

(No Model.)

4 Sheets—Sheet 1.

O. H. NEEDHAM.

MECHANICAL MUSICAL INSTRUMENT

No. 258,667.

Patented May 30, 1882.

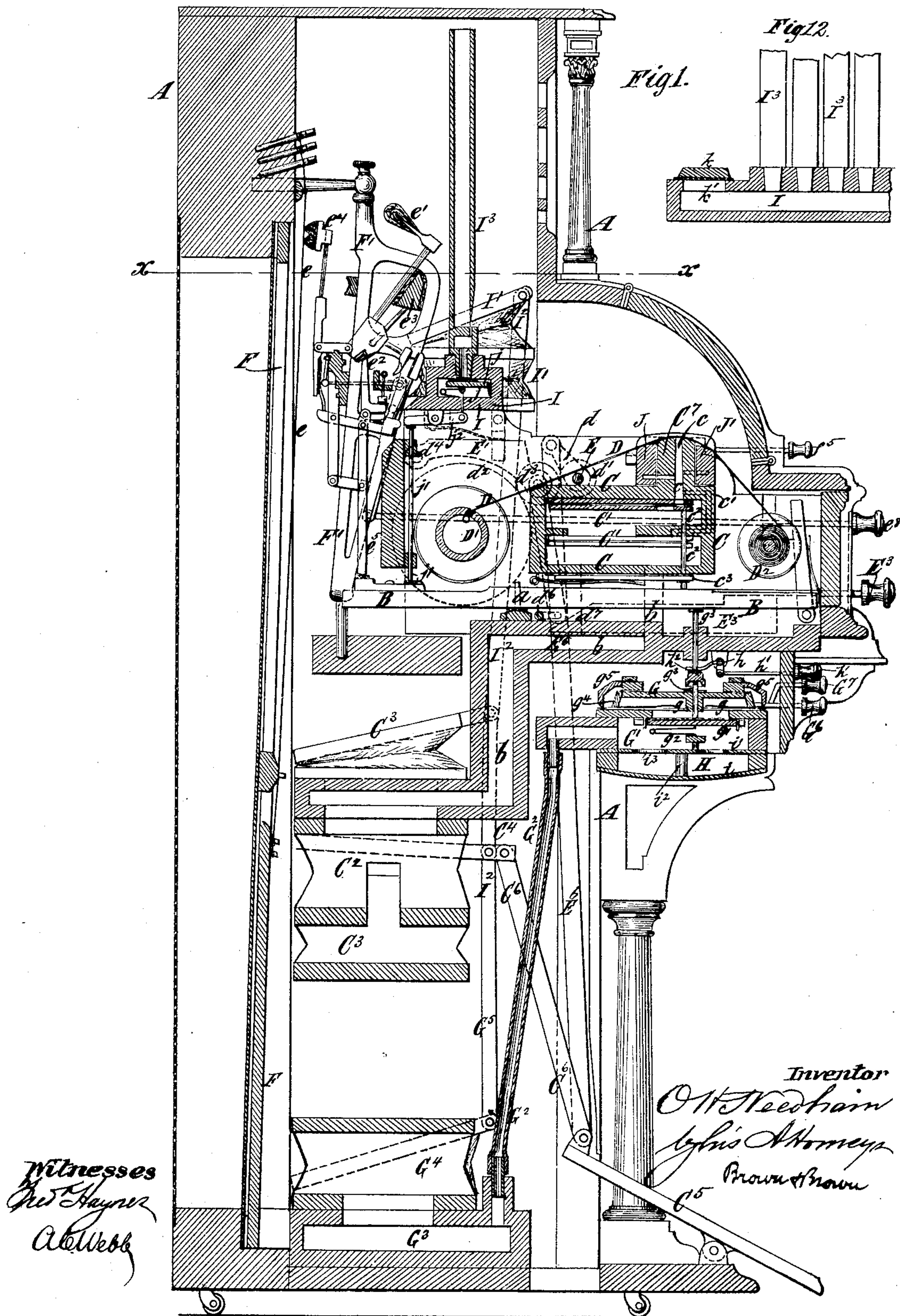


Fig 12.

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16

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Inventor

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Witnesses
J. H. Hays
A. C. Webb

Wm. H. Hayes

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(No Model.)

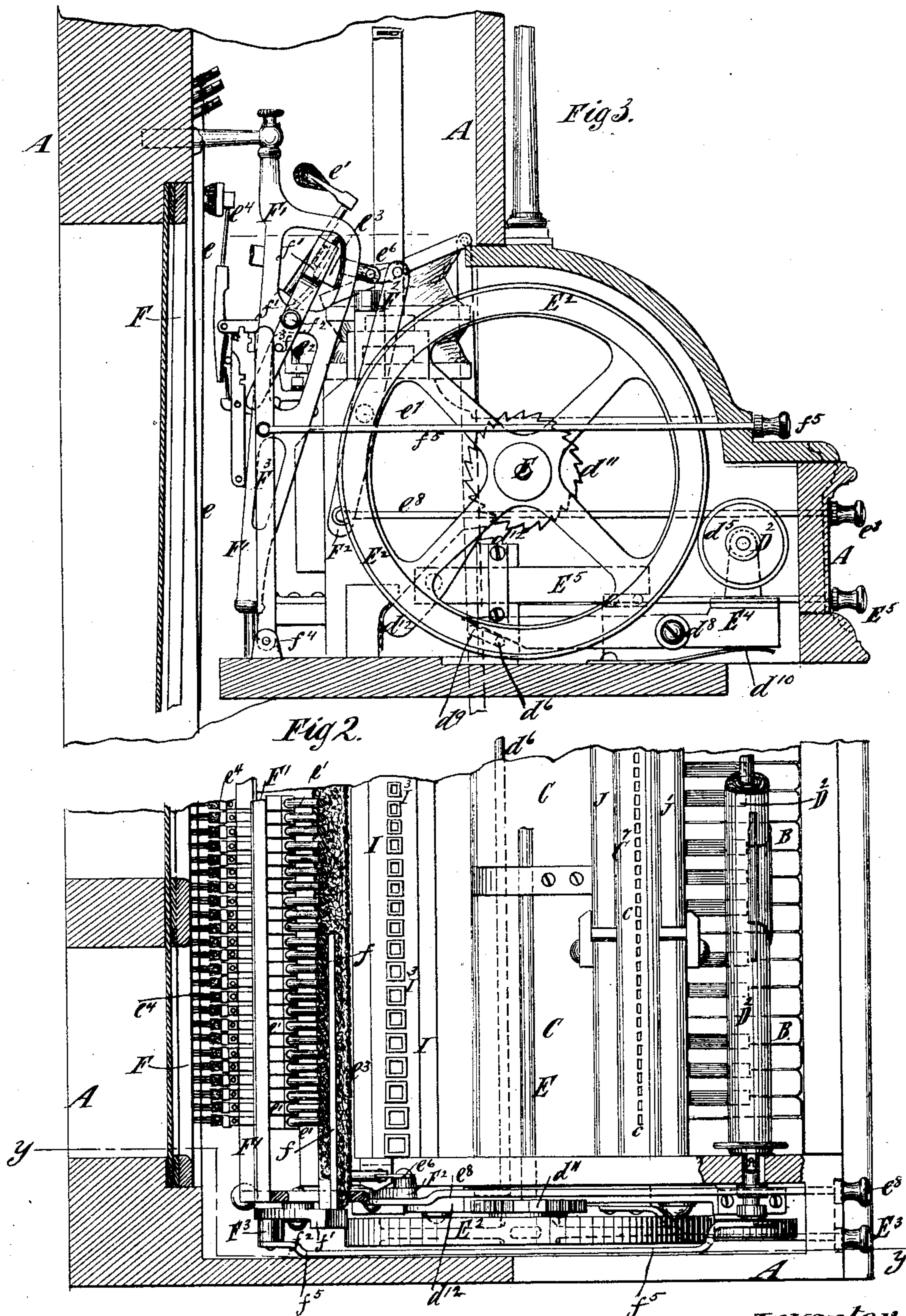
4 Sheets—Sheet 2.

