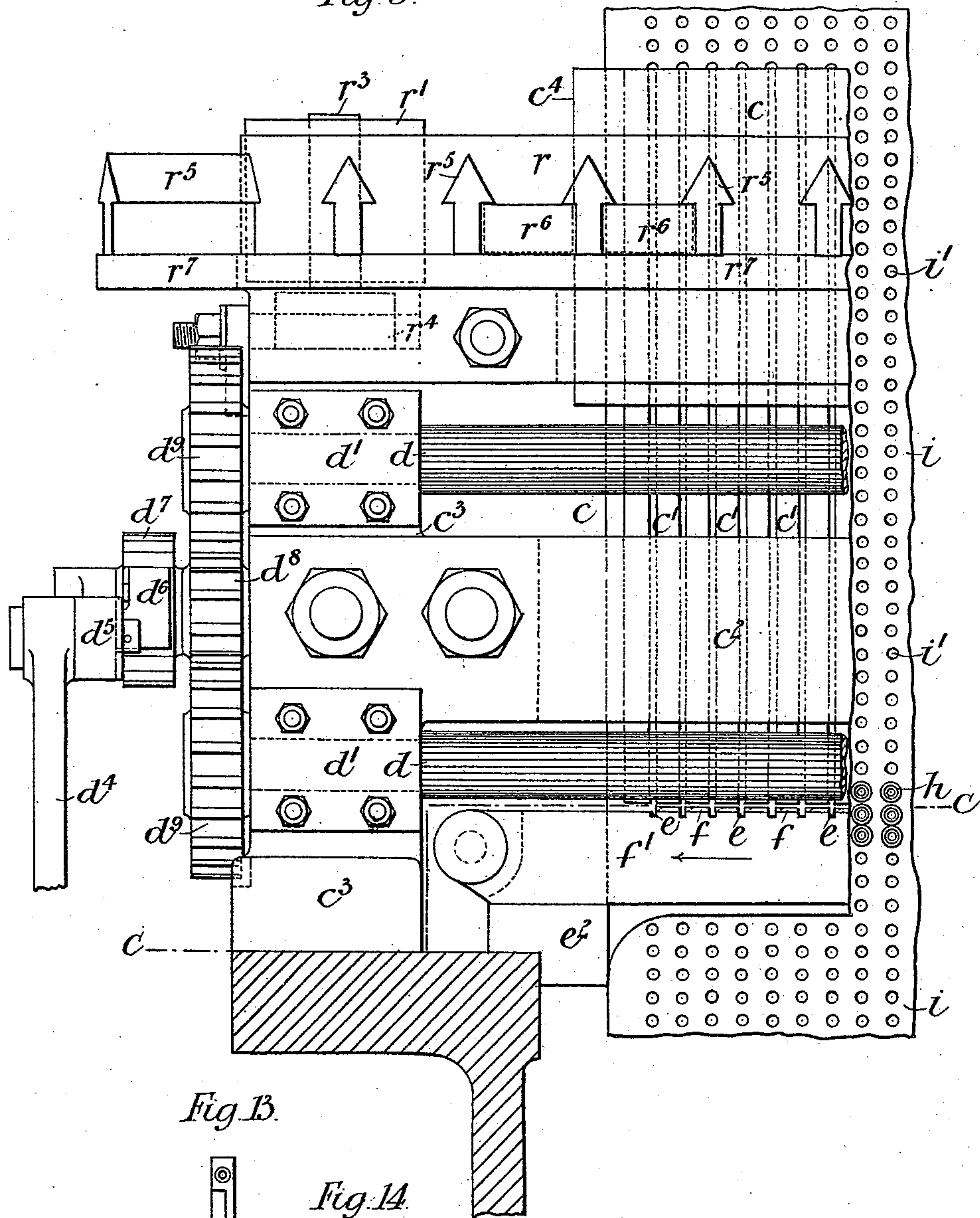


Fig. 13.



Fig. 14.



Witnesses.
H. C. Halsted
J. C. Shaw.

Inventor.
C. R. E. Bell.
By John J. Halsted for
his attys.

