

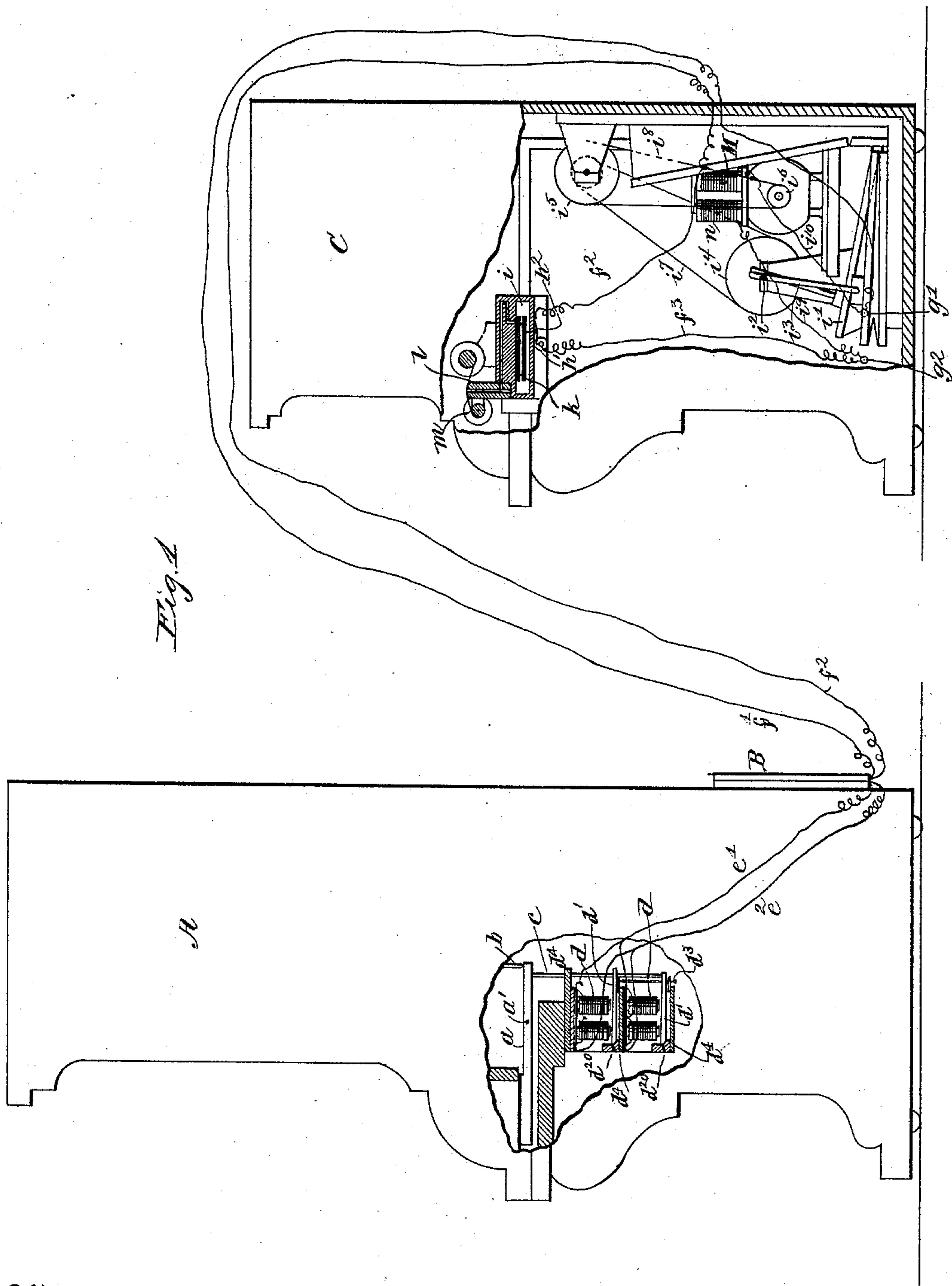
(No Model.)

3 Sheets—Sheet 1.

R. W. PAIN.  
MUSICAL INSTRUMENT.

No. 488,482.

Patented Dec. 20, 1892.



Witnesses  
C. R. Ferguson  
W. M. Phiff.

Inventor  
Robert W. Pain  
By his Attorneys Gifford & Brown

(No Model.)