O. H. NEEDHAM.

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No. 258,667.

Patented May 30, 1882.



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(No Model.)

4 Sheets—Sheet 3.

O. H. NEEDHAM.

MECHANICAL MUSICAL INSTRUMENT.

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Fig 4.

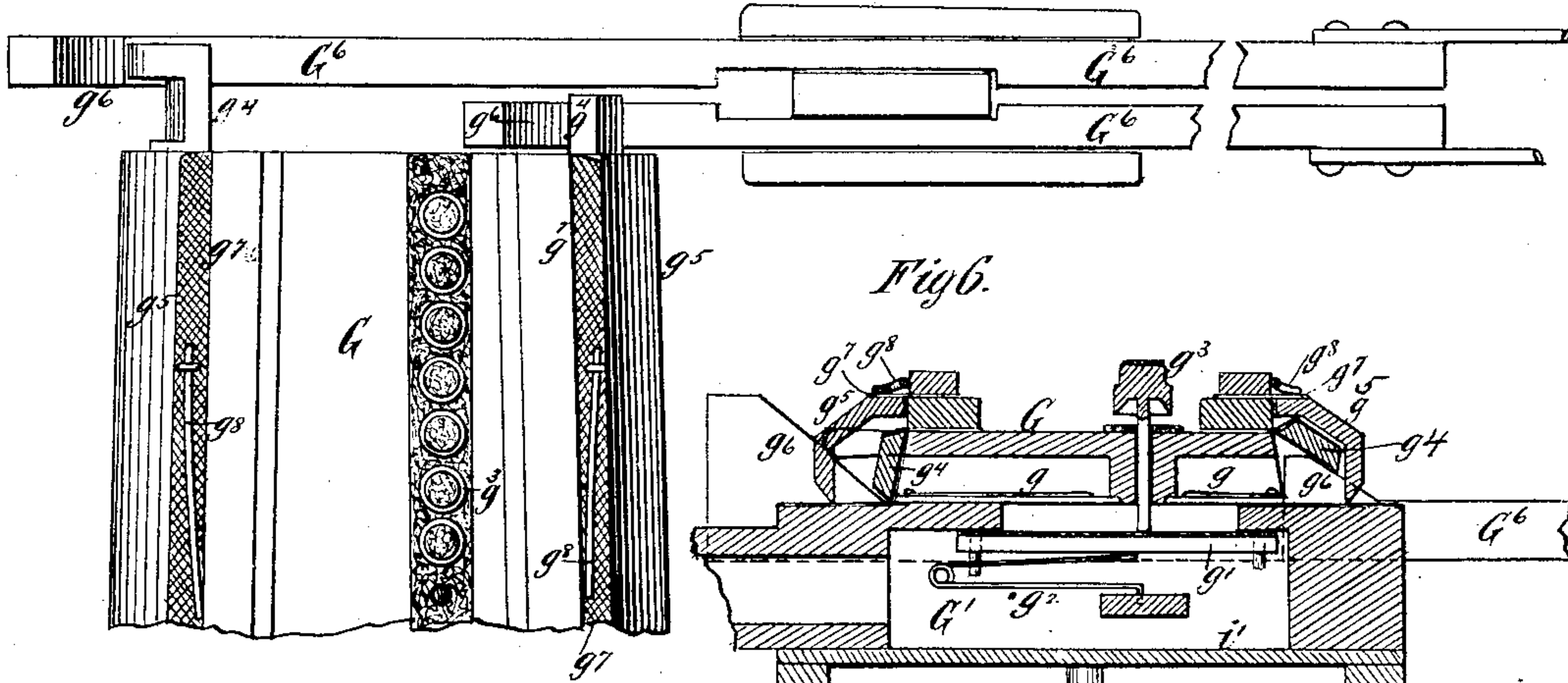


Fig 6.

