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A.D. 1861, 14th SEPTEMBER. N° 2289.

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Concertinas.

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LETTERS PATENT to William Wheatstone, of 20, Conduit Street, St. George's, Hanover Square, in the County of Middlesex, Musical Instrument Maker, for the Invention of "IMPROVEMENTS IN CONCERTINAS AND OTHER MUSICAL INSTRUMENTS, THE TONES OF WHICH ARE PRODUCED FROM THE VIBRATION OF SPRINGS."

Sealed the 7th March 1862, and dated the 14th September 1861.

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PROVISIONAL SPECIFICATION left by the said William Wheatstone at the Office of the Commissioners of Patents, with his Petition, on the 14th September 1861.

I, WILLIAM WHEATSTONE, of 20, Conduit Street, St. George's, Hanover Square, in the County of Middlesex, Musical Instrument Maker, do hereby  
5 declare the nature of the said Invention for "IMPROVEMENTS IN CONCERTINAS AND OTHER MUSICAL INSTRUMENTS, THE TONES OF WHICH ARE PRODUCED FROM THE VIBRATION OF SPRINGS," to be as follows :—

My Invention relates to that class of musical instrument in which the  
10 sounds or notes are produced by the action of wind upon vibrating tongues situate in air cells or cavities, as in concertinas, accordions, and other similar instruments.

The improvements which I herein-after describe as being effected in the construction of these instruments have for their object the accomplishment of  
15 the following desiderata :—



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instrument, and of actuating the bellows whilst using it, whereby the third and fourth fingers of each hand are released from the necessity which at present exists of their employment in that duty, and they are thereby set at liberty to be used, in combination with the other two fingers of each hand, in operating upon the finger studs or keys, thus affording greatly increased facilities in 5 manipulating upon the instrument; 2nd, a more convenient position of the whole series of the finger studs in the "tops" of concertinas and similar instruments, which enables the performer to act upon them in a manner less cramped and restricted than at present; 3rd, an extensive enlargement of the compass of the scales or series of notes to which such instruments have 10 hitherto been confined, without increasing the dimensions, or materially augmenting the weight thereof; 4th, a great extension of the scale or compass of duet concertinas; and, 5th, the production of an improved quality of tone, by giving additional solidity to certain portions of these instruments.

The nature of my Invention and the manner in which the same is to be 15 performed will be more readily understood from the following description thereof, that is to say:—

My first improvement in concertinas and other similar instruments consists in the introduction or application of a new kind of key and valve (which I propose to term the direct valve), which will open a wind passage into a note 20 cell situated immediately underneath the finger stud, thus dispensing with the ordinary levers and fulcrums, the space which they would have occupied being made available for additional notes and valves. The employment of these direct valves also enables me to shift the position of the entire series of finger studs in each "top" from the central portion of the same to a more convenient 25 position near the outer edge of the instrument, by so doing the fingers of the performer can act upon the studs or keys with greater ease and facility of touch or fingering than hitherto. And, further, inasmuch as the position of the finger keys controls or regulates that of the thumb strap, it follows of necessity that when the finger studs are shifted forward that the thumb strap must also 30 be brought forward, so as to preserve their relative distance; in my improved instrument, therefore, the thumb straps are placed in a much better position for taking the weight and ensuring the balance of the instrument, and giving greater command over the bellows; the finger plates are also dispensed with, and the 3rd and 4th fingers of each hand not being required to assist in 35 supporting the instrument can be employed in operating upon the studs or keys. And I still further facilitate the handling of concertinas and similar instruments by providing a semicircular or other suitably shaped rest for the wrist or ball of the palm of each hand.

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In constructing this new direct valve, I form a small rod or pin of metal or other suitable material, to the upper end of which is securely fixed a round disc of metal or other material; if of metal, it may be enamelled or otherwise finished to suit the touch of the fingers, and in colors usually employed to indicate the various intervals of the notes. The lower end of this rod has a small thread or screw turned upon it to receive a small nut, the thread tapped in which nut extends only to half its thickness, so that when it is screwed on to the pin the other or plain half of its thickness forms a cup or chamber for the reception of the top of the valve shank. That portion of the "top" through which the series of pins or studs passes is made of increased thickness, for the purpose of guiding them, and ensuring a true and steady action, and previous to screwing on the nuts a "packing" of felt, cloth, leather, or other elastic substance is attached to the under side of the "top" to prevent any unpleasant noise, and also to act as a sort of spring to keep the nuts in contact with the shanks of the direct valves, and the other finger studs in contact with the ends of the levers, whether the instrument is being used or not. It will be evident that these nuts will also prevent the finger studs from falling out of their places, and any derangement of the keys when the parts of the instrument are separated. Immediately under each of these studs is situated the aperture in the key tray which forms the wind passage belonging to the note cell, and which is opened or closed by the direct valve. This valve consists of a thin plate of metal or other suitable substance, somewhat larger than the wind passage it is intended to close. These plates are stamped out of a form suited to the shape of the cells in which they are to act, and with small projecting pieces formed at their two ends, which are afterwards turned up at right angles to the plate to serve as guides by working into two holes made in the key tray for that purpose. At the desired part of this plate, and in a true vertical line with the finger stud or pin, is connected the shank or stem of the valve, which passes through a guide bar composed of a strip of metal, curved or otherwise shaped, so as to receive the shanks of any desired number of valves. The upper end of the valve shank fits into the cup or chamber of the nut screwed on to the pin of the finger stud. The valve is fitted on its upper surface with a "packing or stopping" of cloth coated with soft kid leather, and is kept close against the under side of the key tray, when not depressed by the performer, by a spring of any suitable form.

My second improvement in concertinas and other similar instruments consists of a novel construction of the lever keys and finger studs, the use of which, in combination with four of the direct valves before described, permits of the shifting of the whole of the forty-eight studs of an ordinary concertina, in the

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manner also before described. The finger stud or pin which I employ to act upon my improved lever key is precisely similar to that described for working the direct valve, so that all the finger studs in the instrument; whether acting upon lever keys or direct valves, present the same external appearance so far as shape and size are concerned. The levers are made of narrow strips or pieces of wood or metal, or other suitable material, shaped according to the positions they are intended to occupy in the key tray, and of lengths proportionate to the distance of the apertures upon which they are to act, from the finger studs by which they are to be worked. They are centred upon metal fulcrums firmly secured to the upper surface of the key tray, which fulcrums are made in one piece with two upright sides, and a knife-edged strip between them, upon which the levers are free to move. The levers are kept in their places, and their valves tight over the wind passages, by springs secured to the rim of the key tray, one spring being made to depress two levers; these springs act upon the upper surface of the levers at the valve end, instead of underneath the arm nearest the finger stud as in ordinary concertinas. The nut upon the finger stud is screwed a little beyond the end thereof, which is coned so that the point of contact between the stud and lever is reduced to the minimum amount, and the friction incidental to the small segmental movement of the ends of the levers is further neutralized by small pieces of vellum being attached thereto, and these same ends of the levers have notches cut in them to work around small pins fixed to the key tray to serve as guides.