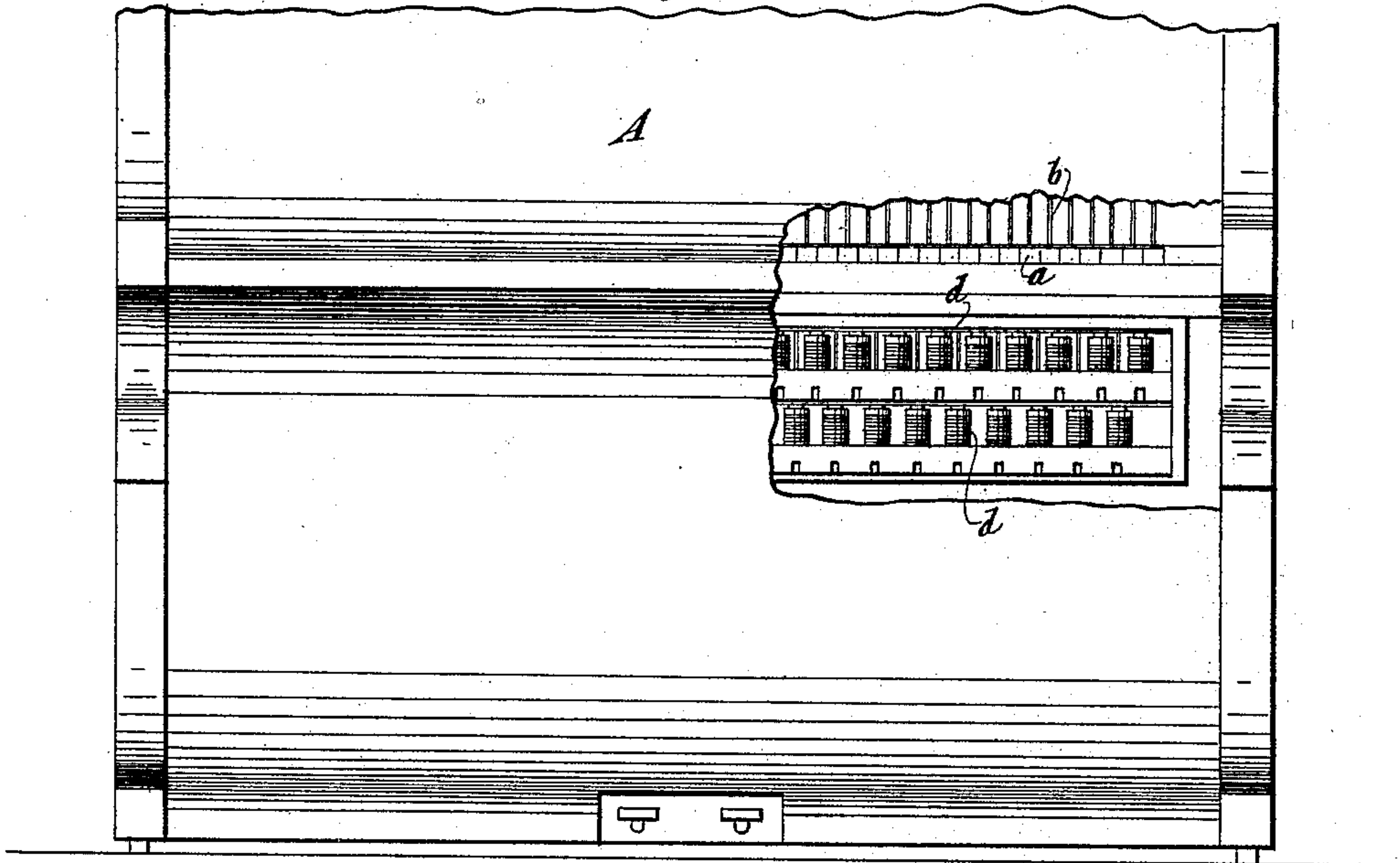
3 Sheets—Sheet 2.