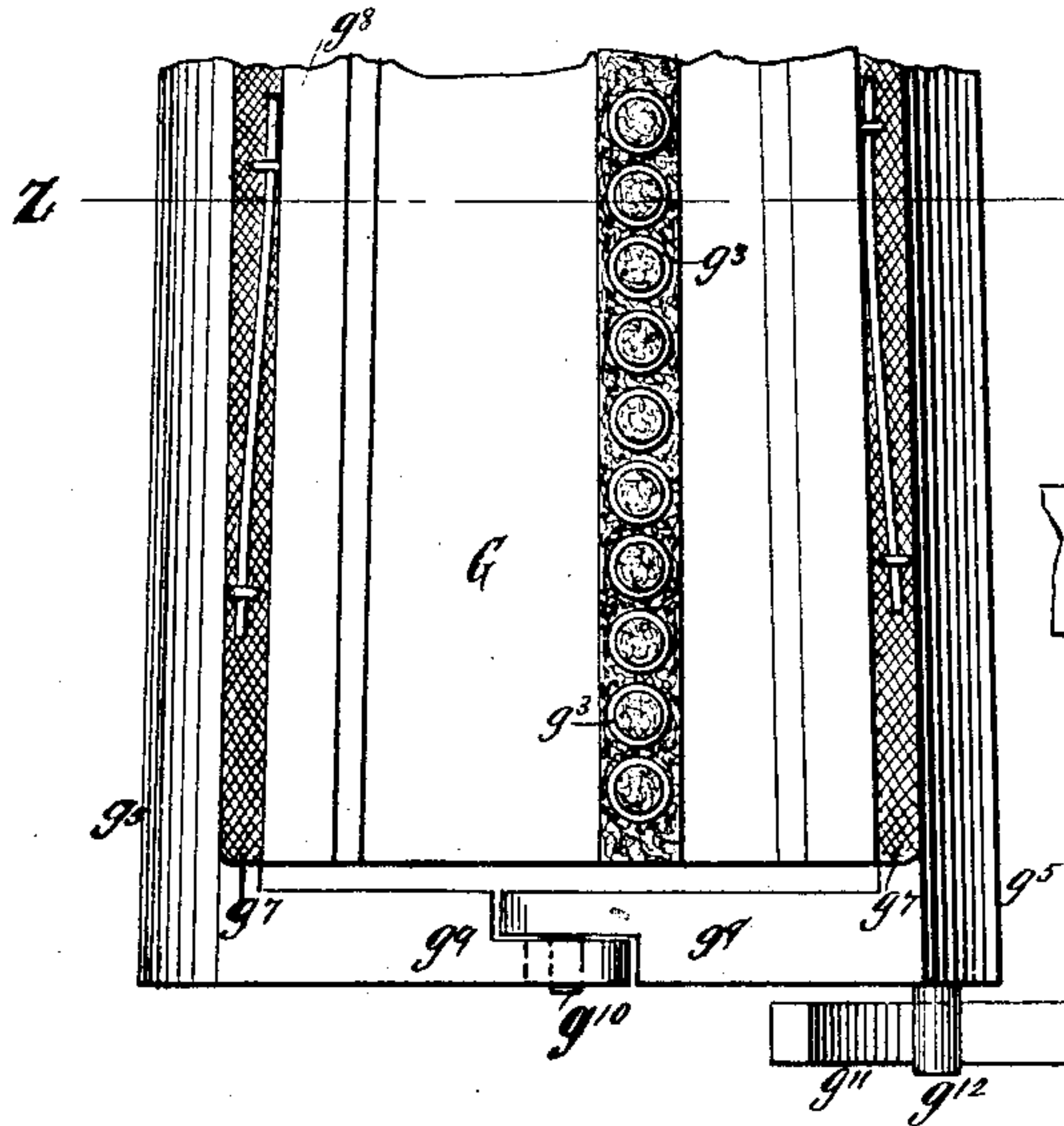
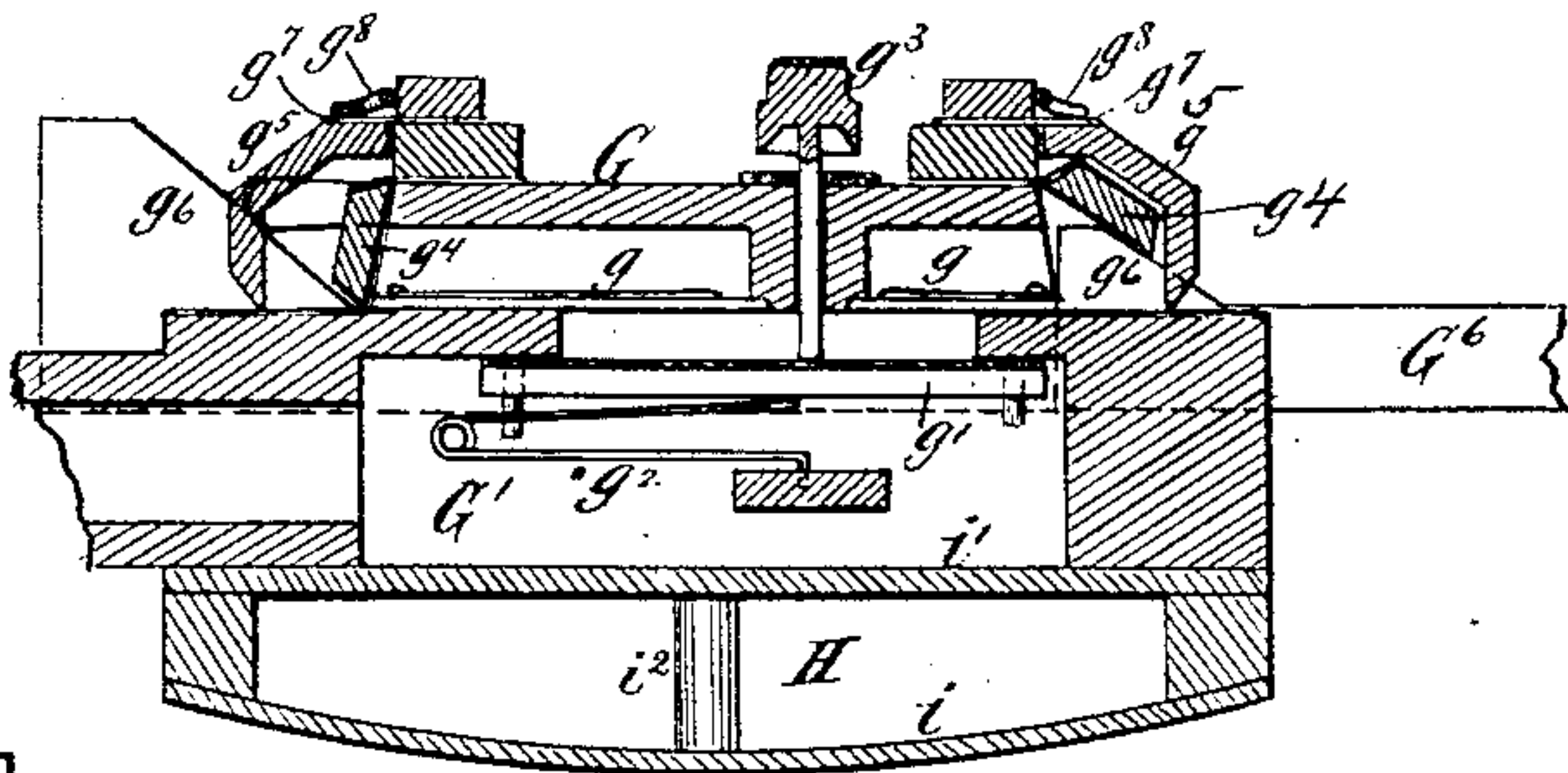


Fig 5.