My third improvement in concertinas and other similar instruments consists in the employment of small note trays inserted in the central portion of the ordinary note tray, left vacant by the described change in the construction of and the removal of the finger studs before mentioned, for the purpose of containing additional notes, which are acted upon by my "direct valves," and by this means the scale or series of notes may be increased from 48 to 62 notes when desired. The manner in which I carry out this part of my Invention is as follows:—The central portion of the note tray is cut out of the required size and form, and a strip of lining of the depth of the cells is inserted, against which the air cells in the ordinary note tray are stopped. To the under side of the note tray, and surrounding the opening thus made, a rim of wood or other suitable substance is attached, the inner diameter of which is smaller than the opening it surrounds to form a rebate to receive the small note tray, which small note tray is made to fit accurately into its place, and is divided into as many cells as it is desired to insert notes, each cell being made to contain the proportionate quantity of air to reciprocate the vibrations of

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its note springs, as is well understood in the construction of concertinas. Immediately over each note in the cells of the small tray is placed the direct valve, already described, for the admission and remission of wind to produce the sound. To the under side of the first rim, of wood or other suitable  
5 material, is secured a second rim of similar shape, but of considerably larger dimensions, in order to project beyond the under notes for the purpose of preventing their valves from opening more than the requisite distance, to serve as a sounding board for these under notes, and to modify the passage of the air in vibration through the same. The first or smaller rim is cut of a  
10 tapering thickness or of a wedge form, so that the second rim is made to approach nearer to the note tray at that portion in which are situated the upper or smaller notes of the musical scale. By the introduction of these rims an increasing solidity is imparted to the key and note trays, and consequently a much greater solidity and improved quality of tone or sound is  
15 obtained from the notes. These small note trays may be made either of a circular, oval, or polygonal form, and the pieces of wood or other material which surround the openings in the ordinary note tray may be of any suitable shape and size. I prefer, however, to make these parts of my improved instruments of an oval or circular shape. In those concertinas the scale or  
20 compass of which I increase from 48 to 62 notes, I make use of 11 of the new direct valves and 20 of the improved lever keys in each "top" or key tray, seven of which direct valves are made to act upon seven pairs of note springs placed in the small note tray, the other four direct valves act upon notes placed in the ordinary note tray. I do not wish, however, to confine  
25 myself to this precise arrangement, as it is evident that the number of direct valves employed, and the number of additional notes to be contained in the small note tray, may be varied at pleasure, but I have found this number and disposition of direct valves and lever keys in the key tray, and of notes in the small note tray, to be the best, so far as my experience at present extends,  
30 for the production of a complete concertina, the scale of which is equal in number of finger keys to that of the harmonium; nor do I confine myself to the present dimensions of concertinas, accordions, and other similar instruments, nor to any particular number of notes, or their arrangement; as the employment of my direct valves, small note trays, and improved lever keys  
35 enables me to increase the musical scale of these instruments in a much greater proportion than any increase in their dimensions or size. Furthermore, by the employment of these new direct valves and these small note trays in conjunction with the improved lever keys before described, I am enabled to extensively enlarge the musical scale or compass of those concertinas known

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as "duet concertinas," the number of notes in which has heretofore been limited to 24. By using 10 of the new direct valves and 17 improved lever keys in each key tray of these instruments, and the introduction of a small note tray containing 3 cells and 3 pairs of note springs, I can increase the scale of the "duet concertinas" from 24 to 54 notes; but I do not confine myself to any particular number of notes, or of lever keys, or of direct valves, nor to their disposition or arrangement in these instruments.

**SPECIFICATION** in pursuance of the conditions of the Letters Patent, filed by the said William Wheatstone in the Great Seal Patent Office on the 14th March 1862.

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**TO ALL TO WHOM THESE PRESENTS SHALL COME, I, WILLIAM WHEATSTONE**, of 20, Conduit Street, St. George's, in the County of Middlesex, Musical Instrument Maker, send greeting.

**WHEREAS** Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Fourteenth day of September, in the year of our Lord One thousand eight hundred and sixty-one, in the twenty-fifth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said William Wheatstone, Her special licence that I, the said William Wheatstone, my executors, administrators, and assigns, or such others as I, the said William Wheatstone, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN CONCERTINAS AND OTHER MUSICAL INSTRUMENTS, THE TONES OF WHICH ARE PRODUCED FROM THE VIBRATION OF SPRINGS," upon the condition (amongst others) that I, the said William Wheatstone, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

**NOW KNOW YE**, that I, the said William Wheatstone, do hereby declare the nature of the said Invention, and in what manner the same is to be

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performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:—

My Invention relates to that class of musical instruments in which the sounds or notes are produced by the action of wind upon vibrating tongues or  
5 springs situated in air cells or cavities as in concertinas, accordions, and other similar instruments.

The improvements which I herein-after describe as being effected in the construction of these instruments, have for their object the accomplishment of the following desiderata:—First, a more convenient method of supporting the  
10 instrument, and of actuating the bellows whilst using it, whereby the 3rd and 4th finger of each hand of the player can be released from the necessity at present existing of their employment in that duty, so that they may be used in conjunction with the other two fingers of each hand in operating upon the  
15 finger studs or keys, thus affording greatly increased facilities in manipulating upon the instrument; second, a more convenient position of the whole series of finger studs in the tops of concertinas and similar instruments, which will enable the performer to act upon them in a manner less cramped and restricted than at present; third, an extensive enlargement of the compass of  
20 the scales or series of notes to which such instruments have hitherto been confined without increasing the dimensions, or materially augmenting the weight thereof; fourth, a great extension of the scale or compass of duet concertinas; and fifth, the production of an improved quality of tone, by giving additional solidity to certain portions of the instruments.

The nature of my Invention, and the manner in which the same is to be  
25 performed, will be more readily understood from the following description thereof, reference being had to the Drawings hereunto annexed, that is to say:—

My first improvement consists in the introduction or application to concertinas and similar instruments of a new kind of key and valve (which I propose to term the direct valve). This direct valve is so contrived and arranged  
30 as to open a wind passage into a note cell situated immediately underneath a finger stud, thus dispensing with the ordinary lever key and fulcrum, and when a number of these direct valves are made use of in place of a like number of lever keys, the space which such lever keys would have  
35 occupied can be made available for additional notes and valves, and the employment of a number of these direct valves permits of the shifting of the entire set of finger studs in each top from the central portion of the same to a more convenient position nearer the outer edge of the finger board.

Furthermore, inasmuch as the position of the finger studs controls or regu-

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lates that of the thumb strap, it follows of necessity that when the finger studs are shifted forward, that the thumb strap must also be brought forward so as to preserve the relative distance between them. The result of this change of position in these parts of these instruments is the attainment of the desideratum firstly herein-before mentioned, and which is herein-after more particularly 5 explained and illustrated.