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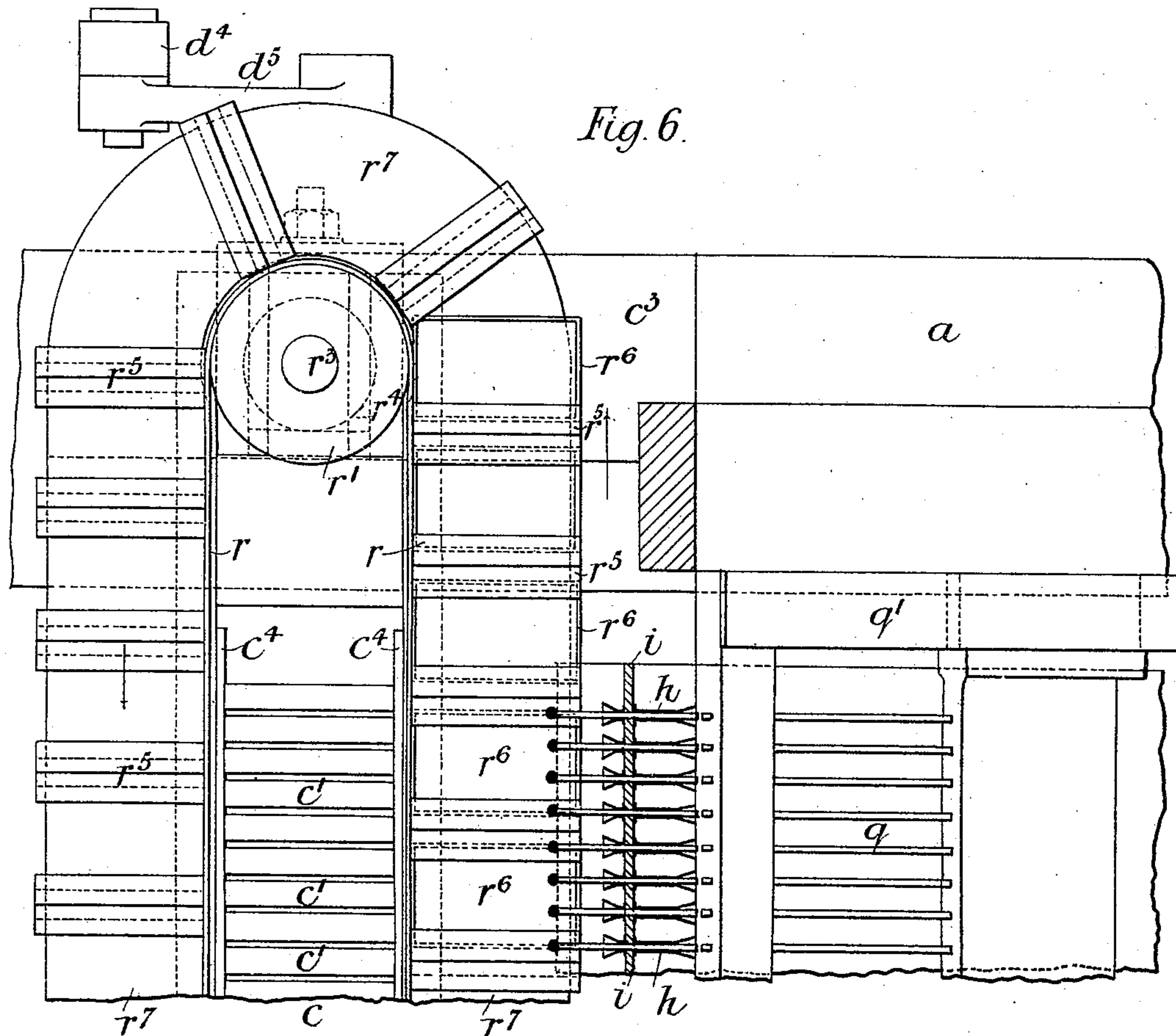


Fig. 11.



Fig. 10.