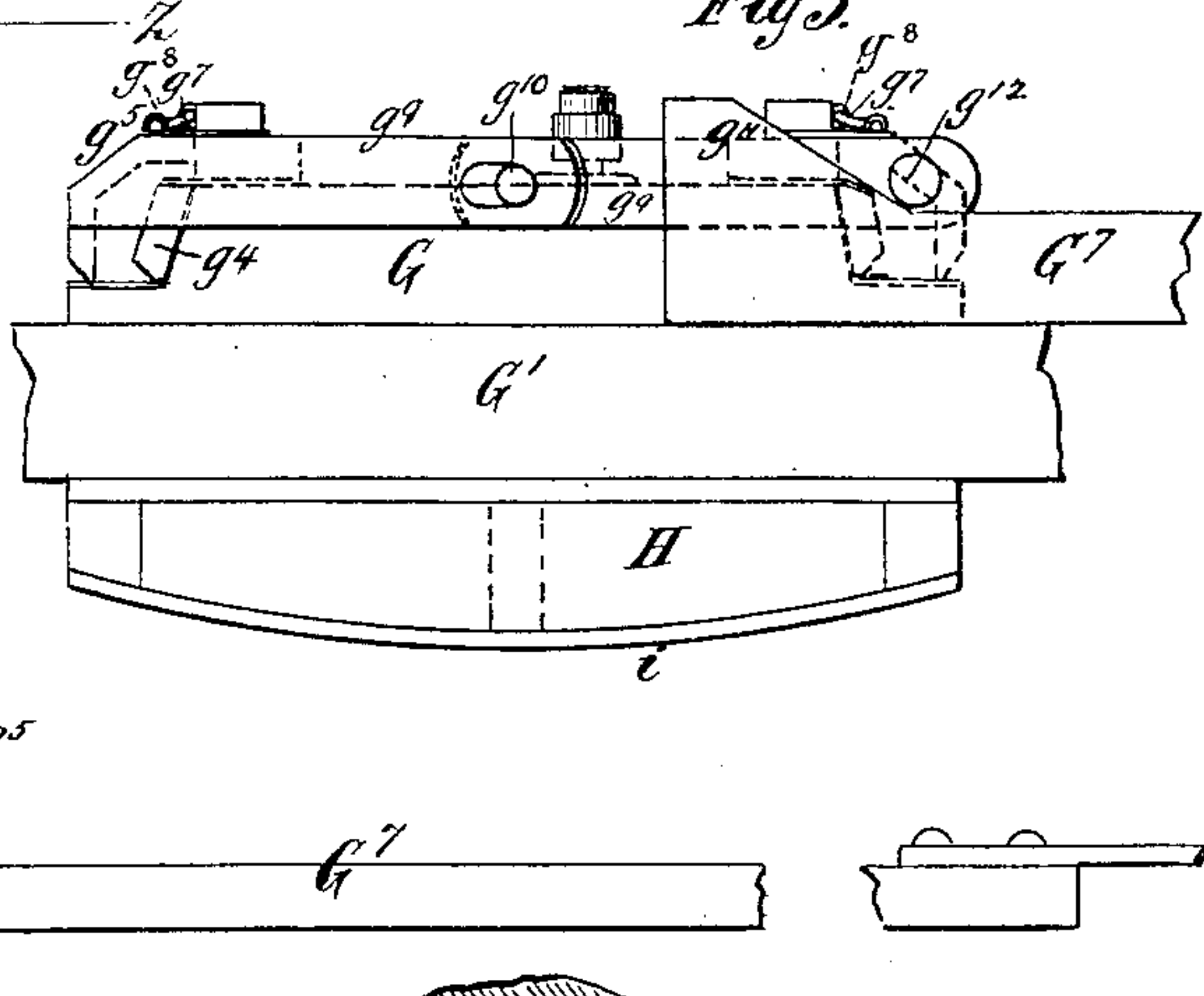
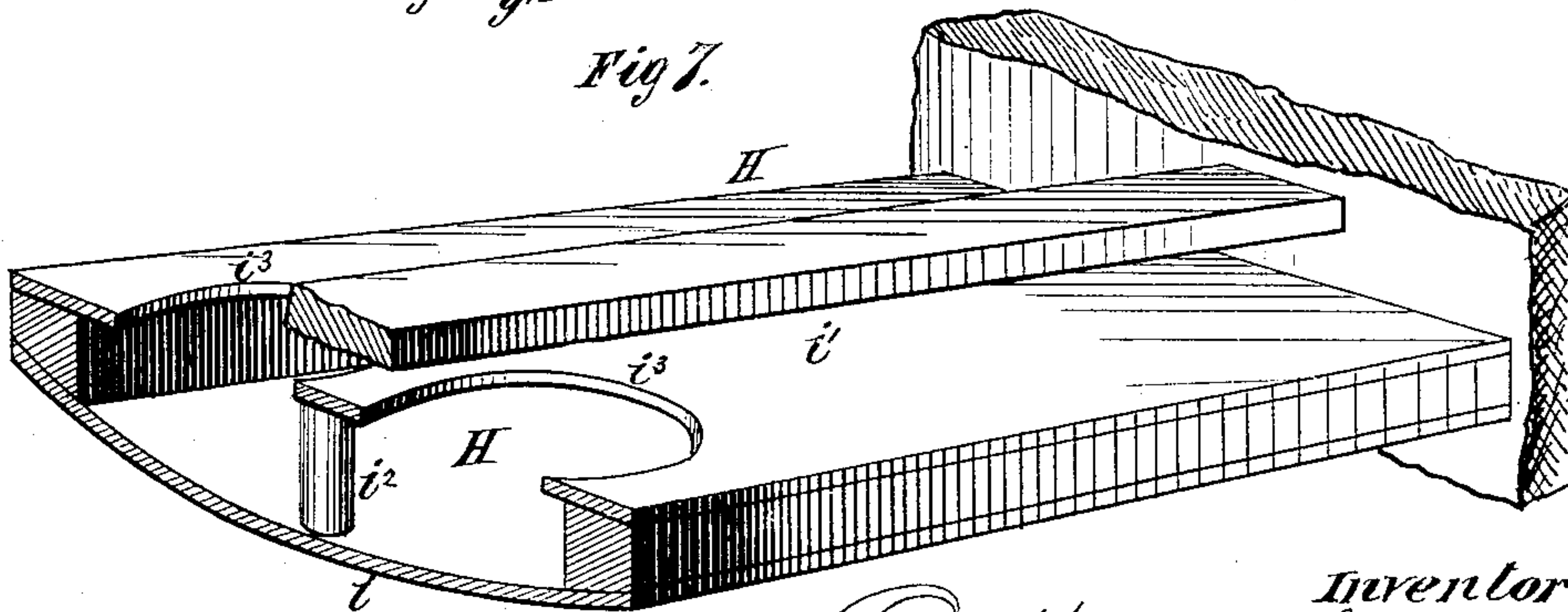


Fig 7.



