

F. W. HEDGELAND.

SELF PLAYING MECHANISM FOR PIANOS OR ORGANS.

No. 547,071.

Patented Oct. 1, 1895.

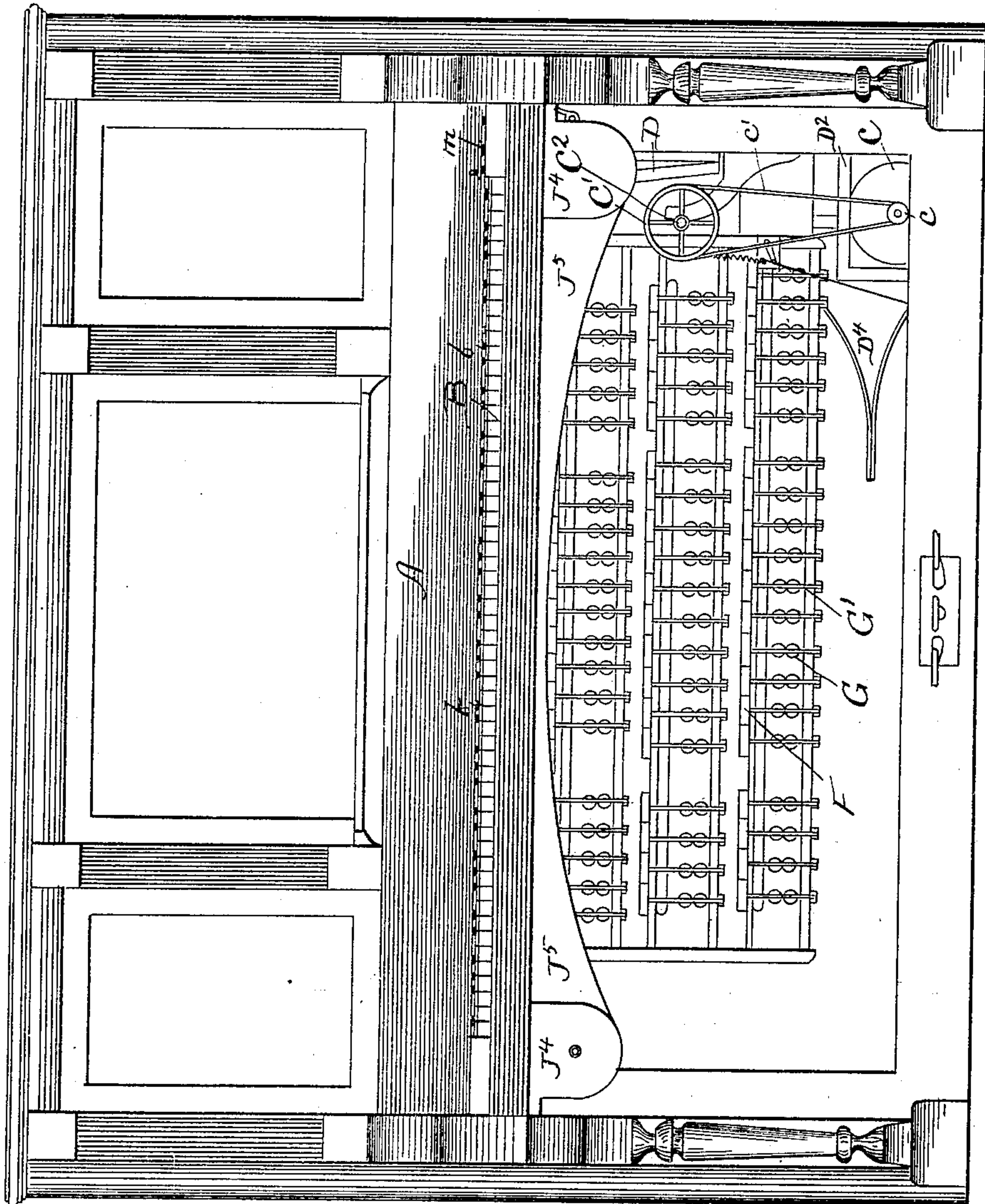


Fig. 1.