The mode of constructing this new direct valve is shewn in detail in Figures 1 and 1<sup>a</sup>. I first form a small rod or pin *a* (which will herein-after be termed a stud) of metal or other suitable material, to the upper end of which is securely fixed a round disc *b* of metal or other material, if of metal, it may be enamelled 10 or otherwise finished to suit the touch of the fingers, and tinted in the colors usually employed to indicate the various notes. The lower end of this stud has a small thread or screw turned upon it, to take a small nut *c*, the thread tapped in this nut extends only to half its thickness (as shewn in section), so that when it is screwed on to the stud, the other or plain half of its thickness 15 forms a cup or chamber for the reception of the top of the valve shank. The valve itself consists of a thin plate *d* of metal or other suitable substance, somewhat larger than the wind passage it is intended to cover, and I prefer to make the valve plate of the form shewn, as it is adaptable to the shape of most of the note cells in which the direct valves have to act. These plates 20 are stamped or shaped with small projecting pieces *e, e*, at their two ends, which are afterwards turned up at right angles to the valve plate, and to which they serve as guides by working into two holes made in the under side of the key tray for that purpose. At a point of this valve plate *d*, determined by the shape of the note cell in which it is situated, and its position relative to 25 the finger stud, is connected the shank or stem *f* of the valve, the upper end of which fits into the cup or chamber of the nut *c*, screwed on to the pin *a* of the finger stud. The valve is fitted on its upper surface with a "packing" or "stopping" of cloth coated with soft kid leather, and is kept close against the under side of the key tray when not depressed by the finger of the performer, 30 by a spring *g* (Figures 3 and 4) of the form shewn, or any other suitable shape. A notch is made in the lower end of the valve shank *f* to receive the end of the spring, and cause it to exert its influence always at a point of the valve plate in a vertical line with the finger stud.

My second improvement, consists in an improved lever key, and is repre- 35 sented in Figures 5 and 6. All of these levers are made of strips or pieces of wood or metal, or other suitable substance, shaped according to the positions they are intended to occupy in the key tray, and they are made of lengths proportionate to the distances of the apertures or wind passages upon which



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they are intended to act from the finger studs by which they are to be worked. Each lever *h* is centred upon a metal fulcrum *i* seen in elevation, section, and plan in Figures 7, 8, and 9 respectively. This fulcrum is made in one piece with two uprights *i*, and a rounded knife edged strip between them; upon  
5 which the levers are free to move. The part *i*\* of the fulcrum is firmly fixed into the key tray, and retains it in an upright position. The lever key is kept in its place, and its valve *l* is kept tight over the wind passage by means of a spring *j*, shewn in Figures 10 and 11, this spring is secured to the rim of the key tray, and is made to depress two levers. Small grooves are formed in the  
10 upper face of the levers to keep the two ends of the spring in their places. The finger stud or pin which I employ to act upon my improved lever key is precisely similar to that described for working the direct valve, so that all the finger studs in the instrument, whether acting upon lever keys or direct valves, present the same external appearance so far as shape and size are concerned.

15 Figure 1<sup>a</sup> represents one of these studs, it will be seen that the nut *c*\* is screwed a little beyond its end, which is tapered or coned so that the point of contact between the stud and lever is reduced to the minimum amount, and the friction incidental to the slightly segmental movement of the end of the lever is further neutralized by a small piece of vellum *m* being attached  
20 thereto; and this same end of the lever has a notch *n* cut in it, to work around a small pin fixed to the key tray, which pin retains the lever in its place, and ensures its vertical movement.

The third part of my Invention consists in the construction and employment of small additional note trays to be inserted in the central portion of the ordi-  
25 nary note tray for the purpose of containing additional notes, the wind passages of which are to be opened or closed by my direct valves, and by these means I am enabled to increase the musical scales or series of notes of concertinas and other similar instruments from 48 to 62, or any intermediate number as may be desired. The manner of carrying out this part of my Invention will  
30 be more particularly set forth in the description of the concertina, having its musical scale extended to the full compass of the harmonium, or 62 notes.

Before proceeding to explain the application and combination of these several improvements to the construction of these different varieties of concertina and other instruments of like principles, it may be remarked that in  
35 the Drawings hereunto annexed, and the description herein-after following, I have confined myself to the illustration of the methods of constructing concertinas alone in accordance with the principles of my Invention, as their application to other existing instruments, the tones of which are in like manner derived from the vibration of springs, will be readily comprehended

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by individuals conversant with such instruments; also, that in all the Drawings I have represented the right-hand top only of concertinas and the component parts thereof, for the reason that the left-hand tops of such instruments in all cases are similar in arrangement and construction, differing only in the position of the thumb and hand straps necessary to the accommodation of the 5 left hand of the performer.

All the Drawings and Figures shewn are drawn to a scale of the actual size of the objects they depict, and in all the Figures and Plans shewn, the same letters of the alphabet, signs, and numbers, denotes similar parts of all the instruments represented. 10

The mode in which I apply my several improvements to the ordinary 48 note concertina is as follows:—Figure 13 represents a plan of the finger board of one of these instruments; Figure 14 is a plan of the note tray; Figure 15 is a plan of the key tray; Figure 16 is a plan of the under side of the same; and Figure 17 is a vertical section through the entire top shewing the bellows 15 frame, and a portion of the bellows. In this instrument I employ 4 of my direct valves, and twenty of my improved lever keys in each “top,” and I select the 4 notes situated nearest the outer edge of the finger board as those to which I apply these 4 direct valves, for the reason that they do away with the necessity of employing lever keys as the means of operating upon the wind 20 passages to the note cells, and as these direct valves occupy so small a portion of the key tray, I can place them in a position in which it would be impossible to employ lever keys, which lever keys must necessarily be of sufficient length to raise the valve the height required for the free and rapid passage of air through the note and wind passage. I am thus enabled to shift forward the 25 whole series of finger studs in the finger board as represented in Figure 13. This change of position of the finger studs effects a great improvement in the method of holding the instrument, and of handling it during the performance of music.

In the concertina as hitherto constructed the instrument is held, and the 30 bellows operated upon by means of a thumb strap and finger plate, in each “top.” The studs by being arranged in the central position of the finger board rendered it imperative to fix the thumb strap considerably out of the line of the centre of gravity of the instrument, and occasioned the necessity of employing the 3rd and 4th fingers of each hand to assist in steadying the instru- 35 ment, and actuating the bellows. The performer has thus but two fingers of each hand entirely at liberty for the performance of music, and this central position of the studs rendered the instrument still further inconvenient by compelling the fingers whilst performing to be exercised in a very cramped

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and restricted manner. These unsatisfactory impediments to a ready acquisition of the art of performing upon concertinas are greatly reduced by the application to them of my several improvements.

I have before stated that the position of the thumb strap is controlled by  
5 that of the studs; it will be seen on reference to Figure 13 that the thumb strap is placed rather more outward from the performer than the centre of the instrument, that the finger plate is dispensed with, and in lieu thereof a semicircular or other suitably shaped rest for the wrist or ball of the palm of the hand is provided. By these appliances the cramping effect of the ordinary  
10 manner of holding concertinas, upon the fingers and muscles of the hand is obviated, a facile command over the bellows is obtained, and the still more important advantages are gained of having the 3rd and 4th fingers of each hand completely free to operate upon the studs, and of being able to employ all the fingers in the performance of music in a more natural and less  
15 disagreeable manner than at present, and it will also be apparent that each finger of the performer will have its appropriate line of notes to operate upon, and not as at present, when two fingers only are entirely free, be compelled to shift from one line to the other.