R. W. PAIN.  
MUSICAL INSTRUMENT.

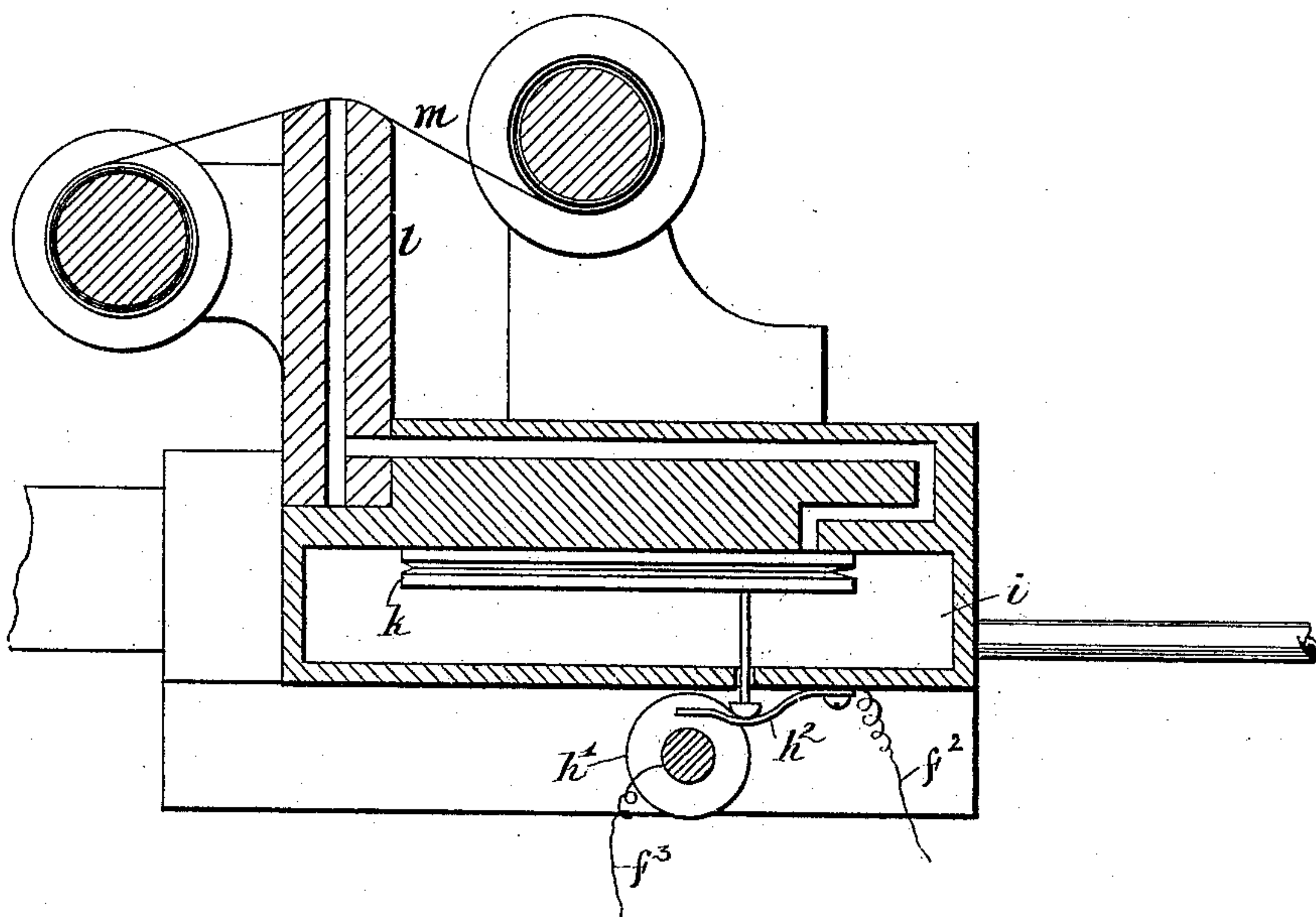
No. 488,482.

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*Fig. 2*



*Fig. 5*



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3 Sheets—Sheet 3.