Witnesses:
Sew. C. Curtis
Emma Hack

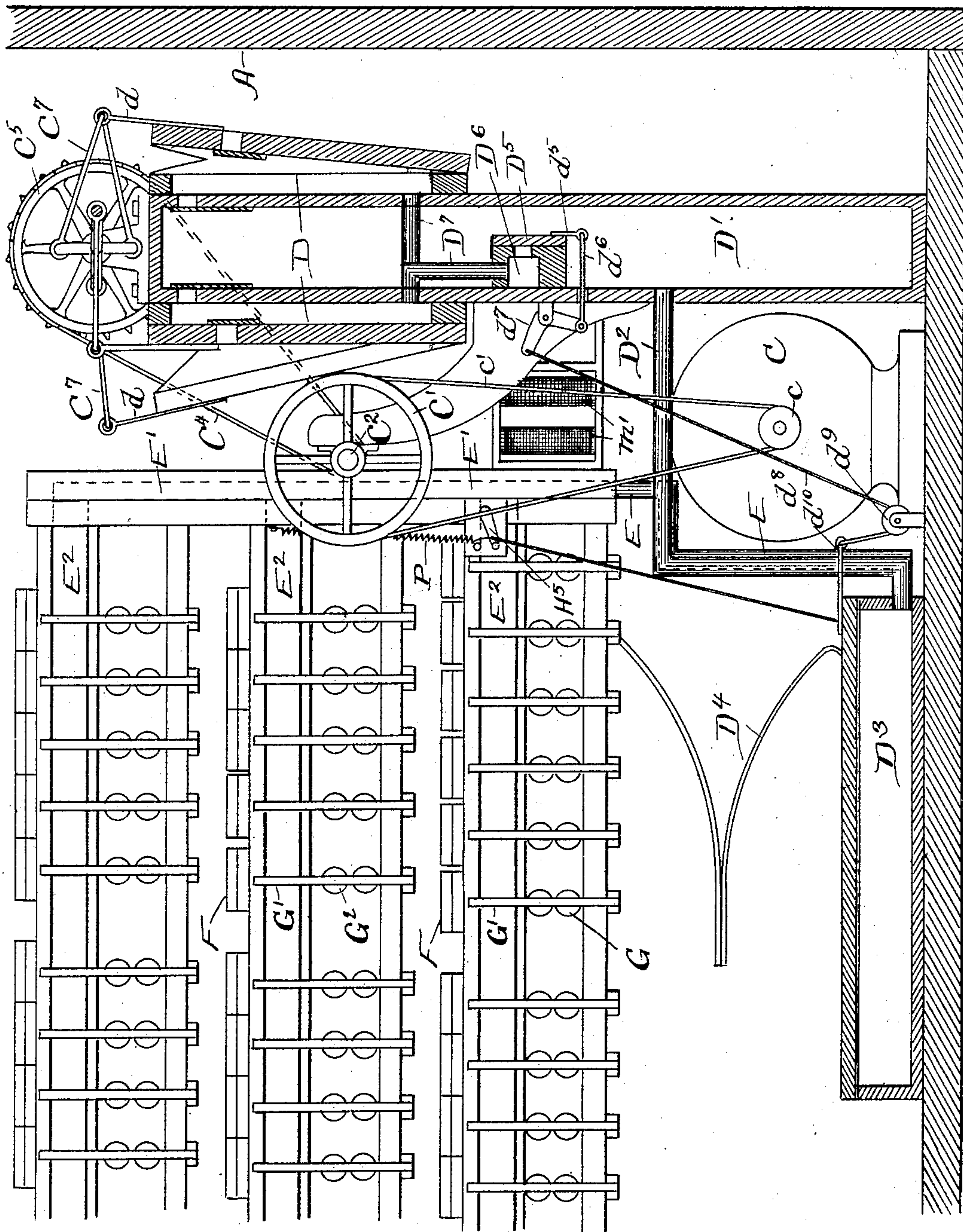
Inventor:
Frederick W. Hedge Land.
By Munday Erants & Aderck
His Attorneys.

F. W. HEDGE LAND.

SELF PLAYING MECHANISM FOR PIANOS OR ORGANS.

No. 547,071.

Patented Oct. 1, 1895.



Witnesses:

Sew. C. Curtis
Emma Hack

Fig. 2.

Inventor:

Frederick W. Hedge Land

By Munday Evans & Aderck

his Attorneys.

(No Model.)