Witnesses

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(No Model.)

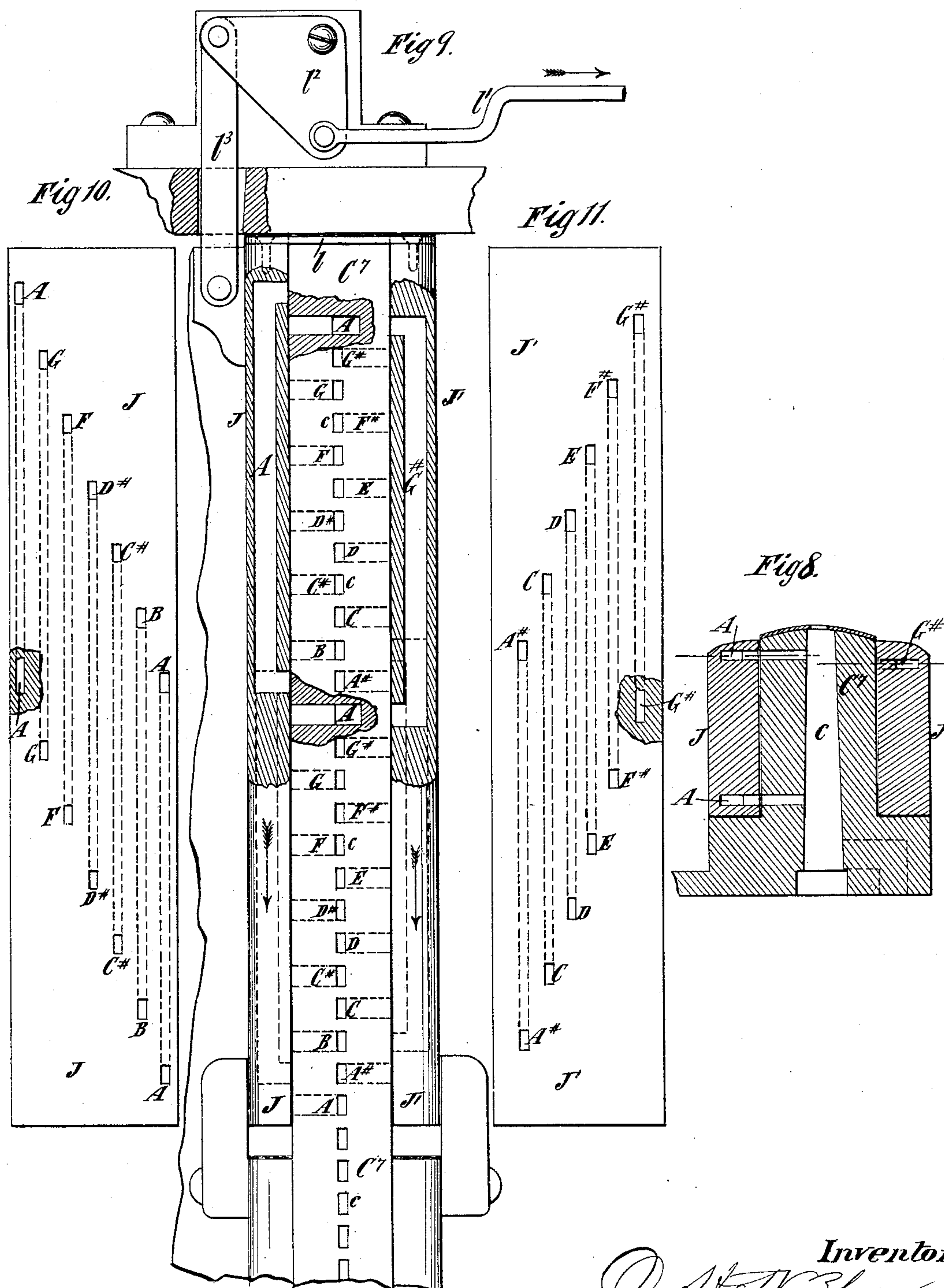
4 Sheets—Sheet 4.

O. H. NEEDHAM.

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No. 258,667.

Patented May 30, 1882.



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UNITED STATES PATENT OFFICE.

ORWELL H. NEEDHAM, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO JOHN NICHOL, OF SAME PLACE, JAMES MORGAN, OF BROOKLYN, N. Y., AND JANE MATTHEWS, OF BOSTON, MASS.

MECHANICAL MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 258,667, dated May 30, 1882.

Application filed January 12, 1881. (No model.)

To all whom it may concern:

Be it known that I, ORWELL H. NEEDHAM, of the city and county of New York, in the State of New York, have invented certain new and useful Improvements in Musical Instruments, of which the following is a specification.

My invention relates principally to musical instruments which are adapted to be played manually by a key-board or mechanically by a traveling music sheet, card, or tablet provided either with projections or perforations.

My invention consists in the combination, in a musical instrument, of sound-producing devices, a rest provided with ducts for the passage of air to operate said sound-producing devices and with ports extending from said ducts to the side of the rest, a traveling music-sheet for controlling the passage of air through said ducts, and a cheek-piece adjustably secured to the side of said rest, and constructed with ports ranging with the ports in said rest, whereby the sound-producing devices of one octave may be coupled with sound-producing devices of corresponding notes in another octave.

It also consists in the combination, in a mechanical musical instrument, of sound-producing devices, a rest provided with ducts for the passage of air to operate said sound-producing devices and with ports leading from said ducts alternately to opposite sides of the rest, a traveling music-sheet controlling the passage of air through said ducts, and cheek-pieces adjustably secured to opposite sides of said rest, and constructed with ports ranging with the ports in said rest, one of said cheek-pieces serving to couple alternate sound-producing devices and the other the intermediate sound-producing devices in one octave with devices of corresponding notes in another octave.