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Fig. 7

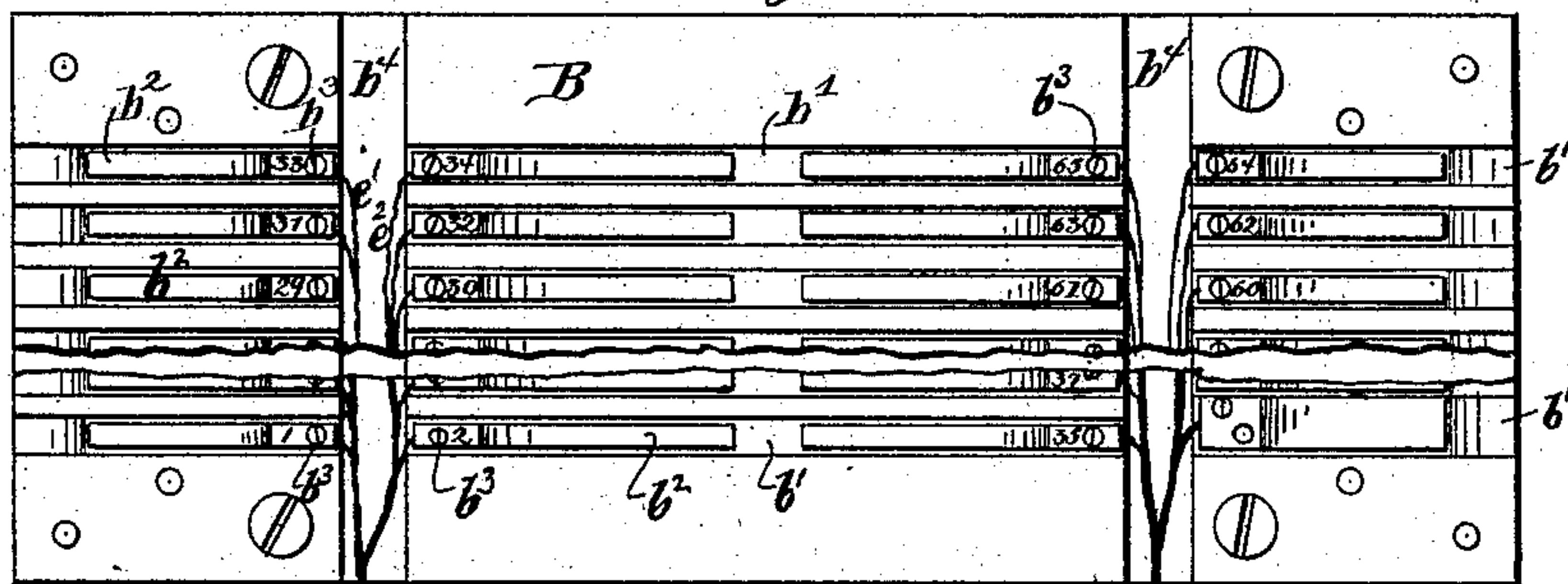


Fig. 8