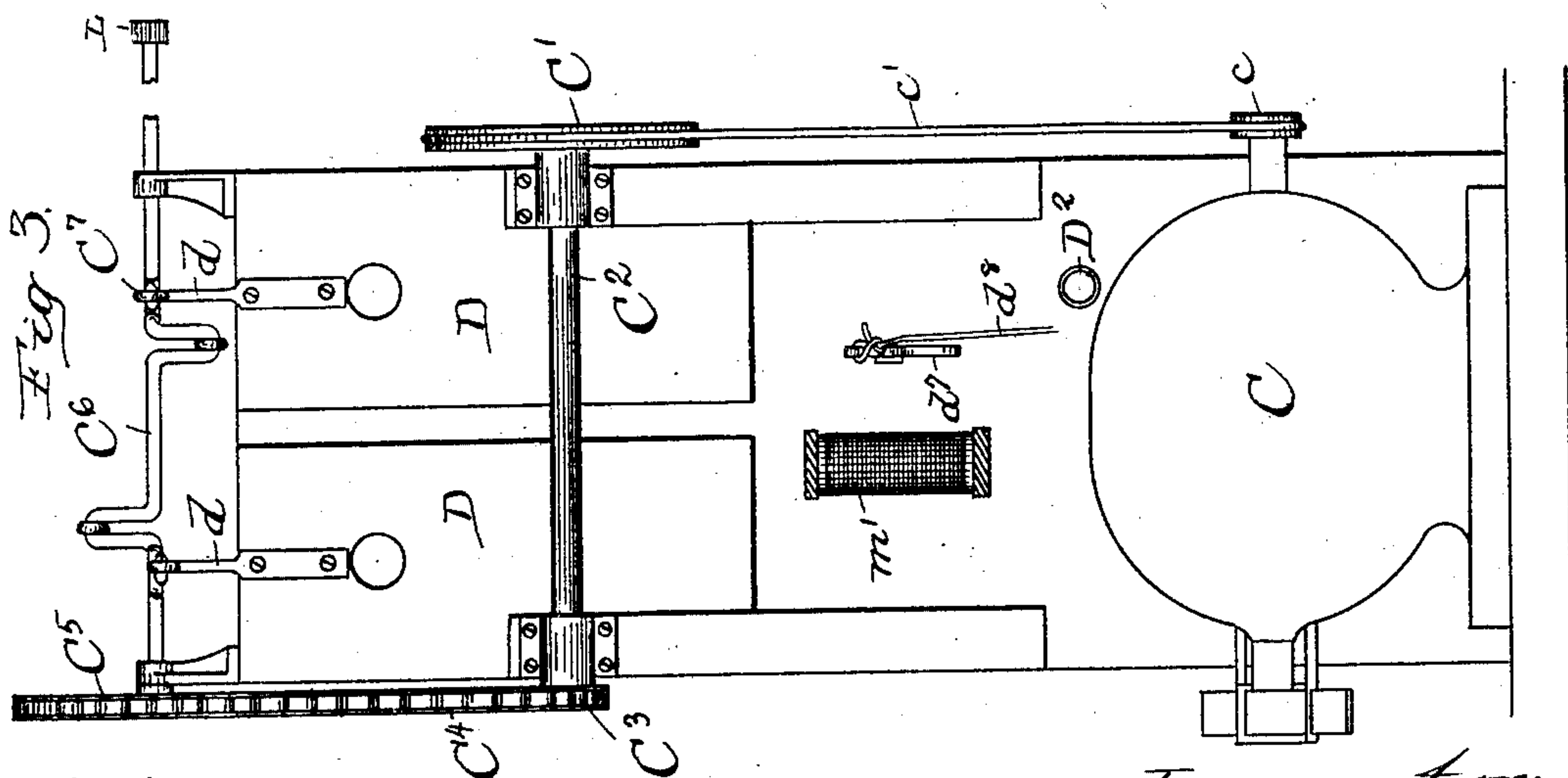
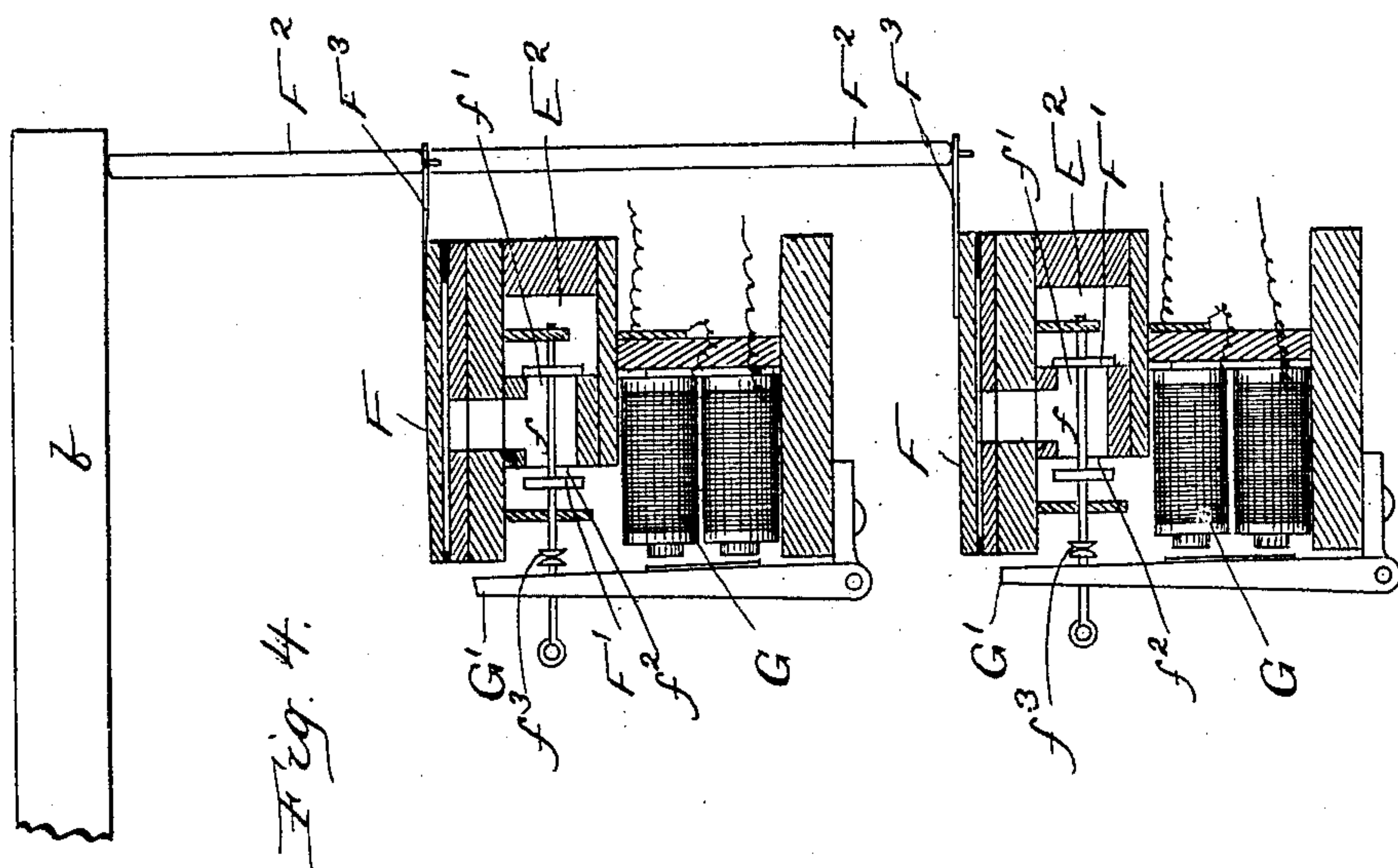
5 Sheets—Sheet 3.

F. W. HEDGELAND.

SELF PLAYING MECHANISM FOR PIANOS OR ORGANS.

No. 547,071.

Patented Oct. 1, 1895.



Witnesses:

Scu. C. Curtis
Emma Hack

Inventor:

Federick W. Hedgeland.

By Munday Evans & Work
His Attorneys.

(No Model.)