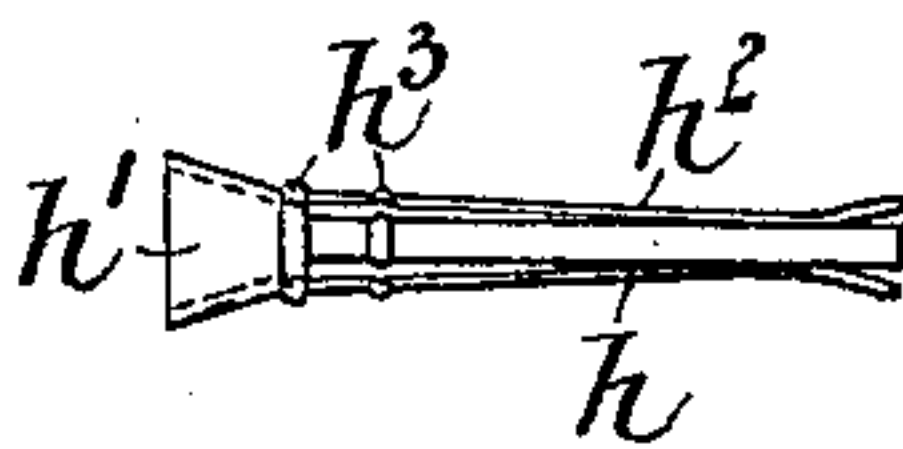
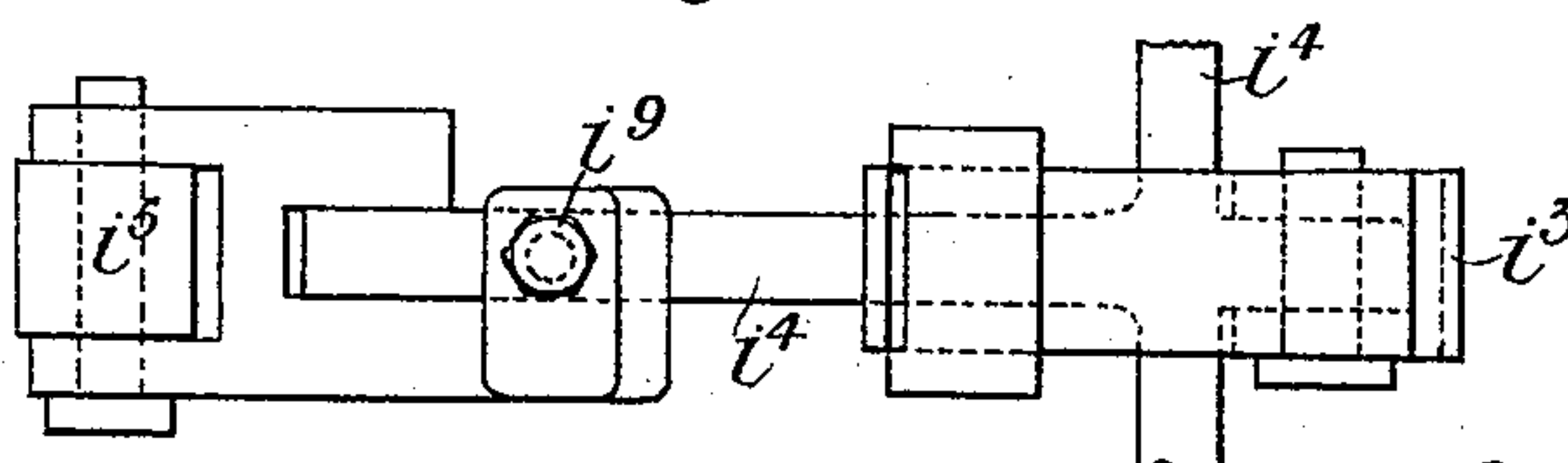


Fig. 12.



Fig. 9.



Witnesses.
H. C. Halsted
J. C. Shaw.

Inventor.

C. R. E. Bell,
John J. Walston & Son
his Atty

(No Model.)

7 Sheets—Sheet 7.

C. R. E. BELL.
MATCH MACHINE.

No. 447,931.

Patented Mar. 10, 1891.

Fig. 7.