In all the Figures A indicates the finger board; B, the key tray; C, the  
20 note tray; D, the bellows frame, and D\* represents a portion of the bellows.

That portion of the finger board A through which the studs *a, a*, pass is increased in thickness by the addition of a piece of wood or other substance A\*, for the purpose of guiding the studs, and of ensuring their true and steady action. To the under side of this piece A\* is attached a packing A<sup>2</sup>, made of  
25 a piece of felt, cloth, leather, or other material, to prevent any unpleasant noise arising from the movement of the studs, and also to act as a sort of spring to keep the nuts *c, c*, of the studs of the direct valves in contact with their shanks *f, f*, and the other finger studs in contact with the ends of the lever keys, whether the instrument is being used or not. The nuts *c, c*,  
30 and *c\*, c\**, prevent the finger studs from falling out of their places, and any derangement of the keys when the parts of the instrument are separated; *d, d*, are the direct valves, and *g, g*, their springs; *h, h*, are the improved lever keys, *i, i*, their fulcrums, and *j, j*, their springs; *k, k*, are the small pins, around which the notches in the ends of the levers work; and *m, m*, are the small  
35 pieces of vellum which diminish the friction of the studs upon the lever keys; *o, o*, are small pieces of felt, cloth, or other substance to prevent the lever striking the key board, and making an unpleasant noise; *t, t*, and *u, u*, are rims of wood or other suitable substance surrounding the opening in the central portion of the note tray, for the purposes more clearly set forth herein-

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after; *r, r*, are the notes, *s, s*, their vibrating tongues or springs; the notes are made of the sizes and shapes and are arranged two to each cell, as is common to the existing double-action concertina; *v, v*, are the small leather valves to the notes; and *w, w*, are the wind passages to the note cells.

Figures 18, 19, 20, 21, 22, and 23, exhibit a concertina constructed according to my improvements, in which the musical scale is extended from 48 to 62 notes without increasing the dimensions of the instrument, or rendering it more cumbersome by augmenting its weight to any material extent. Figure 18 represents a plan of the finger board; Figure 19, a plan of the note tray; Figure 20, a plan of the key tray; Figure 21, a plan of the under side of the same; Figure 22, a vertical section through the entire "top," bellows frame, and part of bellows; and Figure 23 is a plan of the under side of the finger board. In constructing this instrument I make use of 11 of my direct valves and 20 of my improved lever keys in each "top," and in this instrument I employ the additional note tray inserted in the central portion of the ordinary note tray, which constitutes the third part of my improvements, and in which auxiliary note tray are placed 7 notes, the wind passages to which are opened or closed by 7 of my direct valves; the other 4 direct valves are situated in the cells of the ordinary note tray, in a position similar to those employed in the 48 note concertina herein-before described, and these 4 direct valves are operated upon by the studs of the 4 highest notes of the scale, that is, by the 4 studs nearest the outer edge of the finger board. A indicates the finger board; B, the key tray; C, the note tray; D, the bellows frame; and D\*, a part of the bellows. The lever keys, studs, nuts, direct valves, the notes and vibrating tongues, or springs; and other details are indicated by similar letters to those denoting similar parts shewn in the Drawings of the 48 note concertina previously described.

Figure 20 clearly exhibits the combination of my direct valves and improved lever keys as applied to the 62 note concertina, and shews the method of guiding the shanks *f* of the direct valves by small pieces *z, z*, of metal, or other suitable substance, which may be of any convenient shape, and made to take the shanks of any desired number of direct valves. The positions of the fulcrums *i, i*, and springs *g, g*, are also shewn. Figure 21, indicates the positions of the 11 direct valves and their springs on the under side of the key tray, it also exhibits the wind passages to the lever keys; Figure 23 shews the plan of the piece of wood or other substance A\* employed to increase the depth of the holes through which the finger studs pass, the packing A<sup>2</sup> is attached all over the surface of this piece A\*. The additional note tray is seen in plan, in Figure 19, and in section, in Figure 22. To form this small

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note tray, I cut away the central portion of the ordinary note tray C to the required size; and form and insert therein a rim or strip C<sup>1</sup> of wood, or other lining, of the depth of the ordinary note tray C. To the under side of the note tray C, and surrounding the opening thus made in it, is attached a rim *t* 5 of wood or other suitable substance, the inner diameter of which is made smaller than the opening it surrounds to form a rebate or rest to receive the small note tray C<sup>2</sup>; this small note tray fits accurately into the rim C<sup>1</sup>, and is divided by partitions C<sup>3</sup> into as many note cells as it is desired to insert notes, each cell being made to contain the proportionate quantity of air necessary to 10 reciprocate the vibrations of its note springs, as is well understood in the construction of concertinas. The apertures *w*<sup>\*</sup>, *w*<sup>\*</sup>, (Figures 20 and 22,) to permit the passage of wind through the notes situated in the cells of this small note tray C<sup>2</sup> are opened or closed by direct valves of the construction hereinbefore described. To the under side of the first rim or ring *t* is secured a 15 second rim *u* of similar shape, but of considerably larger dimensions, in order to project beyond the notes situated in the under side of the ordinary note tray; and also to project beyond the under notes placed in the small note tray, for the purposes of preventing the leather valves *v*, *v*, from opening more than the requisite distance, and by forming a kind of sounding board to these under 20 notes, to occasion a greater uniformity of sound between these under notes and the corresponding notes situated in the note cells on the upper side of the note trays. The first or smaller rim *t* is made of a tapering thickness, or of a wedge form, so that the second rim *u* is made to approach nearer to the note tray C at that portion in which are placed the upper or smaller notes of the 25 musical scale. Both these rims are made of considerable thickness, to impart increased strength and solidity to the note and key trays, and thereby to render the tones of the instrument much more full, firm, and sonorous. These small note trays may be made either of a circular, oval, or polygonal form, and the rims *t* and *u* which surround the opening in the ordinary note tray may be of 30 any suitable shape and size. I prefer, however, to make these parts of my improved instruments of an oval or circular shape.

I will now proceed to describe the application of my several improvements to the class of concertinas known as "duet concertinas," from the musical scales of such instruments being so arranged in the right and left-hand tops as 35 to permit of the performance of the air or melody of any tune or piece of music with one hand on the finger studs and notes of the one top, whilst the other hand can be engaged in executing the accompaniment to such air or melody on the finger studs and notes of the other top. The scale of these duet concertinas has heretofore been limited in consequence of the impediments occasioned by

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the use of the old levers and keys, as before explained, to a series of notes not exceeding 24 in number, whereas by the application to them of my direct valves and additional note tray, I can extend the series of notes forming the scales of these instruments to 40, 54, or any intermediate number, as might be desirable. It would even be possible to still further extend the scales by 5 increasing the number of notes, but such extension would be attended by certain disadvantages, such as an increase of the weight and size of the instruments, which would be objectionable. In like manner the scales or compass of the series of notes in the concertinas before described may be indefinitely extended by enlarging the dimensions of the instruments, the employment of 10 my direct valves and lever keys affording peculiar facilities for such extension.