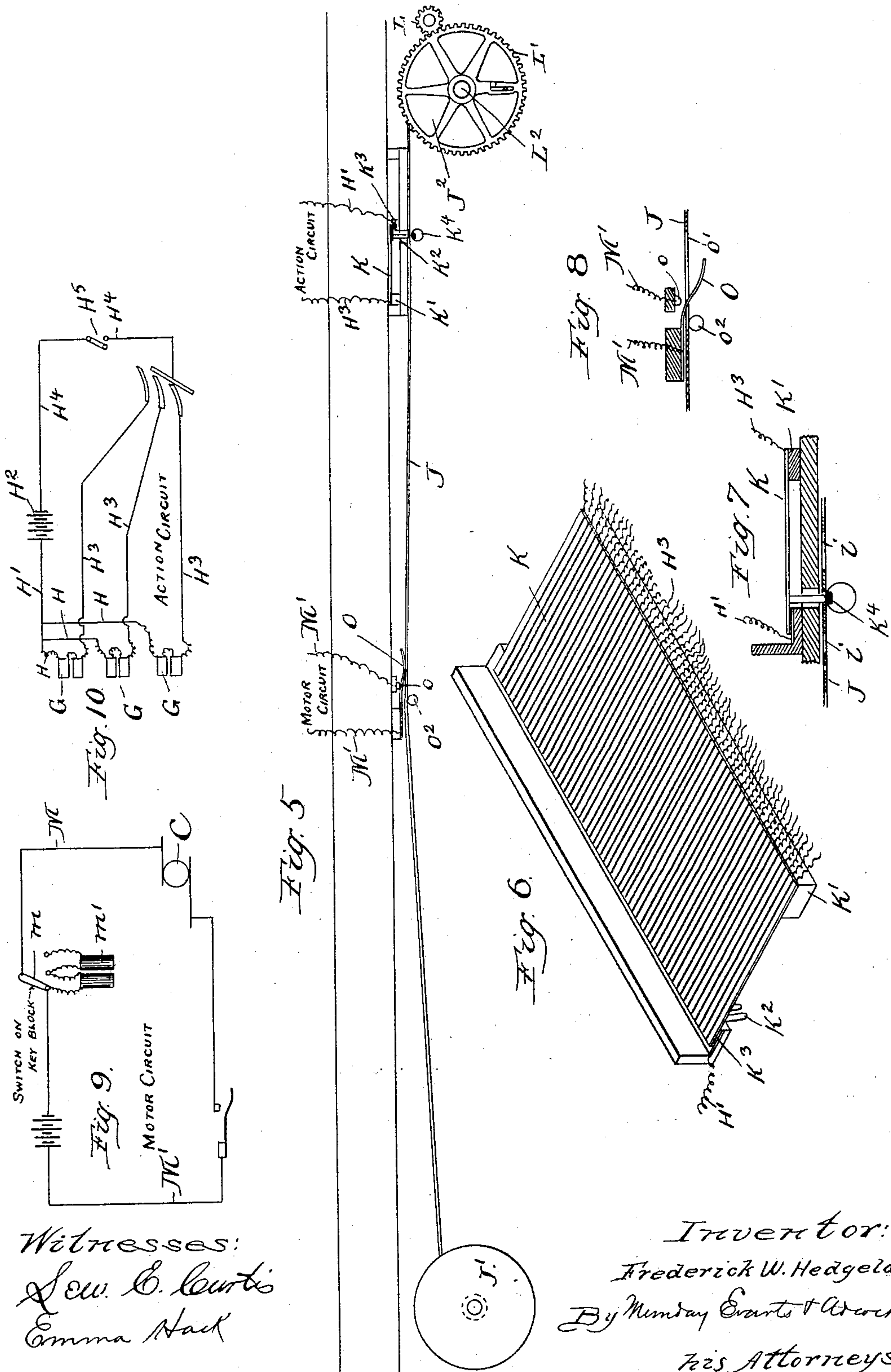
5 Sheets—Sheet 4.

F. W. HEDGELAND.

SELF PLAYING MECHANISM FOR PIANOS OR ORGANS.

No. 547,071.

Patented Oct. 1, 1895.



Witnesses:
Sew. C. Curtis
Emma Hack

Inventor:
Frederick W. Hedgeland
By Munday Evans & Adcock
His Attorneys.

(No Model.)