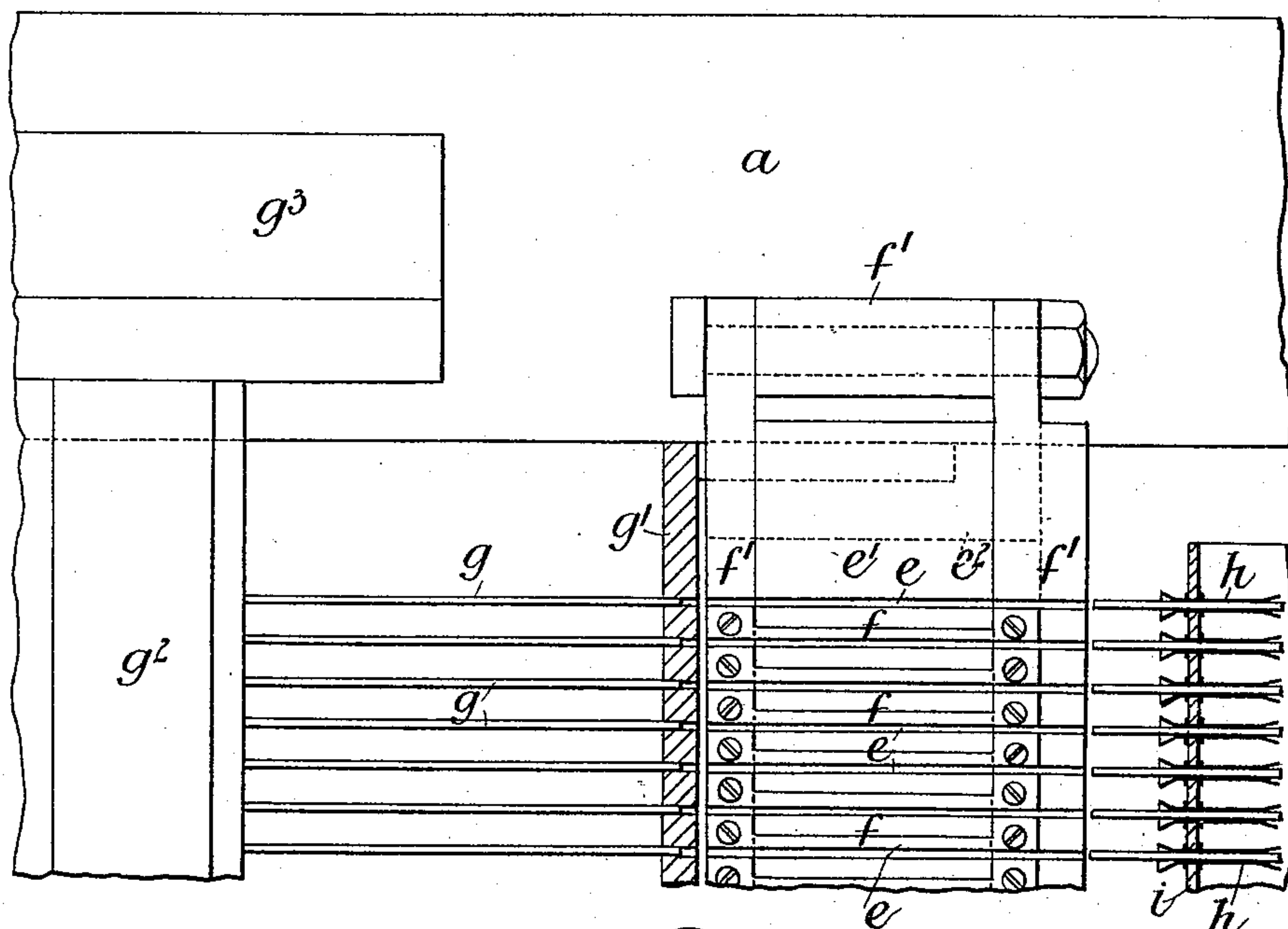
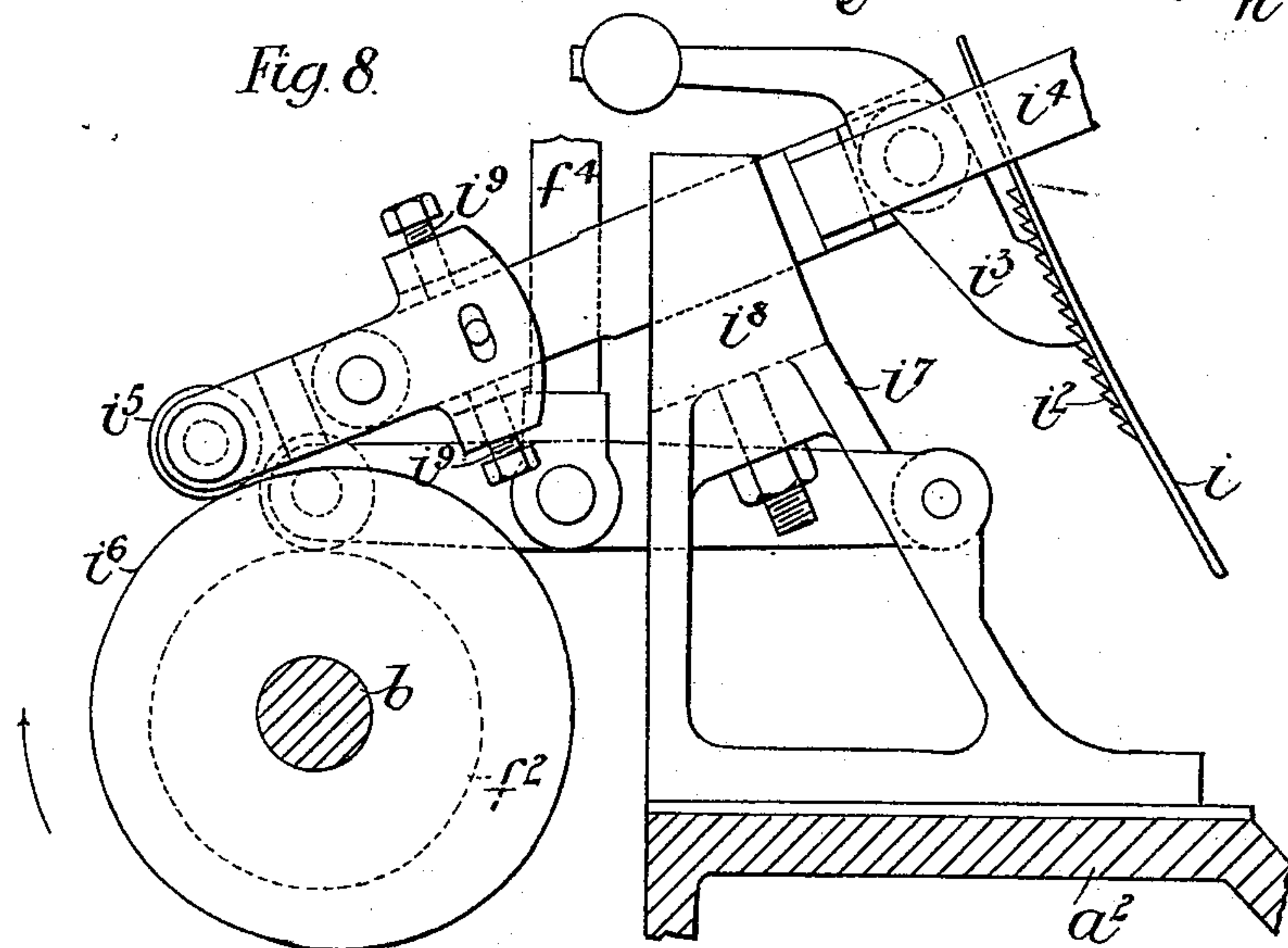


Fig. 8.