Figures 24, 25, 26, 27, and 28 represent a duet concertina, in which the scale or series of notes is extended to 40 notes. Figure 24 is a plan of the finger board, exhibiting the arrangement of the finger studs; Figure 25 is a plan of the note tray; Figure 26 is a plan of the key tray; Figure 27 is a plan 15 of the under side of the key tray, and shews the position of the direct valves and springs, and of the wind passages to the lever keys; and Figure 28 represents a vertical section through the entire top, the bellows frame, and a portion of the bellows.

In this instrument I make use of 4 of my direct valves and 16 of my 20 improved lever keys in each top. The 4 direct valves like those of the 48 note concertina open or close the wind passages to the 4 note cells, in which are contained the 4 highest notes in the instrument. The particular arrangement and combination of these direct valves and lever keys can be readily understood by an inspection of the plan of the key tray, Figure 26. 25

The details of the construction of this instrument are similar to those of the 48 note concertina already described, with the exception of the method of holding the instrument during the performance of music, and the arrangement and number of the finger studs and lever keys. The method of supporting this and other duet concertinas, and of working the bellows, is now in common use in 30 existing varieties of this class of instrument, but as it differs from that of the concertinas herein before described, it may be explained that the four fingers of each hand are passed completely through the space between the strap P and the firm rest P\*, which rises from the finger board A, to which it is fixed at each of its ends, so that the strap may come over the back of the hand, the 35 thumb resting upon the part of the strap at P<sup>2</sup>, the four fingers will then be directly over the finger studs. The performer will now have complete command over the instrument in every respect, and the increase in the number of the notes or extension of the musical scale will enable him to execute music

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hitherto impracticable on duet concertinas as before stated; the same letters, signs, and numbers denote the parts of this duet concertina, similar to those to which they refer in the concertinas previously described.

Figures 29, 30, 31, 32, and 33 represent a duet concertina, in which the musical scale or number of notes is increased to 54. Figure 29 shews a plan of the finger board; Figure 30, a plan of the note tray; Figure 31, a plan of the key tray; Figure 32, a plan of the under side of the same; and Figure 33 shews a vertical section through the entire top bellows frame and part of the bellows.

The method of holding this instrument is precisely similar to that described for the 40 note duet concertina, and its construction is in most particulars also similar, the differences consisting in the increased number and in the disposition of the direct valves and lever keys, and also in the employment of an additional note tray in the central portion of the ordinary note tray, resembling so far as regards the manner in which it is constructed and inserted into the ordinary note tray that already described, as made use of in the 62 note concertina, but as shewn in Figure 30, it is of a circular instead of an oval form in plan, and is divided into 3 note cells in place of 7. In this 54 note duet concertina I employ 10 direct valves and 17 improved lever keys in each top, 7 of which direct valves open and close the wind passages of the 7 note cells marked in Figure 30 as 1, 2, 3, 4, 5, 6, and 7, both inclusive; the other 3 direct valves operate upon the wind passages leading to the 3 note cells, into which the additional note tray C<sup>2</sup> is divided. Both this and the 40 note duet concertina are fitted with the rims or rings *t* and *u*, constructed in the manner and for the purposes before explained.

Having now described the nature of my said Invention, and the manner in which the several improvements are carried into effect, I desire it to be understood that I do not confine myself to the precise arrangements, dispositions, or numbers of finger studs, or of notes forming the musical scales in the various instruments herein-before described, nor to the numbers, dispositions, or arrangements of direct valves, or of improved lever keys in any or all of these instruments, nor do I confine myself to the sizes or shapes of such instruments, nor to the sizes and shapes of the additional small note trays, or the number of air cells into which they may be divided, as it is evident that any or all of these particulars may be considerably varied without departing from the spirit or principles of my Invention; but I do claim as my Invention the methods herein-before described of constructing finger studs, direct valves, and lever keys and fulcrums, and of their respective springs and other appur-

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tenances, and also of the mode of constructing the additional note trays, all in the manner and for the several objects and purposes also herein-before explained and described.

In witness whereof, I, the said William Wheatstone, have hereunto set my hand and seal, this Fourteenth day of March, in the year of our 5 Lord One thousand eight hundred and sixty-two.

WILLIAM WHEATSTONE. (L.S.)

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10 JU 62



○*b*

FIG. 1.

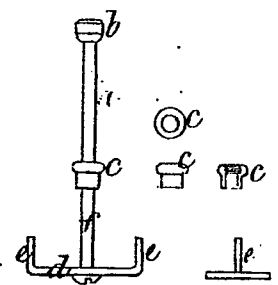
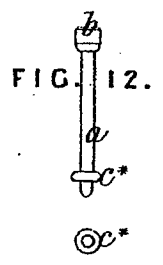


FIG. 2.

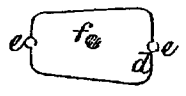


FIG. 3.

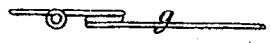


FIG. 4.



FIG. 5.

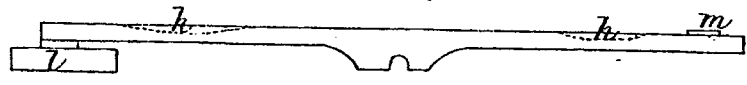


FIG. 6.

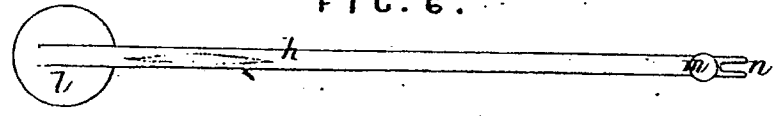


FIG. 7. FIG. 8.

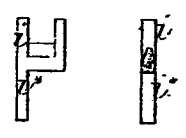


FIG. 9.



FIG. 10.