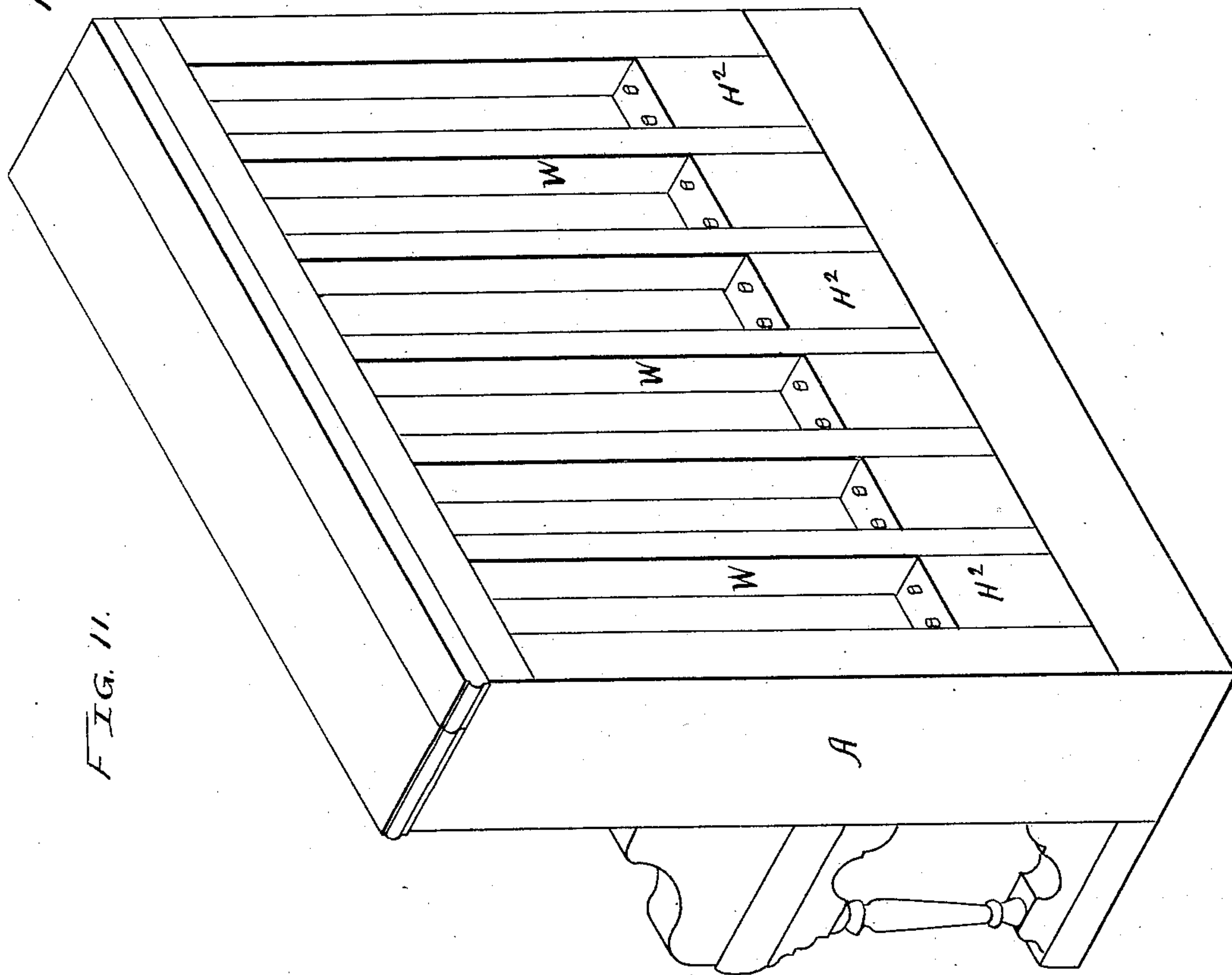
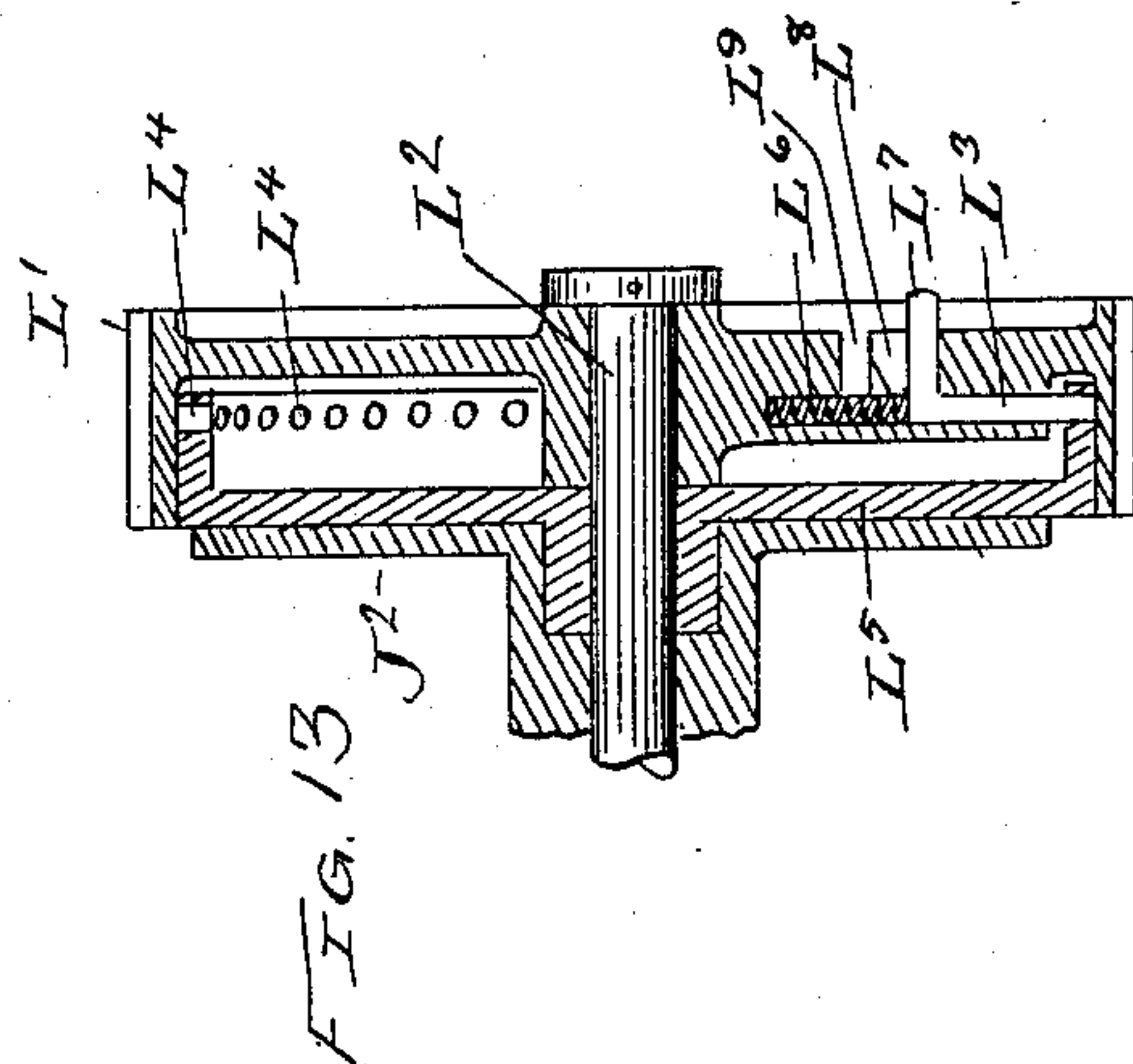
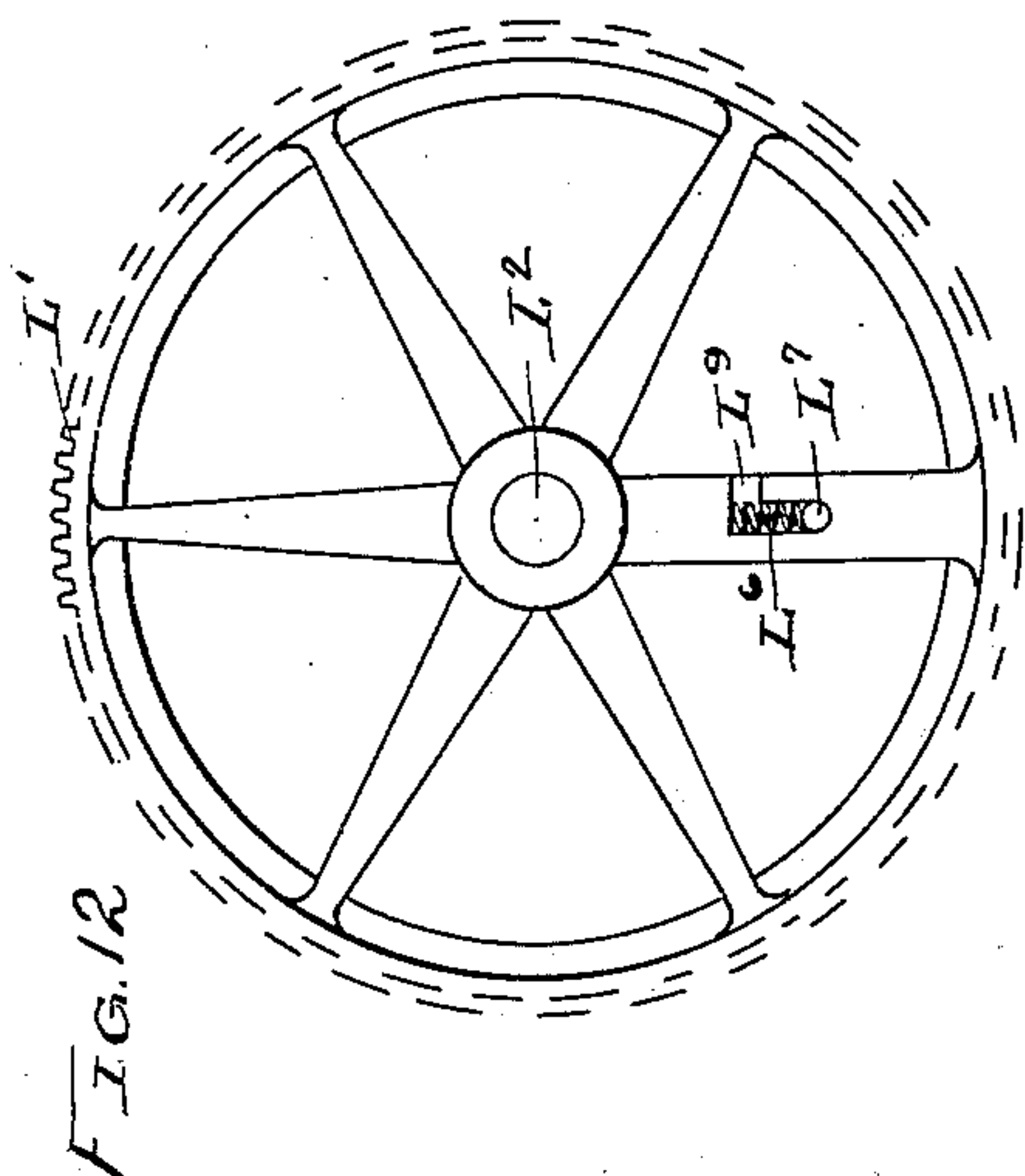
5 Sheets—Sheet 5.