Witnesses.

M. C. Halsted

J. C. Shaw

Inventor.

C. R. E. Bell.

By John J. Halsted, for
his Attys

UNITED STATES PATENT OFFICE.

CHARLES ROBERT EDWARD BELL, OF LONDON, ENGLAND.

MATCH-MACHINE.

SPECIFICATION forming part of Letters Patent No. 447,931, dated March 10, 1891.

Application filed September 27, 1890. Serial No. 366,418. (No model.) Patented in England March 26, 1889, No. 5,208.

To all whom it may concern:

Be it known that I, CHARLES ROBERT EDWARD BELL, a subject of the Queen of Great Britain, residing at Wandsworth, London, England, have invented new and useful Improvements in Machinery for the Manufacture of Matches, (for which I have obtained a patent in Great Britain, dated March 26, 1889, No. 5,208,) of which the following is a specification.

This invention relates to improved machinery for the manufacture of matches, whereby the said matches are produced in a more speedy and economical manner than hitherto.

In carrying out my invention I take what is known as ordinary "match-veneers"—that is to say, strips or veneers of wood of the thickness of a match and of a width corresponding with the length of the matches to be produced, and I arrange the said veneers in a slotted guide, the distance between each guide-slot corresponding with the spacing required for dipping the matches. The strips or veneers are fed through the slots in the guide by feed-rollers acting against the edges of the said strips, the feed-rollers being operated intermittently, so that at each movement the strips are projected into a grooved plate to the extent of the exact thickness to be given to the match. A knife or a series of knives is then passed over the grooved plate, thereby cutting off into match-splints the portions of the strips or veneers projecting into the said grooved plate. A comb or series of plungers is now moved forward and pushes the splints between boards or grippers on an endless band in which the splints are clamped and held. One end of the splint projects from the boards or grippers a sufficient distance. The endless band passes over suitable drums, by means of the intermittent motion of which fresh boards or grippers are consecutively brought into position. I prefer, however, as hereinafter described, to dispense with the endless bands and to fasten the boards or grippers direct to the drum without the intervention of a band. Moreover, I find it advantageous to provide a separate gripper for each match. As the splints are moved by the drum or endless band or

chain the projecting ends thereof are heated by passing in contact with hot air or heated rollers or in any other suitable manner, and they are afterward caused to pass through heated paraffine for the purpose of paraffining the ends. As the splints pass from the paraffining-tank they are advantageously cooled by means of a cold-air blast. The splints being still carried by the drum or endless band are passed over a roller revolving in a tank of ordinary striking composition, and after being dried by means of dry air or in any other suitable manner are brought to a table or platform. The matches are then pushed out of the drum by means of a comb (or from between the boards by means of a finger or the like passing between the said boards) into a series of drawers of ordinary match-boxes, the said drawers being advantageously arranged on the said table or platform in connection with a traveling band or feeding device.

Instead of paraffining the splints by means of the tank hereinbefore described, I can paraffine one edge of the veneers before they are cut into splints.

In order to enable my invention to be fully understood, I will now proceed to describe in detail that form of my machine which I believe to be the best and most generally advantageous.

In the accompanying drawings, Figures 1 and 2 are respectively a partial side elevation and an end elevation partly in section of a machine or apparatus for manufacturing matches according to my invention, the said apparatus being constructed according to the arrangement hereinbefore described, in which a series of grippers arranged on a drum, is made use of. Fig. 3 is a sectional plan of the same, the section being taken on the line A A of Fig. 1. Fig. 4 is a vertical section of that part of the apparatus which comprises the slotted guide, the feed-rollers, the knives, the grooved plate, a portion of the intermittently-rotating drum, portions of the combs for respectively pushing the splints into and the finished matches out of the said drum and the traveling band for moving the drawers of the match-boxes. Fig. 5 is a sectional elevation looking in the direction of the arrow 1,

Fig. 4, of one end of the series of parts described in the said Fig. 4, the section being taken on the line B B. Fig. 6 is a plan of Fig. 5. Fig. 7 is a section on the line C C, of Fig. 5. Fig. 8 is a side elevation showing a suitable arrangement of cams and levers for operating the knives and drum. Fig. 9 is a plan of the free end of the lever for operating the drum. Figs 10, 11, and 12 are a side view and views of each end respectively of one of the grippers. Figs. 13 and 14 are respectively a plan and transverse section of one of the knives. Figs. 4 to 14 are drawn to larger scales than the remainder of the figures.