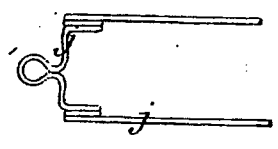
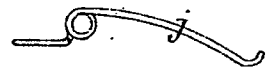


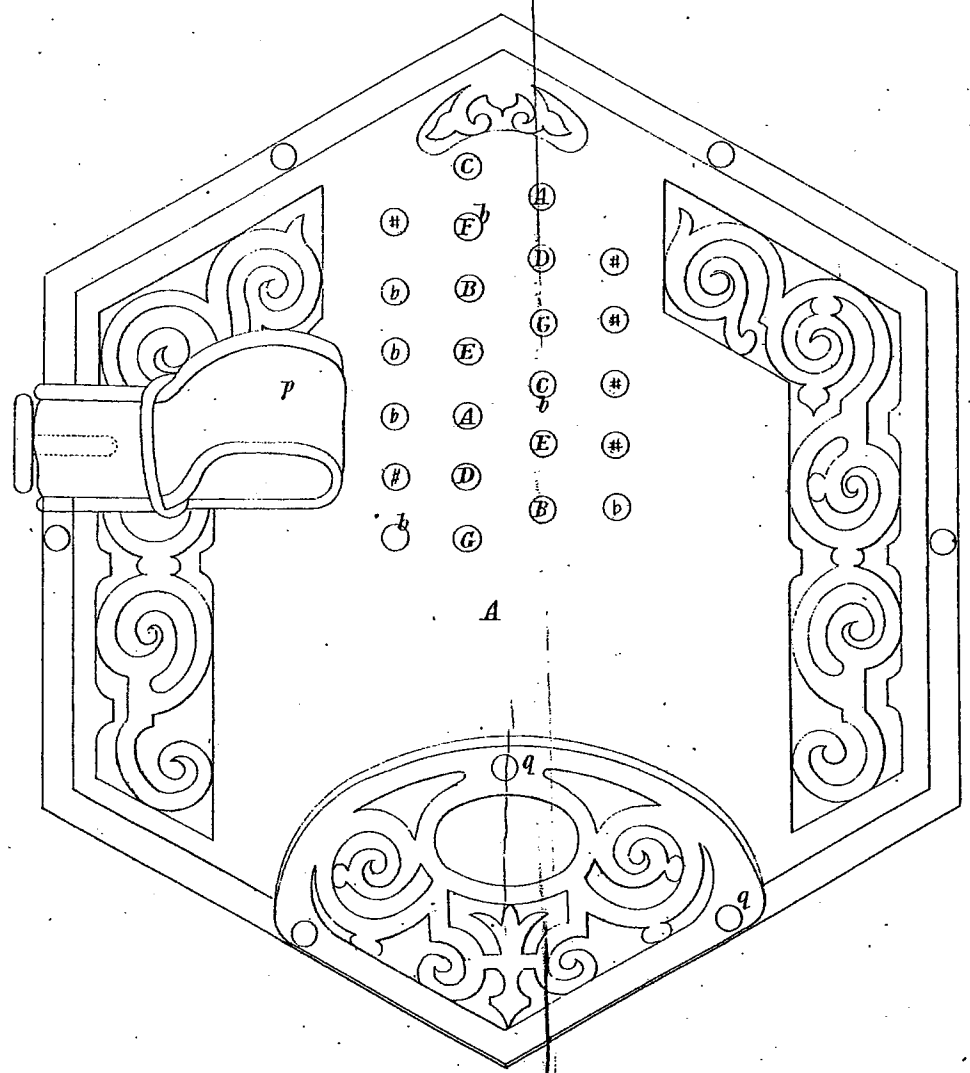
FIG. 11.



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F I G. 13.



F I G . 1 4 .

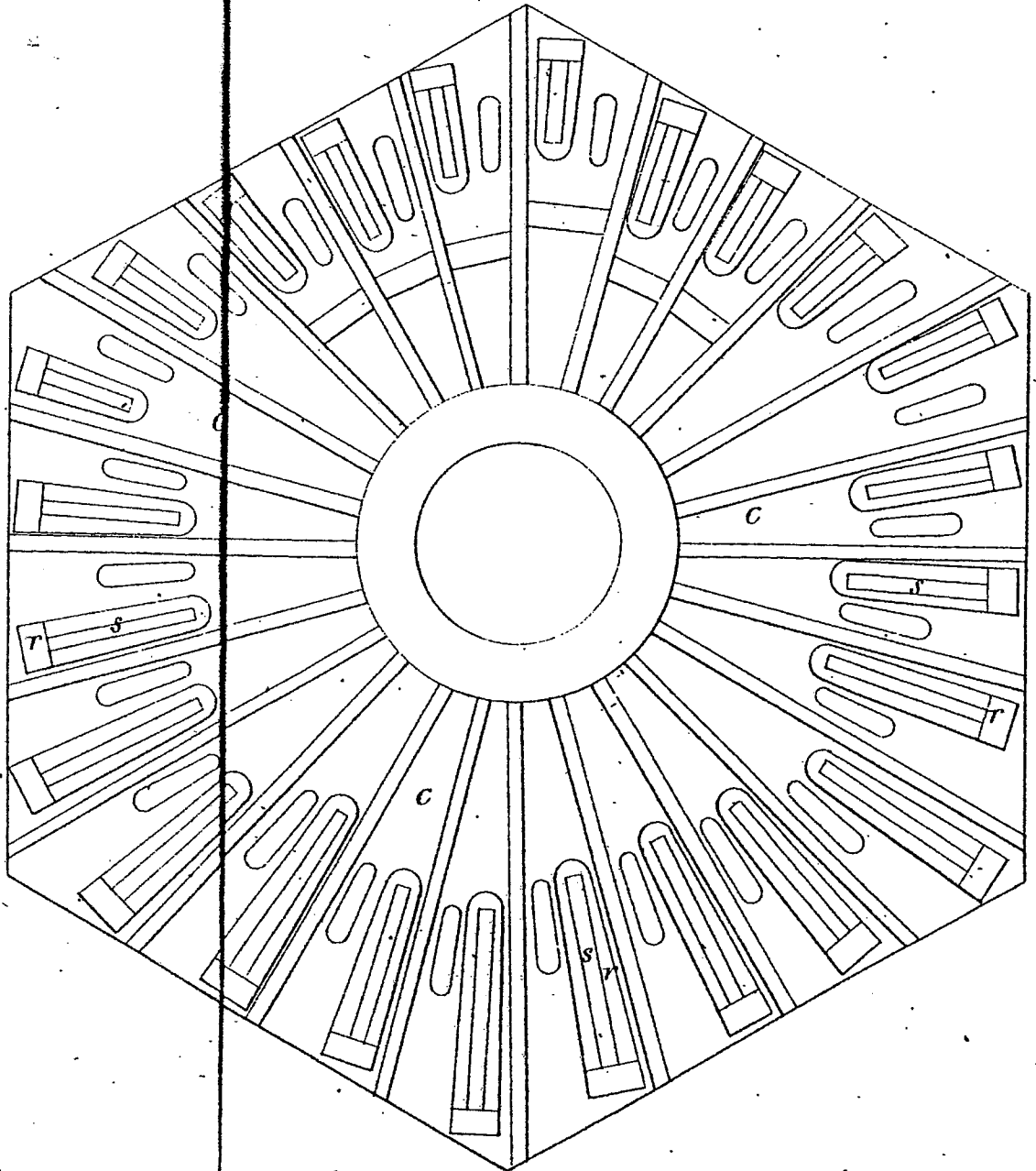


FIG. 15.