F. W. HEDGELAND.

SELF PLAYING MECHANISM FOR PIANOS OR ORGANS.

No. 547,071.

Patented Oct. 1, 1895.



WITNESSES:

Lev. E. Curtis
Emma Hack

INVENTOR:

Frederick W. Hedgeland
BY Munday Curtis & Adcock
HIS ATTORNEYS.

UNITED STATES PATENT OFFICE.

FREDERICK W. HEDGELAND, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE
W. W. KIMBALL COMPANY, OF SAME PLACE.

SELF-PLAYING MECHANISM FOR PIANOS OR ORGANS.

SPECIFICATION forming part of Letters Patent No. 547,071, dated October 1, 1895.

Application filed February 23, 1894. Serial No. 501,149. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK W. HEDGELAND, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Self-Playing Mechanism for Pianos or Organs, of which the following is a specification.

This invention relates to self-playing keyboard instruments, and especially to the means employed for rendering them automatic in their playing.

It has been my endeavor in the invention to improve the self-playing mechanism and render it more practical than previous constructions; also, to adapt it to use in upright pianos of ordinary form without any increase in the size or change in the shape of the instrument-case; also, to avoid adding to the instrument-case any visible mechanism or feature which will impair the appearance of or disfigure the case.

In my improved instrument I operate the keys by means of a series of small bellows, commonly called "pneumatics," one for each key, and control such pneumatics by electrical devices set in operation by the moving perforated paper strip customarily employed in this class of instruments. The action is therefore partly pneumatic and partly electrical. The electric circuits are normally open, but are each provided with a circuit-closer consisting of a stationary contact and a spring-contact, the latter located so as to bear upon the moving perforated strip and so the perforations in the strip will allow the closing of the circuit. A suitable motor is employed to maintain the wind-pressure necessary to operate the pneumatics, and the drum whereon the perforated strip is wound and by which it is moved may be actuated by the same motor. I prefer that this motor should be an electric one, and to control its operating-circuit by means of a spring-circuit breaker which is allowed to operate by means of a perforation in the perforated strip.