It also consists in the combination, in a wind musical instrument, of sound-producing devices, an exhaust chest or chamber with which said sound-producing devices communicate, a hollow sounding-board communicating with said exhaust chest or chamber, and means for exhausting air from said chest or chamber and also from said sound-board, whereby a tension is applied to said sound-board.

In the accompanying drawings, Figure 1 represents a transverse vertical section through an instrument embodying my invention. Fig. 2 represents a horizontal section of a portion of the instrument upon the dotted line *xx*, Fig. 1, a portion of the case and covers being removed to expose the parts beneath it. Fig. 3 represents a vertical section of the upper portion of the instrument upon the irregular dotted line *yy*, Fig. 2. Fig. 4 represents a plan view upon a larger scale of the reed-chest, containing the reed-action and appurtenances, a portion being broken away to economize space. Fig. 5 represents an end view of said reed-chest, and showing also a hollow sounding-board below the same. Fig. 6 represents a transverse section of the reed-chest and sounding-board upon the dotted line *zz*, Fig. 4. Fig. 7 represents a perspective view of a portion of the hollow sounding-board upon a still larger scale. Fig. 8 represents a transverse section of the rest for the traveling music card or tablet and cheek-pieces forming octave couplers upon opposite sides thereof. Fig. 9 represents a plan, partly in section, of a portion of said rest and said cheek-pieces. Figs. 10 and 11 represent face views of the two cheek-pieces, showing the arrangement of ports for coupling sound-producing devices of corresponding notes in different octaves, and Fig. 12 represents a detail view of a portion of the pipe-action.

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

A designates the case of the instrument, which may be of any desirable form, and is provided with suitable hinged covers at the front, which may be opened to afford access to the various parts of the instrument.

B designates the keys of a manual key-board, which are fulcrumed at *a*, and may be operated in the same way as any manual keys to play the instrument. The keys B constitute levers through which power is transmitted to the devices controlling the operation of the several sets of sound-producing devices, and form part of the means whereby the instrument is operated mechanically. In this example of my in-

vention the keys B, and through them the several sets of sound-producing devices, are operated by means of pneumatic motors, which I will now describe.

5 C designates a box or chamber, of suitable size and construction, arranged above the keys B, and containing a series of pneumatic motors, C', arranged in two rows, one row above another; and for the purpose of making the
10 motors as large as possible I preferably arrange the motors in the two rows alternately, those in the upper row being over the spaces between the motors in the lower row. The pneumatic motors are composed in the usual
15 way of two boards or pieces of similar size and shape, and one of which is fixed and a flexible wall connecting them. The box or chamber C containing the pneumatic motors communicates by means of a duct or passage, b, with
20 a receiver, C², upon opposite sides of which are bellows C³, which are connected by a rod, C⁴, and are operated by a treadle, C⁵, through a rod, C⁶. Thus is a constant vacuum maintained in the box or chamber C containing the
25 pneumatic motors C'. The top of the box or chamber C is constructed to form a rest, C⁷, for a traveling music card or tablet, here shown as consisting of a perforated sheet, D. In the
30 said rest are ducts c, which lead directly to the pneumatic motors in the upper row, and through branch ducts c' (shown in dotted outline in Fig. 1) communicate with the pneumatic motors of
35 the lower row. When a perforation in the music-sheet opens one of the ducts c one of the motors will expand, and through its tracker-pin c² and a lever, c³, hinged at one end and bearing upon the key at the other end, will depress one of the keys.

Turning now to a description of the mechanism whereby the music-sheet D is controlled,
40 D' designates a take-up roller, upon which the music-sheet will be wound in the act of playing, and D² designates a music-roller, upon which the sheet is wound before being played,
45 and also upon which said sheet is to be rewound after playing. The roller D' is not intended to be removed from the case A; but the roller D² is secured in bearings, which permit it to be readily removed with the music
50 from the case when desirable for the purpose of changing the music. When placed in the instrument the music-sheet is wound upon the music-roller D², and the end of said sheet is drawn over the rest C⁷ and secured in or to
55 the take-up roller D'. The travel of the music-sheet is produced by imparting a positive rotation to the take-up roller D', and this may be effected as follows:

E designates a driving-shaft extending across
60 the instrument parallel with the key-board, and having a crank, d, at each end, one only being here shown. The treadle C⁵ is connected with the crank d by a connecting-rod or pitman, E⁶, and to the crank at the opposite end
65 of the shaft is connected a second rod or pitman imparting motion from a second treadle,

the two cranks being set at right angles to each other to effect the uniform operation of the shaft.

Upon the shaft E is a pulley, d', and upon
70 the take-up roller d' is a pulley or flange, d²; and d³ designates an intermediate friction-wheel, whereby motion is imparted from the driving-shaft to said take-up roller. As shown
75 in dotted outline in Fig. 1, the intermediate wheel, d³, is pivoted in a bearing-block, E', pivoted at d⁴, and having a spring bearing upon the upper surface for pressing the wheel d³ tightly between the wheels d' d². When it is
80 desired to disconnect the take-up roller D' from the driving-shaft E and stop the feed of the music-sheet, all that is necessary is to raise the bearing-block E' sufficiently to lift the wheel
85 d³ out of contact with the wheels d' d².

The driving-shaft E has upon it a fly-wheel, E², (see Figs. 2 and 3,) for steadying its
90 motion; and in order to enable the music-sheet to be rewound quickly upon the music-roller D², I provide said roller with a small pulley, d⁵, which, when the roller is moved slightly, is in
95 position to bear tightly upon the periphery of the fly-wheel E², so that the fly-wheel will through it effect the rapid rotation of said roller.

It is desirable that the take-up roller D' and
95 the music-roller D² be simultaneously connected with and disconnected from the driving-shaft E, and this is effected by a rod or bar, d⁶, arranged parallel with the shaft and pivoted at
100 each end, so that it is adapted to be oscillated slightly in either direction. At one end of the rod or bar d⁶ is an arm (shown in dotted outline in Fig. 1) projecting from one side thereof, and
105 connected by a rod (shown in dotted outline) with the free end of the bearing-block E'.

E³ designates a stop-draw, which has upon
110 its inner end an incline, d⁷, adapted to bear upon the arm of the rod or bar d⁶, and when said stop-draw is pushed inward to raise the bearing-block E' and stop the feed of the music-sheet.