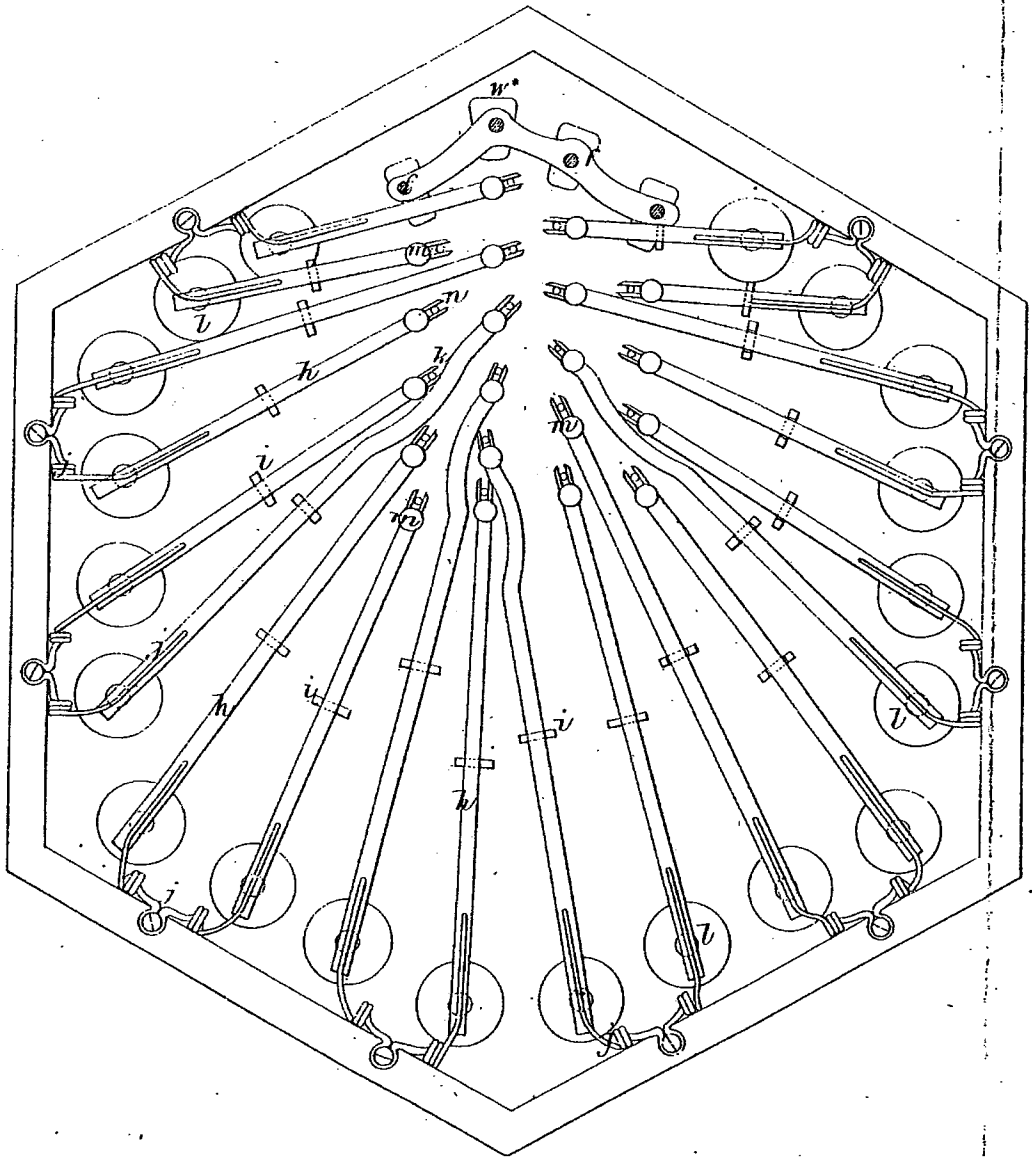
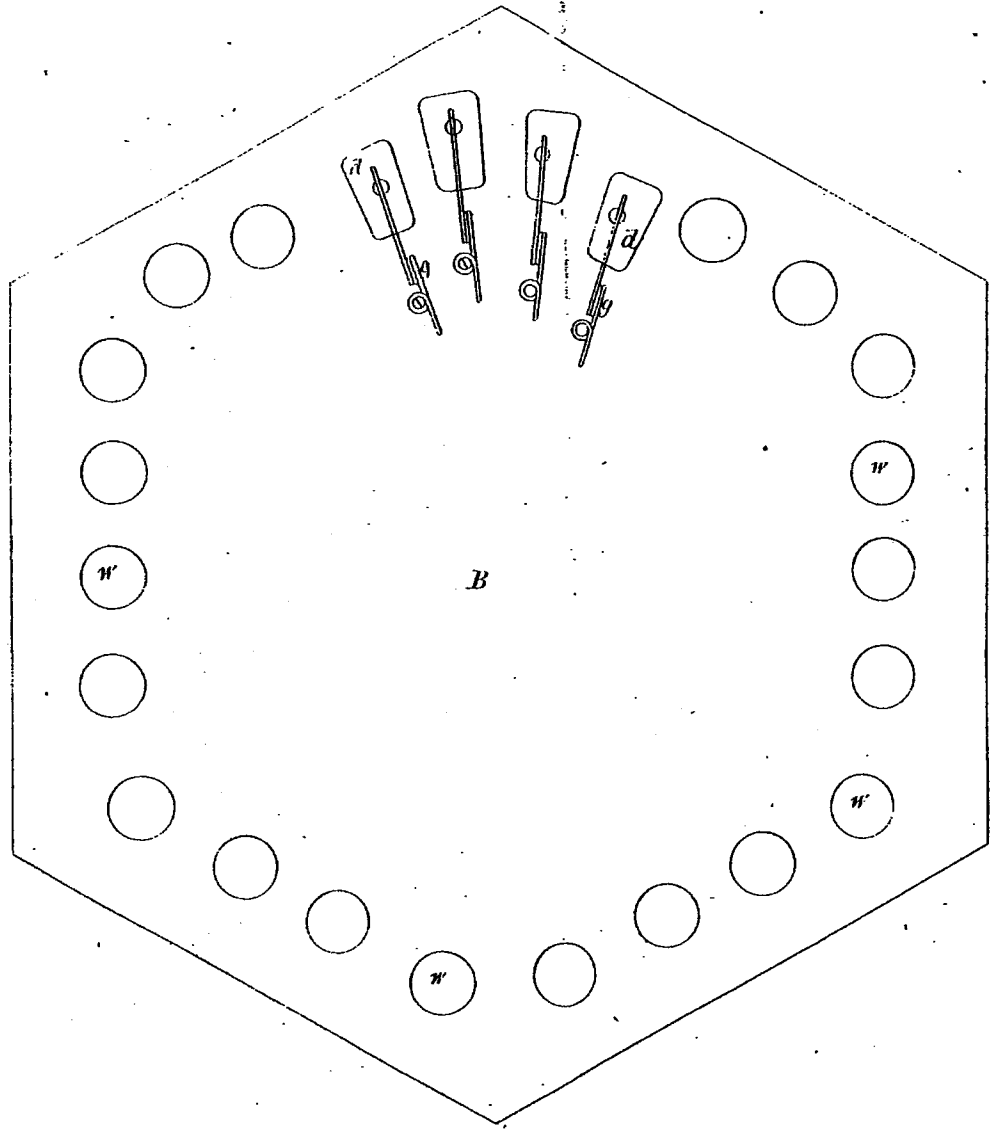
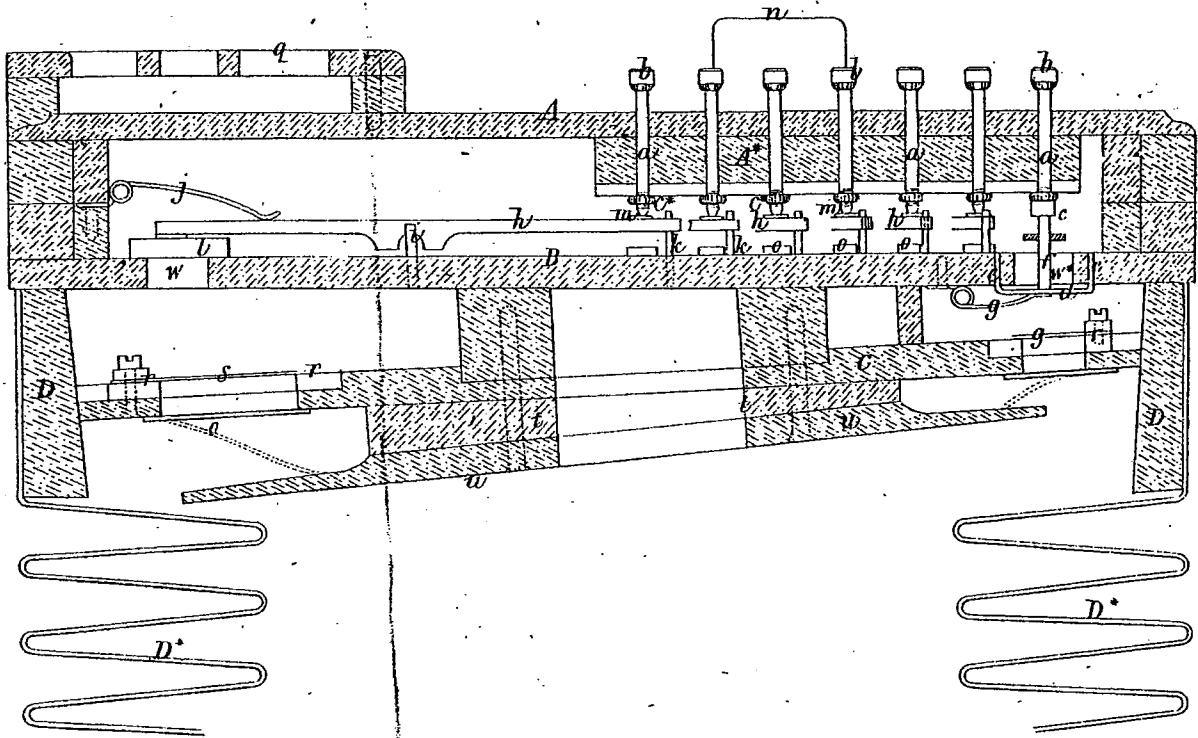