Similar reference-letters indicate similar parts throughout the drawings.

a a represent the framing of the machine or apparatus, consisting of two side portions connected together at their ends by tie-rods *a' a'* and cross-girders *a² a³*, as shown clearly in Figs. 1, 2, and 3. In this framing is arranged a shaft *b*, which forms the main shaft, through the medium of which the various parts of the apparatus are operated, as hereinafter described. *b' b'* are pulleys for driving the said shaft.

c, Figs. 2 to 6, is my slotted guide, which is advantageously constructed of a series of plates *c'*, arranged side by side between grooved plates *c² c²*. The plates are placed at a sufficient distance apart from one another to allow of ordinary match-veneers being inserted between them. The plates *c² c²* are attached at both ends to brackets *c³ c³*, fixed upon the side frames *a a*. The upper parts of the plates *c'* are in the drawings shown confined between plates *c⁴*.

The dotted lines *c⁵* in Fig. 4 represent a portion of one of the veneers.

d d are the feed-rollers journaled in bearings *d' d'* in the brackets *c³ c³*, and which are preferably fluted, so as to grip the edges of the veneers in order to feed them down into the row of grooves *e* in the upper surface of the grooved plate *e'*, the said grooved plate being attached at each end to the side frames *a a*. The width of the grooves *e* corresponds with the thickness of the veneer and the depth with the thickness of splints to be cut. The necessary intermittent motion of the rollers *d d* is transmitted from the main shaft *b* through the medium of a cam *d²*, lever *d³*, rod *d⁴*, lever *d⁵*, pawl *d⁶*, ratchet-wheel *d⁷*, and gear-wheels *d⁸* and *d⁹*.

The knives are marked *f f*, and are arranged between the grooves *e*. They extend across the grooved plate *e'*, and are attached at their ends to a frame *f'*, which slides on supports *e²* on the grooved plate *e'* in the direction of the arrow, Fig. 5. The knives *f* work in contact with the upper surface of the grooved plate *e'*, so as to cut off the portion of the veneers which is contained in the grooves *e*, thereby forming the match-splints. The said knives are driven from the main

shaft *b*, through the medium of a cam *f²*, lever *f³*, rod *f⁴*, bell-crank *f⁵*, and rod *f⁶*.

g is the comb, forming a series of plungers working through a guide-plate *g'* and attached to a slide *g²*, which works in guides *g³* upon the side frames *a a*, and causes the said plungers to enter the grooves *e'* and to push the match-splints into the grippers *h*, arranged in the face of the drum *i*, the said grippers being omitted in Figs. 1, 2, and 3 for the sake of clearness. The slide *g²* is operated from the main shaft *b*, through the medium of cams *g⁴*, levers *g⁵*, rods *g⁶*, bell-cranks *g⁷*, and links *g⁸*, as clearly shown in Figs. 1 and 2. Each of the grippers *h*, as shown clearly in Figs. 10, 11, and 12, comprises a bell-mouth *h'*, which projects from the face of the drum *i*, and a tubular shank *h²*, which projects inside the said drum and is split for a portion of its length, so as to make it elastic or of a spring nature, whereby it will bear upon and grip the sides of a match-splint. The grippers are also provided with collars *h³*, which serve to fix them in position on the face of the drum, to effect which they are each passed shank foremost from the outside face of the drum into one of the holes *i'* therein and forced or sprung into place. The grippers *h* are arranged in the periphery of the drum *i* in rows which are successively brought opposite the row of grooves *e'* to receive the splints as they are pushed therefrom. To effect the necessary intermittent movement, the drum *i* is provided in the center of its face with ratchet-teeth *i²*, which are operated upon by a pawl *i³*, attached to a bifurcated lever *i⁴*, a roller *i⁵*, the free end of which bears upon a cam *i⁶* on the main shaft *b*, as shown clearly in Figs. 1, 2, and 8.

In order to reduce friction I can arrange to support the lever *i⁴* when not being operated by the cam *i⁶*. For this purpose I employ the bracket *i⁷*, provided with an adjustable pad or block *i⁸*, on which the lever rests.

For adjusting the position of the roller *i⁵* relatively with the cam *i⁶*, I form the part of the lever *i⁴*, carrying the said roller adjustable relatively with the other part, as shown clearly in Figs. 8 and 9, set-screws *i⁹* serving to effect the adjustment.

The drum *i* consists of two rings *i* i**, Figs. 2 and 3, which project sidewise from and are carried by the rim of the wheel *j*, mounted on an axle *j'*, journaled in bearings *j²* on the side frames *a*. By this construction room is provided inside the drum *i* to allow of the arrangement of the comb or series of plungers hereinafter described, for pushing out the finished matches.