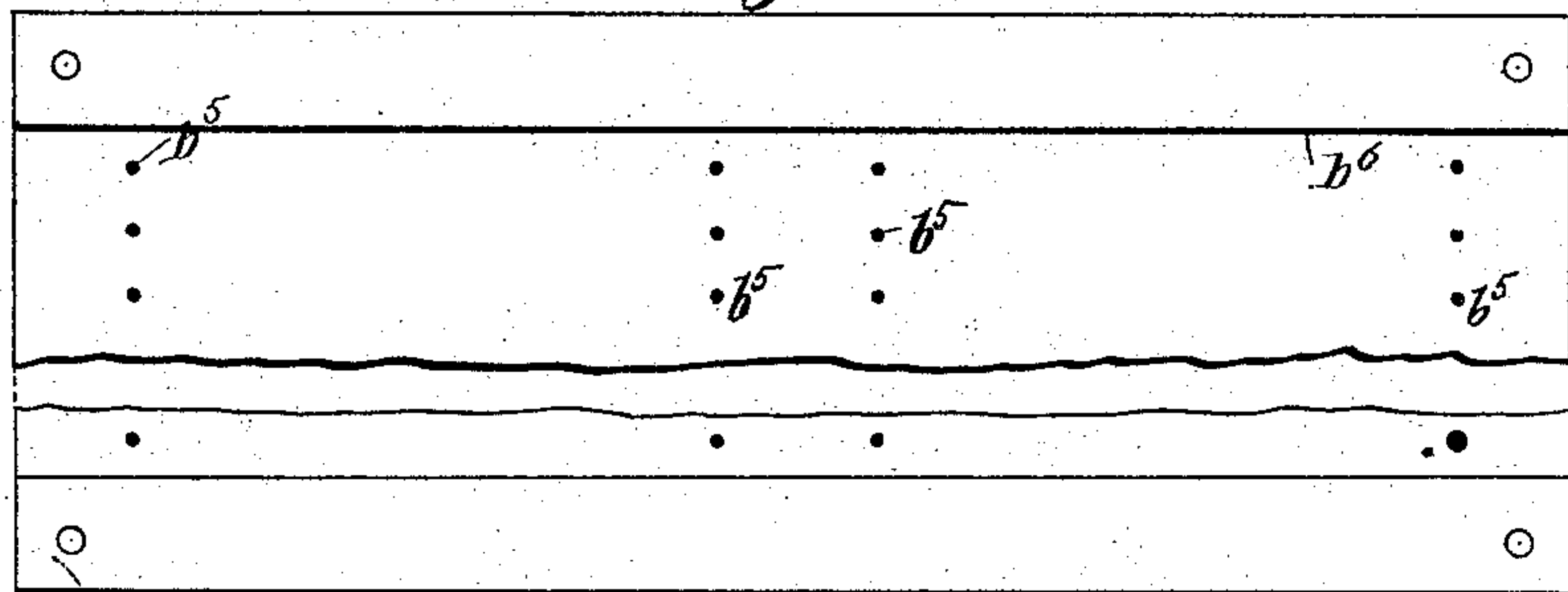


Fig 6

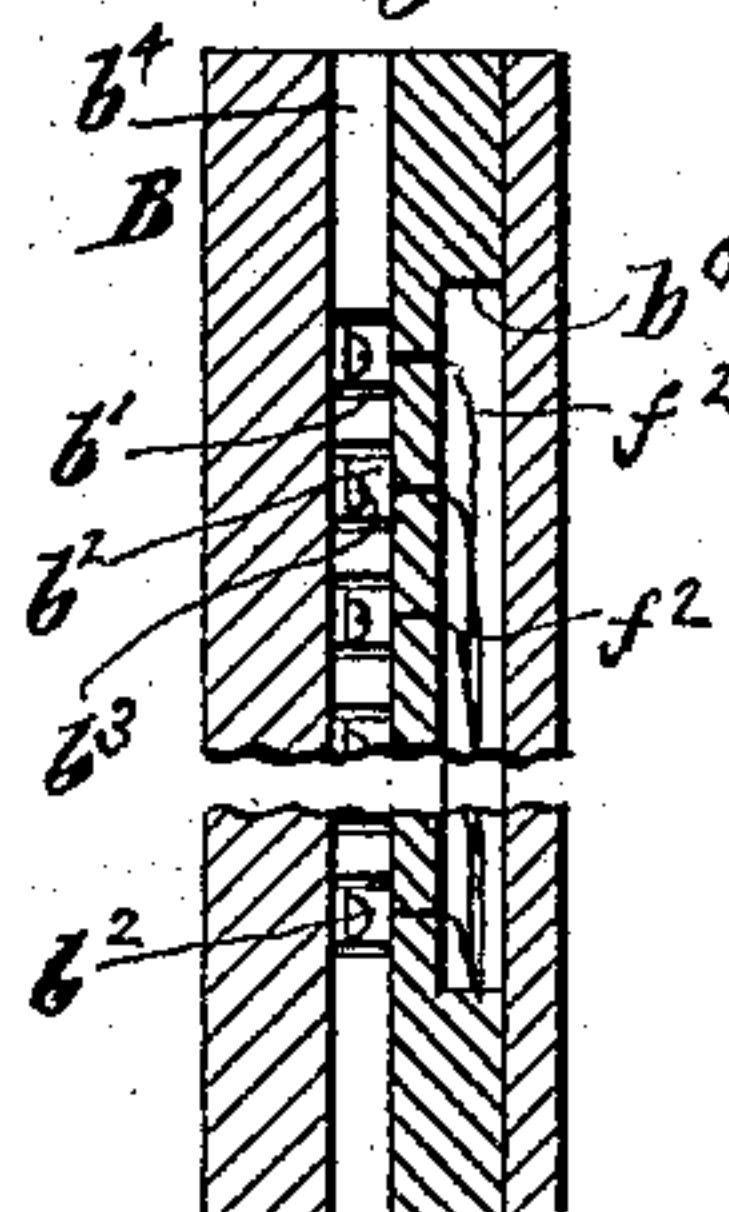
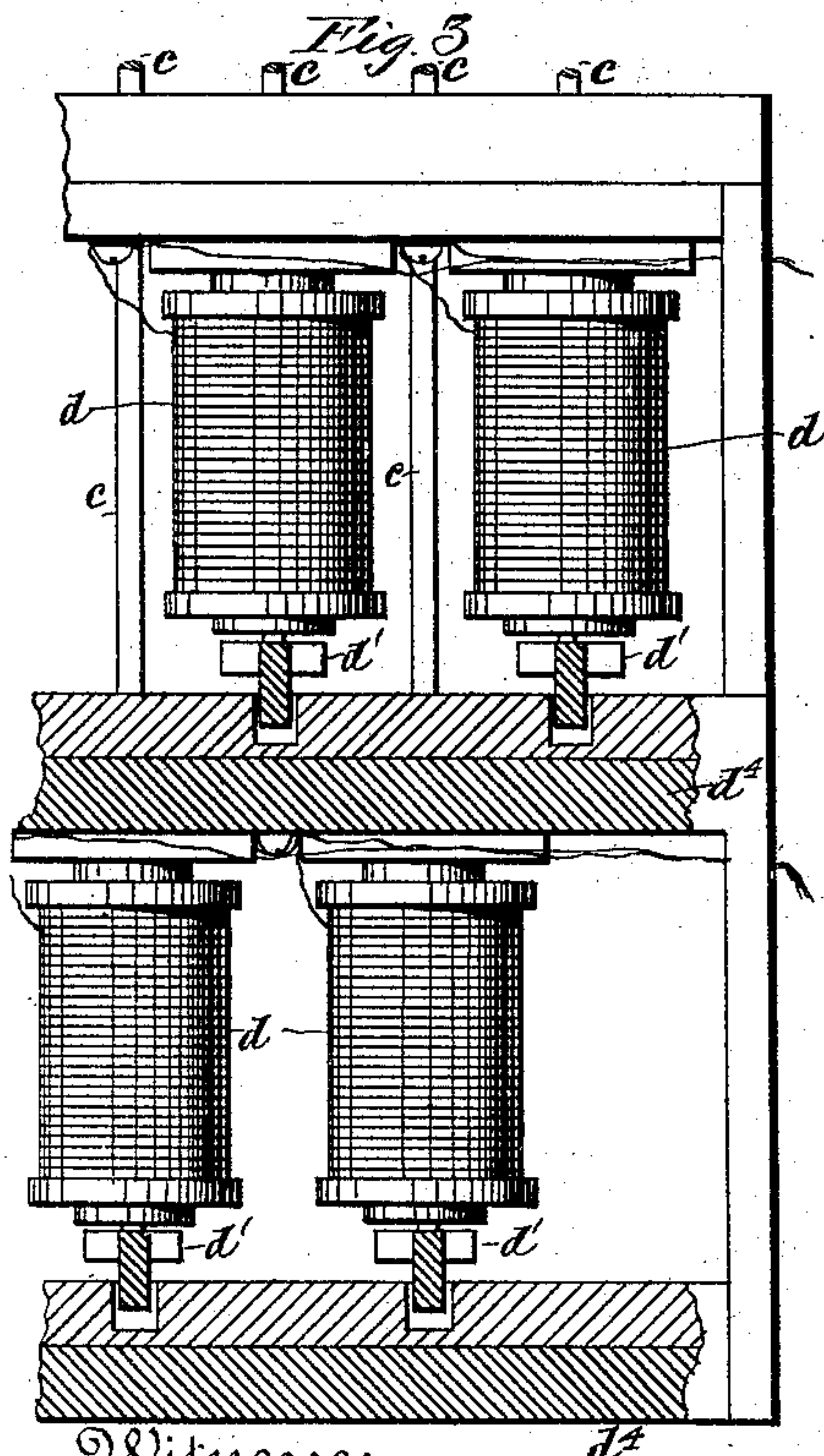