In order to adapt the invention to use upon existing styles of instruments, I have placed the moving strip immediately under the keyboard, with the winding and unwinding drums below the ends of the board, so that no inter-

ference is thereby caused with the limbs of any person or persons seated at the instrument. The motor, the wind-boxes, the pneumatics, the magnets through which the valves of the pneumatics are actuated, and the bellows are all located within the base portion of the case and behind the knee-board, while the batteries for applying the electric energy are also located within the case and in ordinary upright pianos between the back posts of the case. It will thus be seen that no change in the construction of ordinary upright pianos is necessary in order to permit the application of my invention thereto and that it may be easily applied to existing instruments of that style. The only parts added to the outside of the case of such pianos are the paper drums, and they are so placed as to be inconspicuous, so that it is also true that the general appearance of the instrument remains unaffected.

Many features of the invention may also be used in other pianos and in cabinet and other organs.

The details of my invention are fully shown in the accompanying drawings, wherein—

Figure 1 is a front view of an upright piano to which my invention has been applied, the knee-board being left off, so as to disclose the inner construction. Fig. 2 is a partial vertical section enlarged, showing the motor, wind-pressure-creating mechanism, and the pneumatics. Fig. 3 is a cross-section showing the same parts as Fig. 2. Fig. 4 is a detail section of the pneumatics and their controlling devices. Fig. 5 is a front elevation of the perforated strip and its supporting-drums. Fig. 6 is a perspective of the series of circuit-closers employed to close the action-circuits. Figs. 7 and 8 are detail sections of the perforated strip, the former showing one of the circuit-closers and the latter showing the breaker employed in the motor-circuit, both in action. Figs. 9 and 10 are diagrams of the motor-circuit and the electric action-circuit, respectively. Fig. 11 is a perspective of the back of the piano-case. Figs. 12 and 13 are details of the paper-winding drum.

In the drawings, A may represent the case of the instrument, the one shown being that of an upright piano. B is the keyboard, and b b are the keys of the instrument. The ma-

5 jor portion of my improved automatic mechanism is located in the lower portion of the case behind the front or knee board thereof and in front of the strings and frame, and a portion of it is placed under the keyboard.

10 I will first describe the pneumatic action for operating the keys. C is a motor, preferably an electric one, the duty of which is to operate the air-feeders D, which are similar in construction to the feeders commonly employed with organ-bellows, and whereby the necessary wind-pressure is created. These parts are mechanically connected by pulley c upon the motor-shaft, belt c', pulley C', 15 shaft C², sprocket-pulley C³, chain C⁴, wheel C⁵, crank-shaft C⁶, carrying said wheel, pitman C⁷, and arms d, attached to the movable sides of the feeders. I employ a plurality of feeders in order the better to obtain a steady 20 pressure and to even up or distribute the work put upon the motor. The feeders force the air into a vertical passage-way D', which supplies it to a pipe D², conducting it to the reservoir D³, the top whereof is adapted to rise as the internal pressure increases and is 25 pressed downwardly by the spring D⁴. To prevent excessive pressure a valve D⁵, located in the passage D', is made to open whenever such pressure occurs by power received from 30 the movable top of the reservoir and to give the air in said passage vent back into the feeders through separate passages D⁶ and the series of pipes D⁷, connecting said passages with the different feeders. The valve D⁵ is 35 connected to the reservoir-top by arm d⁵, attached to the valve, connecting-rod d⁶, elbow-lever d⁷, and belt d⁸, passing under pulley d⁹ and united to arm d¹⁰ upon the reservoir-top. When the relief-valve is open, the air simply 40 circulates through the passage D' and the feeders instead of being forced into the reservoir and also acts to keep the feeder-inlets closed against the entrance of fresh air. From the reservoir the air passes by the pipe E and 45 air-trunk E' into the wind-boxes E², of which there is one for each row of the pneumatics F. The latter are similar to the pneumatics employed in organ actions and are preferably arranged in three rows, as that arrangement 50 gives room for the large number necessary, it being requisite to provide one for each key of the keyboard. They are disposed horizontally upon the wind-boxes, and the passages f, leading from the boxes into the pneumatics, 55 are guarded by double-headed sliding valves F', which are operated as hereinafter fully set forth. One head of these valves controls the inlets f' of passages f and the other controls the air-outlets f² from said passages, the 60 inlets being normally closed and the outlets normally open and each being open when the other is closed. The movable side of each pneumatic is joined to a lifting rod or bar F² in some suitable way—as, for instance, by an 65 outstanding arm F³, secured to the movable side—and said lifting-rod is placed immediately under the rear end of the key it is in-

tended to operate. It will thus be seen that whenever the motor is set in operation the feeders will act to charge the wind-boxes with 70 air under pressure, and that whenever the valves F' are operated and the inlets f' opened the pneumatics will be charged, so that the keys with which the latter are connected will be sounded. Each valve F' is electrically 75 operated by a magnet G, located in proximity to the valve, and a pivoted lever G', carrying the armature of the magnet and actuated thereby and so located as to insure its contact when the armature and lever are drawn 80 to the magnet, with the button f³ upon the stem of the valve. In this manner the valve is slid so as to open the inlet f' and charge the pneumatic, and it is instantly brought back to its normal position whenever the elec- 85 tric force is withdrawn by the air-pressure acting against its heads. The several magnets G are located in and energized by suitable electric circuits, which I prefer should consist of individual wires H, one for each 90 magnet, and all adapted to be connected to the single wire H', leading to one pole of the battery H², and individual wires H³, one for each magnet, all joined to the single wire H⁴, leading to the other pole of the battery. The 95 switch H⁵ in wire H enables all the circuits to be opened and closed, and circuit-closers are also employed with each of the individual circuits, as presently to be described.