The end of the music-roller D² upon which
115 is the pulley d⁵ is mounted in a bearing-block, E⁴, (see Fig. 3,) which is pivoted at d⁸, and has at its end an incline bearing upon an arm, d⁹, projecting from the rod or bar d⁶ upon the
120 opposite side to that previously described. When the stop-draw E³ is moved inward to raise the bearing-block E' the rod or bar d⁶ is oscillated and the arm d⁹ moved down, releasing the block E⁴ and permitting it to be moved
125 upward by a spring, d¹⁰, to cause the pulley d⁵ to press tightly enough upon the fly-wheel E² to receive motion therefrom. The mechanism for producing the travel of the music-sheet forms no part of my invention.

In order to enable the driving-shaft to be
130 started readily in whatever position it may stop, I employ a starting device composed of a ratchet-wheel, d¹¹, upon the shaft E and a pawl, d¹², which is pivoted to a stop-draw, E⁵, whereby said pawl may be made to engage

with the ratchet-wheel when the stop-draw is pulled outward, and thereby move the shaft forward, as shown clearly in Fig. 3.

I have here represented three sets of sound-producing devices—namely, a piano-forte action, a reed-action, and a pipe-action; but two or any desirable number of sets more than two may be combined.

I will now proceed to describe the three sets of sound-producing devices in the order above named.

The piano-forte action (best shown in Figs. 1 and 3) is but little different from a common action.

F designates the frame, arranged in an opening in the back of the case A, and e designates the strings thereof. The action-frame F' is properly secured in the case of the instrument; and e' designates the hammers. e^2 designates the jacks. e^3 designates the hammer rest-rail. e^4 designates the dampers; and e^5 designates the rods, pins, or bars which bear upon the top of the manual keys B and transmit motion from said keys to the jacks e^2 . The hammer rest-rail (see Fig. 3) is connected by a link, e^6 , with one end of a lever, F^2 , which is fulcrumed at e^7 ; and e^8 designates a stop-draw connected with the other end of said lever. By drawing out the stop-draw e^8 the lever F^2 is vibrated, and the hammer rest-rail, with all the hammers, is moved so as to carry all the hammers beyond or out of reach of all the jacks, and thus I am enabled to render the piano-forte action inoperative while either the reed-action or the pipe-action, or both, are being operated.

So far as explained my piano-forte action is of a common kind, and it possesses only one novel feature—namely, that the bass-hammers may be moved up toward the strings independently of and apart from the other hammers to produce a subdued bass. This I effect by providing an auxiliary rest-rail, f , (see Fig. 2,) for the bass-hammers, which is fixed in one end of a lever, f' , (see Fig. 3,) pivoted at f^2 to the frame F' of the action, and having a pin, f^3 , projecting outward from its side.

F^3 designates a lever, pivoted at f^4 and bearing upon said pin f^3 , and by means of a stop-draw, f^5 , the lever F^3 may be drawn forward, the auxiliary rail f moved back, and the tone of the bass subdued by moving the bass-hammers so as to shorten their throw or stroke.

Turning now to the reed-action shown in Fig. 1, and more clearly in Figs. 4, 5, 6, and 7, G designates a reed-board arranged below the manual keys B, and having two series of reed-cells, severally containing reeds g , the speaking of which is controlled by pallet-valves g' , arranged in an exhaust chest or chamber, G' , below said reed-board, and kept closed by the usual pallet-valve springs, g^2 . The exhaust chest or chamber G' communicates, by means of an air-trunk, (here shown, for convenience, as consisting of flexible tubes G^2 ,) with a receiver, G^3 , which is exhausted of air by means

of a bellows, G^4 , operated through the rod G^5 from the movement of the treadle C^5 . Thus is the air exhausted from the chest or chamber G' . The keys B act upon the pallet-valves g' to depress them through tracker-pins g^3 in a common way, the said tracker-pins each being composed of two sections or pieces, one resting upon the other.

In order to prevent the speaking of the reeds g when desirable, I employ stops g^4 , hinged at each side of the reed-board G and covering the reed-cells, so as to prevent the passage of air through them, and outside these stops are hinged swell-covers g^5 , which may be operated when desired to augment the volume of tone. The stops g^4 , as shown clearly in Fig. 4, are opened by means of stop-draws G^6 , which have upon them inclines g^6 , which, by moving said stop-draws outward, act upon the projecting ends of the stops g^4 to open the latter. The swell-covers g^5 are hinged at g^7 by flexible hinges to the reed-board G or pieces attached thereto, and are pressed down to hold them closed by springs g^8 . At one end (see Figs. 4 and 5) the swell-covers g^5 have arms, which project toward each other and are united by a pin, g^{10} , fitting in an elongated hole in one arm. The swell-covers g^5 may be both opened or raised by means of one stop-draw, G^7 , having upon it an incline, g^{11} , which, as it is moved outward, engages with a pin or projection, g^{12} , on one swell-cover, and, tilting said cover upon its hinge, depresses the connected ends of the arms g^9 , and thereby opens or raises the opposite swell-cover.

When it is desired to play mechanically either the piano-forte action or the pipe-action alone, or to operate them together and without the reed-action, it is very desirable that the pneumatic motors C' be relieved from the pressure of the pallet-valve springs g^2 , so as to enable them to exert a more powerful force upon the keys B, which force is by them transmitted to the hammers or the valves of the pipe-action. This result I accomplish by adjusting the tracker-pins out of the way of the keys by means of a rock-shaft, h , (see Fig. 1,) which may be oscillated by means of a stop-draw, h' , and has a number of fingers or arms, h^2 , for bearing upon the tracker-pins g^3 and depressing them, so that they cannot transmit the force of the pallet-valve springs g^2 to the keys and increase the resistance offered to the pneumatic motors. Of course such depression of the tracker-pins will open all the pallet-valves g' , and hold them open; but if the stops g^4 be closed down over the mouths of the reed-cells no air can pass them, and hence the reeds will not speak.