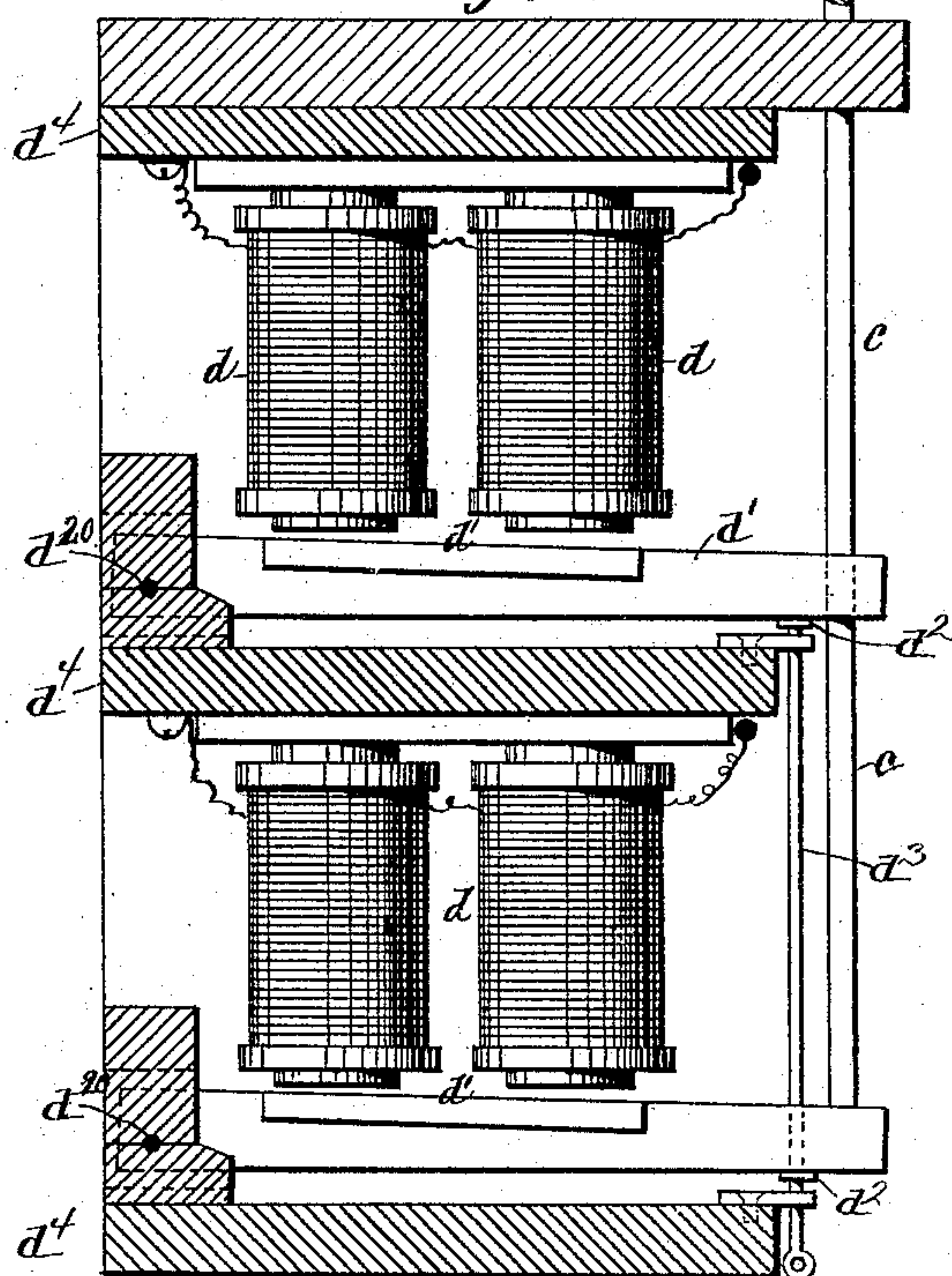
Fig. 3



Witnesses

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Fig. 4



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# UNITED STATES PATENT OFFICE.

ROBERT. W. PAIN, OF NEW YORK, N. Y.

## MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 488,482, dated December 20, 1892.

Application filed December 4, 1890. Serial No. 373,607. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT. W. PAIN, of New York, in the county and State of New York, have invented a certain new and useful  
5 Improvement in Apparatus for Effecting the Mechanical or Automatic Operation of Keyed Instruments, of which the following is a specification.

My improvement relates to the operation of  
10 keyed instruments by apparatus which effects the playing mechanically or automatically.

My object is to render the application of such apparatus more convenient than heretofore.

15 Briefly stated, my improvement consists in combining a number of electro-magnets with a keyed instrument and providing in a separate stand an apparatus whereby the electro-magnets will be energized and de-energized  
20 to effect the playing of tunes.

I will describe a pianoforte and an apparatus for mechanically or automatically playing the same having my improvement embodied therein, and afterward I will point out  
25 the novel features in claims.