The moving perforated paper strip is shown 100 at J and is located immediately below the keyboard, where it takes up no valuable room and may be easily concealed. The unwinding roll or drum is shown at J' and the winding or drawing drum or roll is seen at J², these 105 drums being located under the ends of the keyboard and being covered in front by hangers or doors J⁴. A depending strip J⁵ may be employed to prevent the moving strip from being visible at any point, and this strip is 110 cut away at the center to avoid interference with the knees of players using the piano for manual playing. The perforated strip may be such as is now in common use. Immediately above the moving strip are a series of 115 springs K, all mounted upon a bar K' and each joined to one of the wires H³, the bar standing transverse of the strip. The springs correspond in number with the number of keys and circuits, and each carries a stud K², 120 adapted to bear upon the strip J and enter such of the perforations i therein as present themselves in line with the stud. When the stud enters one of the perforations, it brings about contact between the free end of its 125 spring K and a contact-plate K³, which is electrically joined to the wire H', so that, supposing the controlling-switch to be closed, a circuit is completed and a current generated, which passes through and energizes the mag- 130 net of the circuit, and the magnet is thus caused to operate its lever and corresponding valve F', all resulting in the sounding of the key or note to which the circuit and valve be-

long. The stud when it falls into the perforations is met by an insulating-strip in the transverse bar K^4 and is lifted out of the perforation by the continued movement of the strip, thus breaking the circuit at the plate K^3 . The stud now rides upon the surface of the strip and keeps the circuit open until another perforation allows it to descend and renew the contact between the spring and contact-plate. The breaking of the circuit of course allows the valve F' to move back into its normal position, shutting off the air-pressure from the pneumatic and allowing the air in the same to escape. The stud enters the strip only a slight distance and is moved only slightly either up or down, and consequently there is little danger of tearing the paper or of objectionable wear upon the walls of the perforations, and there is also a saving of time both in opening and closing the valve F' . The bar K^4 maintains the moving strip at the proper horizontal plane to insure lifting of the spring-circuit closers and thus avoid any permanent closing of the action-circuits.

Motion is given the winding-drum by the pinion L upon the end of crank-shaft C^6 , meshing with the gear L' upon the journal L^2 of the drum. This gear L' is free to rotate independently of the drum; but it carries a catch or pin L^3 , adapted to enter any of the openings L^4 in the overhanging flange of the drum-head L^5 and thus carry the drum with it. A spring L^6 acts to keep the catch in engagement with the drum. The catch is also provided with a right-angled projection L^7 , whereby it may be moved out of engagement, said projection traveling in the slot L^8 in the arm of the gear, and the side enlargement L^9 of the slot permitting the catch to be detained from engagement against its spring L^6 . The ability to detach the gear from the drum afforded by this construction permits the perforated strip to be drawn back and wound upon drum J' .

The electric circuit for operating the motor is composed of the wires M , connecting one pole of the battery or source of energy with the motor, and the wire M' , connecting the other pole therewith. In one of these connections I place a switch m , whereby the current may be directed through one or more resistance-coils m' and the speed of the motor be thereby controlled to accord with the time required by the music being played. In the other wire I locate a circuit-breaker adapted to be operated by the perforated strip, and which may consist of an electrically-connected spring O , located and constructed so it will ride upon the surface of the strip and be held up thereby, with its free end bearing against the contact-point o , and thus to maintain the circuit while the instrument is playing, but adapted to fall and destroy its contact with point o when the slit or opening o' in the perforated strip presents itself at the conclusion of the playing. A supporting cross-bar o^2 is placed under the perforated strip and beneath the circuit-breaker to insure the

maintenance of the circuit-contact with point o during operation. By means of this circuit-breaker the motor is automatically stopped at the conclusion of the piece being played. The switch m is preferably located where it is readily accessible—as, for instance, upon one of the key-blocks, as shown.

The controlling-switch of the action-circuits is connected to the top of the bellows-reservoir by a cord or other suitable device, so that when the reservoir becomes empty and the top descends the switch will be opened and the circuits destroyed, and a spring P also acts upon the switch in a direction contrary to the cord and closes the same whenever the reservoir is filled sufficiently to create slack in the cord. Through these devices the circuits are automatically opened whenever the wind-pressure gives out and automatically closed whenever it becomes strong enough to operate.

I prefer to use several batteries H^2 whereby to obtain the electric energy necessary to operate the various circuits employed in the instrument and to locate such batteries, in the case of upright pianos, in the spaces between the vertical posts W of the back frame. I thus obviate the necessity, which would otherwise exist if they are to be borne in or upon the instrument so as to be movable therewith, of placing them inside the case, where all the room is needed for other things, or enlarging the case to accommodate them.

I do not claim herein anything shown in patent to Pain, No. 417,680.

I claim—

1. The combination in a self playing key board instrument and with the keys thereof, of a pneumatic action for operating said keys a bellows for said action, electrical devices and circuits for controlling the pneumatic action, a motor, an electric circuit controlling the motor, the moving perforated music strip, circuit closers in said action circuits operated by said strip, and a circuit breaker in said motor circuit operated by said strip, substantially as set forth.

2. In an electric pneumatic action for musical instruments, the combination with the bellows and the electric circuits of a switch controlling said circuits, and connections between said switch and the bellows whereby the switch is opened when the air pressure in the apparatus ceases, substantially as specified.

3. The combination of the pneumatics, the valves controlling the pneumatics and the electric circuits and magnets operating said valves, with the bellows and the switch common to all said circuits and which is operated to open or close the same according to the presence or absence of the air pressure in the apparatus, substantially as set forth.

4. The combination with the pneumatics, the valves controlling the pneumatics, the electric circuits and magnets operating said valves, of the bellows for charging the pneumatics and means operated by the bellows for

automatically breaking said circuits when the air pressure ceases, substantially as set forth.

5. The combination in a self playing instrument, with the motor, the feeders operated by
5 the motor, and the reservoir, of the relief valve mechanically connected to the movable top of the reservoir, air pipes connecting said valve

with the feeders and the pneumatics for actuating the keys, substantially as set forth.

FREDERICK W. HEDGELAND.

Witnesses:

H. M. MUNDAY,
EMMA HACK.