I will now describe the construction and arrangement of the hollow sounding-board H, which in this example of my invention is arranged in proximity to the reeds g and immediately below them, it forming in fact the lower side or bottom of the exhaust chest or chamber G' . The construction of said sounding-board is clearly shown in Figs. 5, 6, and 7,

and its arrangement and manner of operation are illustrated in Fig. 1 upon a smaller scale. The sounding-board is composed of the boards i i' and sounding-posts i^2 , the board i constituting in this example of my invention a bottom board. The bottom board, i , is crowning or convex, and the middle board, i' , which is straight, has in it openings i^3 , which afford a free communication between the exhaust chest or chamber G' and the interior of said sounding-board, and upon the air being exhausted from said chest or chamber G' a reduction of pressure is effected in the sounding-board. Upon such reduction of pressure within the sounding-board the atmosphere exerts a pressure upon the outer side of the board i and tends to bulge such board inward or upward. The atmospheric pressure is transmitted through the sounding-post i^2 , and subjects the board i' to tension, whereby the tone of the reeds is greatly improved and partakes more or less of the tone of the violin or violoncello.

Though I have here only illustrated the sounding-board H in connection with reeds, it may be adapted for use in connection with other sound-producing devices.

Turning now to the pipe-action, I designate a pressure wind-chest, which is supplied with air by means of bellows I' , operated by a rod, I^2 , which receives motion from the treadle C^5 , as clearly shown in Fig. 1. The pipes I^3 are fixed in the wind-chest I , and the passage of air through them is controlled by valves j , which are opened by the keys B acting through push-pins j' and levers j^2 , connected at one end with said valves j . As the valves j are here shown as opening downward, it is necessary that the levers j^2 be employed; but I prefer to arrange the wind-chest I' so that the valves j shall open upward, and then the push-pins j' can act directly upon them without the intervention of any additional mechanism.

In order to render the pipe-action inoperative, I may arrange an outwardly-opening valve, k , (shown in the detail view, Fig. 12, which represents a longitudinal section through a portion of the wind-chest I), adapted to close an opening, k' , in said wind-chest. When it is desired to render the pipe-action inoperative the valve k may be opened by a stop-draw or other mechanism, and then all air delivered by the bellows I' into the wind-chest I will pass out through the opening k' , and will not be compressed in the chest I , and hence will not cause the pipes to operate.

In lieu of employing a separate bellows for the pipe-action, I might, and preferably shall, add a bellows-board to the top of the bellows G^4 , and then the air exhausted from the chest or chamber G' will be compressed and delivered directly by a suitable air-trunk to the wind-chest I .

I will now describe the octave-couplers which I employ.

In order to increase the volume of tone of the instrument, I provide for coupling a sound-

producing device in one octave with a sound-producing device of corresponding note in another octave, so that when a single perforation in the music-sheet D comes opposite a duct c in the rest C^7 said duct will be coupled or placed in communication with the corresponding duct in the next octave, and two pneumatic motors will be caused to operate, and two hammers, two pipes, or two reeds will be operated, or all six sound-producing devices will be operated. As here represented, these couplers consist of two cheek-pieces, J J' , adapted to be adjusted longitudinally in rabbets upon opposite sides of the rest C^7 . They are shown as connected together by a bridge, l , and may be adjusted by a stop-draw, l' , connected with the cheek-piece J by means of a bell-crank lever, l^2 , and link or rod l^3 .

It will be observed that in Fig. 9 I have designated the ducts c of two octaves by the letters of the notes of the sound-producing devices to which said ducts correspond, and it will there be seen that alternate ducts c of the two octaves have ports extending to the left side of the rest, to be controlled by one cheek-piece, J , while the intermediate ducts c have ports extending to the right side of the rest, to be controlled by the other cheek-piece, J' . The lettering of these ducts has no relation to the lettering of the other parts of the instrument.

In the faces of the cheek-pieces J J' are ports, which are each an octave in length, and which range vertically with the ducts c and ports in the rest, which are designated by letters indicating corresponding notes. As shown in Fig. 9, the octaves are not coupled; but if the two cheek-pieces J J' be adjusted longitudinally it will be seen that the port A in the cheek-piece J will connect or place in communication the two ducts c , which are indicated by corresponding notes A A in the rest C^7 . The port $G\sharp$ in the cheek-piece J' in a like manner connects the two ducts c indicated by corresponding notes $G\sharp$ in the rest C^7 .

From this description it will be clearly understood that when the cheek-pieces J J' are adjusted to couple two octaves all the ducts c in one octave will be coupled with corresponding ducts in the other octave, and hence that if a perforation in the music sheet, card, or tablet comes opposite any of the ducts c in one octave the corresponding sound-producing devices in both octaves will be sounded.

By my invention I produce a musical instrument of great scope and power, and one which can be operated mechanically or manually with equal convenience, and may in either case take the place of a number of separate instruments.

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

1. In a musical instrument, the combination of sound-producing devices, a rest provided with ducts for the passage of air to operate said sound-producing devices and with ports extending from said ducts to the side of the rest, a traveling music-sheet for controlling the

passage of air through said ducts, and a cheek-piece adjustably secured to the side of said rest, and constructed with ports ranging with the ports in said rest, whereby the sound-producing devices of one octave may be coupled with sound-producing devices of corresponding notes in another octave, substantially as specified.

2. In a musical instrument, the combination of sound-producing devices, a rest provided with ducts for the passage of air to operate said sound-producing devices and with ports leading from said ducts alternately to opposite sides of the rest, a traveling music-sheet controlling the passage of air through said ducts, and cheek-pieces adjustably secured to opposite sides of said rest, and constructed with ports ranging with the ports in said rest, one of said cheek-pieces serving to couple alternate sound-producing devices and the other the intermediate sound-producing devices in one octave with devices of corresponding notes in another octave, substantially as specified.

3. The combination, with the rest C^7 , of a cheek-piece adjustably secured upon the side thereof, and a link, l^3 , lever l^2 , and rod or stop-draw l' for adjusting the position of said cheek-piece, substantially as specified.

4. The combination, with the rest C^7 , of cheek-pieces $J J'$, a bridge, l , connecting said cheek-pieces, and a link, l^3 , lever l^2 , and rod or stop-draw l' , connected with one of said cheek-pieces, substantially as specified.

5. In a wind musical instrument, the combination of a set of sound-producing devices, an exhaust chest or chamber with which they communicate, a hollow sound-board, also communicating with said chest or chamber, and means for exhausting air from said chest or chamber and also from said sound-board, for applying tension to said sound-board, substantially as specified.

6. The combination of the reeds g , the valves g' , the exhaust chest or chamber G' , the sound-board composed of the boards $i i'$, the latter of which is provided with openings, and the posts i^2 , and the bellows G^4 , for exhausting air from said chest or chamber to cause the outer board, i , to be bulged inward by atmospheric pressure, and tension to be applied to the board i' through the posts i^2 , substantially as specified.

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Witnesses:

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