As will be seen by reference to Figs. 4, 6, and 7, the splints are not pushed completely into the grippers, a certain portion of their length being left protruding, so as to allow of them being paraffined and tipped with striking composition, as hereinafter described, the extent to which they protrude being regu-

lated by what I term a "gaging-roller" k , journaled in bearings k' on the side frames a , and arranged across the face of the drum i , so that as the match-splints are carried round by the said drum they will be caused to come into contact with the gaging-roller and the distances which the splints protrude from the drum will be equalized.

For heating the splints I employ a heating-chamber consisting of a casing l , which incloses a portion of the face of the drum i , as shown clearly in Fig. 1. This casing is similar in section to that shown at the upper part of Fig. 2, to be hereinafter described, and the splints pass through this casing in their passage to the tank m , containing paraffine, which tank is arranged beneath the face of the drum i , and is heated by means of gas-burners m' or other suitable means contained at one end of a chamber m^2 beneath the said tank and beneath the chamber l . The heated products of combustion from the burners pass through the said chamber m^2 , thereby imparting heat to the said chamber l and to the splints therein. The said products of combustion are then passed or drawn away through the tubes or pipes m^3 on each side of the apparatus, as hereinafter described.

n is the tank containing the striking composition, in which revolves an adjustable roller n' , a scraper n^2 being used to gage the thickness of composition on the said roller in the ordinary manner. The tank n is advantageously mounted upon wheels n^3 , so as to allow of it being easily placed in position beneath the face of the drum i .

o is another casing or chamber similar to the casing l , through which the fumes from the tanks m and n are drawn by means of a suitable fan, (not shown in the drawings,) the said fan being connected to the chamber o by the pipe o' and hollow cross-girder a^3 . The draft of air which is caused to pass into the casing o also serves to cool the splints as they pass from the tank m .

Another casing or chamber p , which practically forms a continuation of the casing or chamber o , is arranged around the face of the drum i from the hollow girder a^3 to a point situated just above the slotted guide c , and is connected to the chamber m^2 by the pipes m^3 , hereinbefore described, so that the products of combustion from the burners m' are drawn through the pipes m^3 and casing p by the fan, hereinbefore mentioned. By this arrangement of the casings o and p the matches are thoroughly dried as they pass therethrough.

q is the comb or series of plungers for pushing the finished matches from the grippers h , the said comb being shown formed in two portions which work in guides q' , supported upon the side frames a , as shown clearly in Figs. 1 and 3. The two portions of the comb q are operated from the bell-cranks q^6 , through the medium of rods q^2 , levers q^3 , and links q^4 , as clearly shown in Fig. 1, so that at the same

time that a row of match-splints is being pushed into the face of the drum i by the comb g a row of finished matches is being pushed out of the said face by the comb q .

r is the traveling band or feeding device, in connection with which are arranged a series of drawers of ordinary match-boxes for receiving the finished matches from the drum i . This band r , which is endless, as shown in Fig. 3, is arranged across the face of the drum i just below the point at which the finished matches are pushed out of the same and passes round the upper part of the slotted guide c and over the surfaces of two pulleys r' r^2 , rotating on pins r^3 r^3 , in the directions of the arrows at the top of the brackets c^3 c^3 . One of the pins r^3 is attached to an adjustable sliding block r^4 , as clearly shown in Figs. 4, 5, and 6, so as to allow of the band r being tightened as it becomes stretched by use. Instead of a band, a chain passing round sprocket-wheels can be used. The said band r is provided with a series of arms r^5 , between which are placed the drawers r^6 of the match-boxes to be filled, the upper part of the said arms being formed conical, so that any matches falling thereon will drop into the drawers r^6 .

r^7 is the table or platform on which the drawers r^6 are supported, the said table being attached to the brackets c^3 c^3 .

The band r is operated intermittently in the direction of the arrow, Fig. 3, from the main shaft b through the medium of a cam s , lever s' , rod s^2 , lever s^3 , pawl s^4 , ratchet-wheel s^5 , bevel-wheels s^6 s^7 , and pulley r^2 , as clearly shown in Figs. 1, 2, and 3, and in such a manner that if a series of empty drawers r^6 be placed upon the table r^7 between the series of arms r^5 and fed across the machine they will receive sufficient matches to fill them.

In the apparatus shown in the drawings there are sixty slots in the guide c , sixty knives f , and plungers g and q , and the grippers h are arranged in rows of the same number across the face of the drum i , the drawers r^6 being arranged so as to receive four matches from each succeeding series of four grippers for each movement of the band r , as shown clearly in Fig. 6.