In the accompanying drawings, Figure 1 is a sectional elevation of a pianoforte and of an apparatus connected therewith embodying my improvement. Fig. 2 is a front elevation  
30 of a portion of the pianoforte. Fig. 3 is a view similar to Fig. 2 except that it is made on a larger scale and shows less of the instrument. Fig. 4 is a transverse vertical section of a portion of the pianoforte on a large scale. Fig.  
35 5 is an enlarged transverse section of a portion of the apparatus whereby the pianoforte is controlled. Fig. 6 is a transverse vertical section of a coupling piece whereby the electro-magnets of the pianoforte are detachably  
40 connected with the apparatus by which they are controlled. Fig. 7 is a back view of the coupling piece with one of the parts removed. Fig. 8 is a rear view of one of the parts of the coupling piece.

45 In Figs. 6, 7 and 8, wherein the coupling piece is illustrated a portion is broken away between the top and the bottom to economize space and enable the parts to be illustrated in a small space upon a large scale.

50 Similar letters and figures of reference designate corresponding parts in all the figures.

I will first describe the pianoforte A. It

may be of any suitable construction so far as the action is concerned, hence I have not made any effort to illustrate the construction of the  
55 action other than to show the finger keys *a* and rods *b* actuated by the keys and serving to set in action the hammers and their appurtenances. The keys are shown as fulcrumed between their ends by pins *a'*. Under their  
60 rear ends rods *c* bear and these are operated by electro-magnets *d*, one of the latter being provided for each rod *c* and key *a*. The armatures *d'* of the electro-magnets (as may be seen best by reference to Fig. 4) are fulcrumed  
65 by pins *d''* to fixed parts of the instrument and are free to vibrate beneath the poles of the electro-magnets. When the electro-magnets are de-energized they are retracted by gravity. Stops of any suitable character may  
70 be provided for limiting the retractile movement of the armatures. I have shown stops *d''* connected to a vertically adjustable rod *d'''* employed for this purpose.

The arrangement of the electro-magnets is  
75 immaterial so long as their armatures may operate the rods *c* beneath the keys *a*. A convenient arrangement, however, is to place them in two tiers or rows, as illustrated in Figs. 2 and 3, for if they are so arranged and  
80 staggered or disposed in such manner that those of each row will be opposite the spaces between those of the other row, the whole series may be arranged closer together lengthwise of the pianoforte than otherwise would  
85 be possible, and hence larger magnets can be used with the ordinary arrangement of keys.

It will be seen that the electro-magnets are supported at their upper ends by plates or boards *d''*. These may be secured to the sides  
90 of the pianoforte frame and also connected together at intervals to brace and stay them. The upper one may also be secured to the under side of the key-board if desired. The armatures are shown as fulcrumed to blocks  
95 which are erected upon the plates *d''*. The coils of the electro-magnets are connected by wires *e'* *e''* which extend to a coupling piece B. The main section of this coupling piece  
100 B has in its rear side a number of longitudinal grooves *b'* in which spring metal strips *b''* are located. These strips are secured at but one end by pins or screws *b'''* and at the other end project rearwardly. The resilience of



these springs is such that their free ends will project rearward beyond the rear surface of the section of the coupling piece in which they are secured. This main section of the coupling piece is fastened by screws or otherwise to the back of the pianoforte case with the grooved side rearward and consequently outward.

It will be seen that the grooves  $b'$  in which the strips  $b^2$  are fastened extend lengthwise of the coupling piece and horizontally. Besides these grooves there are transverse vertical grooves  $b^4$  which intersect the grooves  $b'$ . The numerous wires  $e' e^2$  connected with the electro-magnets may be wrapped into a sort of group or cable and passed therefrom through the transverse grooves  $b^4$  to the springs  $b^2$ . Each pair of wires  $e' e^2$  will be connected with springs  $b^2$  arranged on opposite sides of the grooves  $b^4$  and in the same horizontal plane, as, for instance, turning to Fig. 7, it will be seen that one pair of wires  $e' e^2$  connects with springs, 1, 2, another pair with springs 29, 30, the third pair with springs, 33, 34, and so on.

The coupling piece has a secondary section which is provided with a number of holes  $b^5$  through which extend pairs of wires  $f' f^2$ , leading from an apparatus C whereby the electro-magnets of the pianoforte are controlled. There will be a number of pairs of wires  $f' f^2$  corresponding to the number of wires  $e' e^2$ . Instead of having the wires  $f' f^2$  themselves extend through the holes  $b^5$ , they may be attached to several contact pieces. The wires  $f' f^2$ , or the contact pieces which may be used in connection therewith, are intended to press against the springs  $b^2$  of the main section of the coupling piece when the secondary section is fastened in its place in rear of the main section and thus form an effective electrical contact between the several pairs of wires  $f' f^2$  and  $e' e^2$ . The secondary section of the coupling piece may be fastened by screws to the main section. The several pairs of wires  $f' f^2$  may be formed into a cable or group so as to lead together from the apparatus C to the pianoforte A. In the rear of the secondary section of the coupling piece is a longitudinal groove  $b^6$  through which the wires  $f' f^2$  may extend. Rearward of the secondary section of the coupling piece a cover consisting of a flat piece may be arranged. Screws may be employed to secure it in place. All the parts of the coupling piece may be made of wood. The wires  $f' f^2$  and  $e' e^2$  will of course be insulated except where they are to make electrical communication with other parts.

Obviously by means of the coupling piece which I have described, a connection may be readily made and broken between the apparatus C and the pianoforte. If the wires  $f' f^2$  are made of suitable length the apparatus C may be arranged at any desired distance from the pianoforte. The wires  $f'$  extend to a binding post  $g'$  which is intended to be in electri-

cal communication with one pole of an electric battery. The other pole of this electric battery is to be in electrical communication with a binding post  $g^2$ . From the latter binding post a wire  $f^3$  extends to a contact piece  $h'$ . The wires  $f^2$  extend to a corresponding number of contact pieces  $h^2$ . The contact piece  $h'$  is made in the form of a roller and is intended to be constantly rotated by any suitable means. The contact pieces  $h^2$  are made in the form of spring strips of metal which normally are out of contact with the contact piece  $h'$ , but which may be depressed against their resilience into contact therewith.

As here shown, the contact piece  $h'$  is journaled in bearings to rotate below a wind chest  $i$  which will be in communication with a number of bellows  $i'$ . Preferably these will be exhaust bellows and will produce a rarification of air in the wind chest  $i$ . Within the wind chest  $i$  a number of pneumatic motors  $k$  are arranged. These correspond in number with the electro-magnets  $d$  and consequently with the number of pairs of wires  $f' f^2 e' e^2$ . From each of these pneumatic motors  $k$  ducts extend to a rest or tracker  $l$  over which passes a music sheet  $m$  provided with perforations capable of producing a tune. Whenever a perforation of the music sheet passes over a duct belonging to a pneumatic motor, that pneumatic motor is expanded, and by means of a pin extending between it and the corresponding contact piece  $h^2$ , the latter will be pressed against the opposite contact piece  $h'$ , whereupon the electric circuit including the corresponding electro-magnet  $d$  will be completed and such electro-magnet energized. This will result in effecting a vibration of the corresponding key  $a$  of the pianoforte in a manner to effect the sounding of a note.

The bellows  $i'$  may be operated in any suitable manner. In the present instance, I have shown as operated by a crank shaft  $i^2$  and pitman rods  $i^3$  extending between the cranks of such shaft and the movable boards of the bellows. The crank shaft is driven by means of pulleys  $i^4 i^5 i^6$  and belts  $i^7 i^8$  from an electro-magnetic motor  $n$ . The coils of the field magnets of this motor are shown as connected by wires  $i^9 i^{10}$  with the binding posts  $g' g^2$ .

The electricity necessary for the operation of the apparatus C may be obtained from any desirable source instead of from a battery if preferred.

It will be seen that the apparatus C has a complete case. This may be made to correspond with that of an organ or pianoforte or may be of a different design. Preferably it will be supported upon rollers so as to facilitate moving it from place to place.

It will be seen that by my improvement I provide for operating a pianoforte without overloading the pianoforte with apparatus necessary to its automatic playing and by the simple addition of a series of electro-magnets.



What I claim as my invention and desire to secure by Letters Patent, is:

1. The combination, with a pianoforte, of a number of electro-magnets arranged within the same and acting upon the keys thereof, electric circuit-wires extending from said electro-magnets and an apparatus at a distance from the pianoforte and connected with said electric circuit wires and comprising movable contact pieces, a coupling piece whereby the circuits may be disrupted, pneumatic motors for operating the contact pieces and a music sheet, card, tablet or roller controlling the pneumatic motors, substantially as specified.
2. The combination, with a pianoforte, of a number of electro-magnets arranged within the same and acting upon the keys thereof, electric circuit wires extending from said electro-magnets and an apparatus at a distance from the pianoforte and connected with said electric circuit wires and comprising movable contact pieces, a coupling piece whereby the circuits may be disrupted, pneumatic motors for operating the contact pieces and a music sheet, card, tablet or roller controlling the pneumatic motors and also comprising bellows for effecting the operation of the said pneumatic motors, substantially as specified.
3. The combination, with a pianoforte, of a number of electro-magnets arranged within the same and acting upon the keys thereof, electric circuit wires extending from said electro-magnets and an apparatus at a distance

from the pianoforte and connected with said electric circuit wires and comprising movable contact pieces, a coupling piece whereby the circuits may be disrupted, pneumatic motors for operating the contact pieces and a music sheet, card, tablet or roller controlling the pneumatic motors and also comprising bellows for effecting the operation of the said pneumatic motors and an electro-magnetic motor for driving said bellows, substantially as specified.

4. The combination with a pianoforte provided with a number of electro-magnets for operating its keys and an apparatus for effecting the operation of said electro-magnets and controlled by a traveling music sheet, card, tablet or roller and a coupling piece, B, whereby circuits extending between said apparatus and pianoforte may be disrupted and connected, substantially as specified.

5. The combination with a pianoforte provided with a number of electro-magnets for operating its keys and an apparatus for effecting the operation of said electro-magnets and controlled by a traveling music sheet, card, tablet or roller and a coupling piece comprising a grooved section fitted with springs and a secondary section provided with holes, substantially as specified.

ROBERT. W. PAIN.

Witnesses:

A. A. GREENHOOT,  
JAMES MORGAN.