The operation of the apparatus is as follows—that is to say, assuming each of the slots or divisions in the slotted guide c to contain a veneer and the parts of the apparatus to be in the positions shown in the drawings: If the main shaft b be operated in the direction of the arrows the cam d^2 will cause the feed-rollers d to feed down the said veneers into the grooves e in the plate e' , the movement occupying a quarter of a revolution of the said shaft b . The cam f^2 during the next quarter of a revolution of the shaft will cause the knives f to cut off the splints which during another quarter of a revolution of the said shaft will be pushed out of the grooved plate e' by the comb g into a row of grippers h in the drum i by the action of the cam g^4 and

the pushers return to their normal position. The remaining quarter of a revolution of the shaft *b* will then cause the cam *i*⁶, Fig. 8, to move the drum *i* in the direction of the arrow 2, Fig. 1, so as to move the row of splints just pushed therein away from and bring another row of grippers *h* in front of the grooves *e*. These operations being continued, the drum *i* will intermittently move round in the direction of the said arrow and the splints contained therein will first come into contact with the gaging-roller *k*, as hereinbefore described, and, after passing through the heating-chamber *l*, will be carried through the paraffine in the tank *m*, and being thus paraffined they will be tipped with the striking composition by passing over the roller *n*⁷, the splints before being tipped being cooled, as hereinbefore described. The matches will then pass into the casings *o* and *p*, in the latter of which they will pass through the heated products of combustion from the burners *m*⁷, as hereinbefore described, so that by the time they reach the comb *q* they will be dry. Each row of matches as it comes opposite to the comb *q* will be pushed out into the drawers *r*⁶ below, which in the meantime must have been arranged between the arms *r*⁵ of the band *r*, the mechanism for actuating which is operated at the same time as the veneers are fed down.

Various portions of my improvements may be usefully applied without the remainder thereof or in conjunction with substitutes for others thereof. For instance, my improvements for cutting and filling splints can be used with any ordinary match-frames. My rotating drum, with its grippers, could be used if the splints were cut and laid in the grooves for the comb to operate upon by the ordinary cutting and filling devices, and so on; also, certain portions of my improvements may obviously be applied in the manufacture of wax matches. It is also obvious that some stages of the process may be omitted—as, for instance, the veneers may be paraffined before being fed into the machine, and the matches may be delivered into a slide or shoot or other receptacle and put into boxes by hand or otherwise.

I am aware that there has been a previous attempt to make matches by a continuous automatic machine; but this attempt failed, one reason of such failure being that the matches were held sidewise while being tipped instead of being held vertically downward, and another that the general idea of the machine was ill-conceived.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. An automatic machine for the manufacture of matches by a continuous process, having in combination the following devices, namely: an intermittent feed which presents

the edge of the veneers toward a rotary drum, a knife or knives for cutting the veneers in the direction of their grain, grippers for holding the splints in such intermittently-rotating drum, a casing or chamber inclosing a portion of the drum and through which the splints pass, a paraffine heating-tank for paraffining the splints, a rotating drum coated with striking composition, a cooling and drying chamber inclosing a portion of the drum, and a comb for delivering the finished articles, the combination being and operating substantially as described.

2. In a match-making machine, an intermittently-rotating drum carrying a system of grippers adapted for receiving, gripping, and holding match splints or tapers, said grippers having a bell-shaped or funnel mouth and a set of spring gripping-tongues, substantially as and for the purposes set forth.

3. In a match-making machine, the combination, with the intermittently-rotating drum, of feed-rollers bearing on the opposite edges of the veneer, and a knife or knives whose cutting edge or edges are substantially in line with the radius of the drum for severing the splints from the veneer, and plungers for pushing the said splints or tapers into the grippers in the drum, substantially as shown and described.

4. In a match-making machine, the combination, with the said intermittently-rotating drum and with intermittently-operated rollers serving to bear on the edges of the veneer to feed the same, and with a knife or knives reciprocating in right lines and cutting the veneers in the direction of the grain of the wood into match splints, and a plunger for pushing the said splints into clips in the said drum, of devices, substantially as described, for heating, paraffining, cooling, tipping, and drying the matches.

5. In match-making machinery, the combination, with the drum and with the grippers *h h'*, having the bell-mouth and split shank, of an ejecting-comb actuated by rods and levers within the drum and serving automatically to push the finished matches from the grippers in the drum into suitable receptacles, substantially as described.

6. In an automatic machine for the continuous manufacture of matches from a strip or sheet, the combination of a slotted guide with intermittently-actuated feed-rollers bearing against and gripping the edges of the strip or sheet, and whereby said strips are vertically introduced into measuring-grooves, substantially as and for the purposes described.

7. In an automatic machine for the continuous manufacture of matches, the combination of an intermittent feed and a slotted guide, as described, with a horizontal plate provided with grooves, into which the ends of the strips of veneer or the like are introduced by the act of feeding, the depth of the

grooves corresponding to the predetermined thickness of the match.

5 8. An automatic machine for the continuous manufacture of matches, having in combination an intermittent vertical feed, slotted guides, grooved plate, and horizontally-reciprocating knives, as set forth, and whereby the portion of the veneers advanced into the recesses of the grooved plate is held for sever-

ing and is cut off of the predetermined thickness, all substantially as set forth.

CHARLES ROBERT EDWARD BELL.

Witnesses:

G. F. REDFERN,

Of the firm of G. F. Redfern & Co., Patent Agents, 4 South St., Finsbury, London, England.

A. ALBUTT.