FIG. 16.



*The filed drawing is partly colored.*

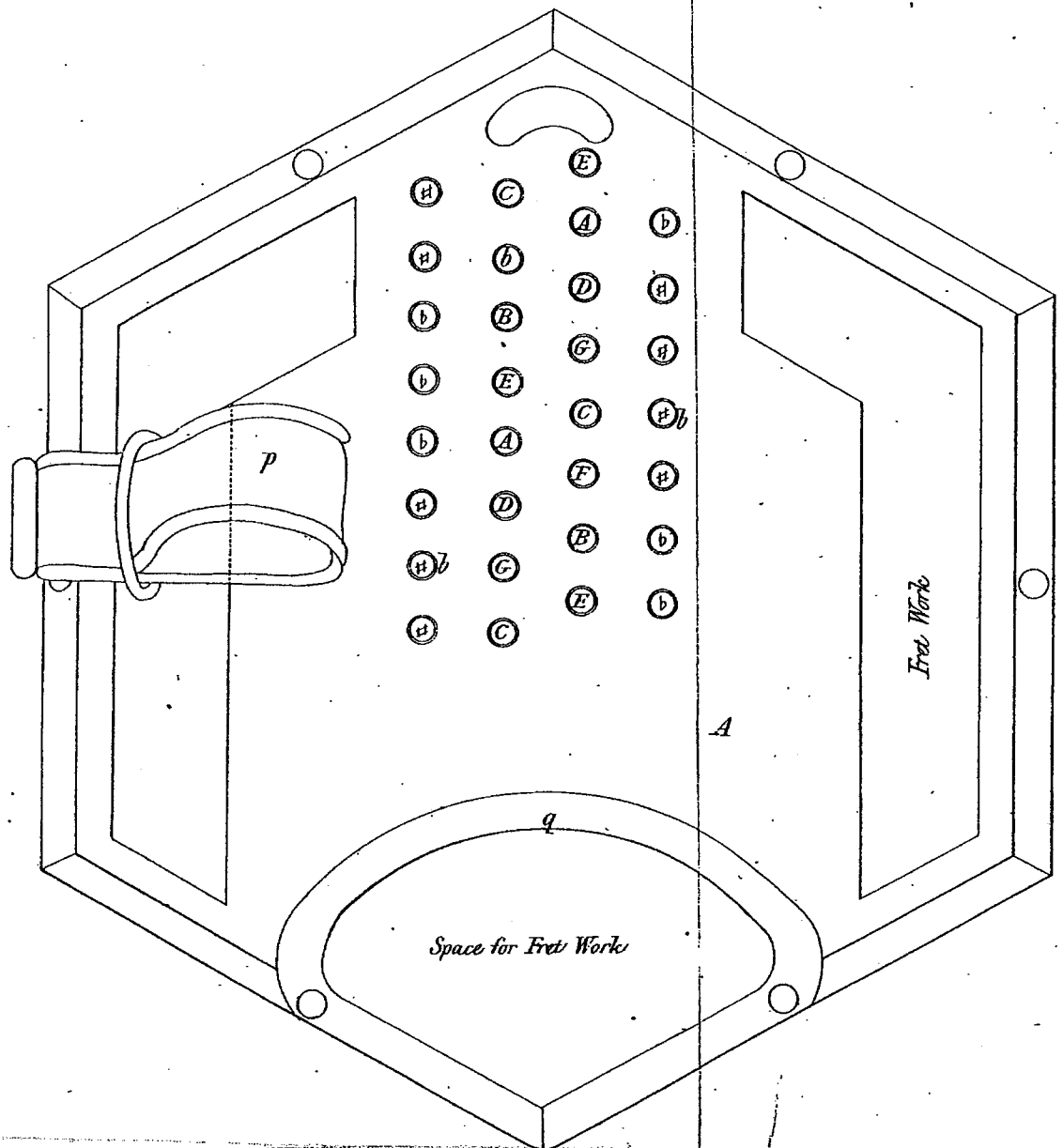
FIG. 17.



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A.D. 1861. SEP. 14. N<sup>o</sup> 2289.  
WHEATSTONE'S SPECIFICATION.

F I C . 1 8 .



F I C . 1 9 .

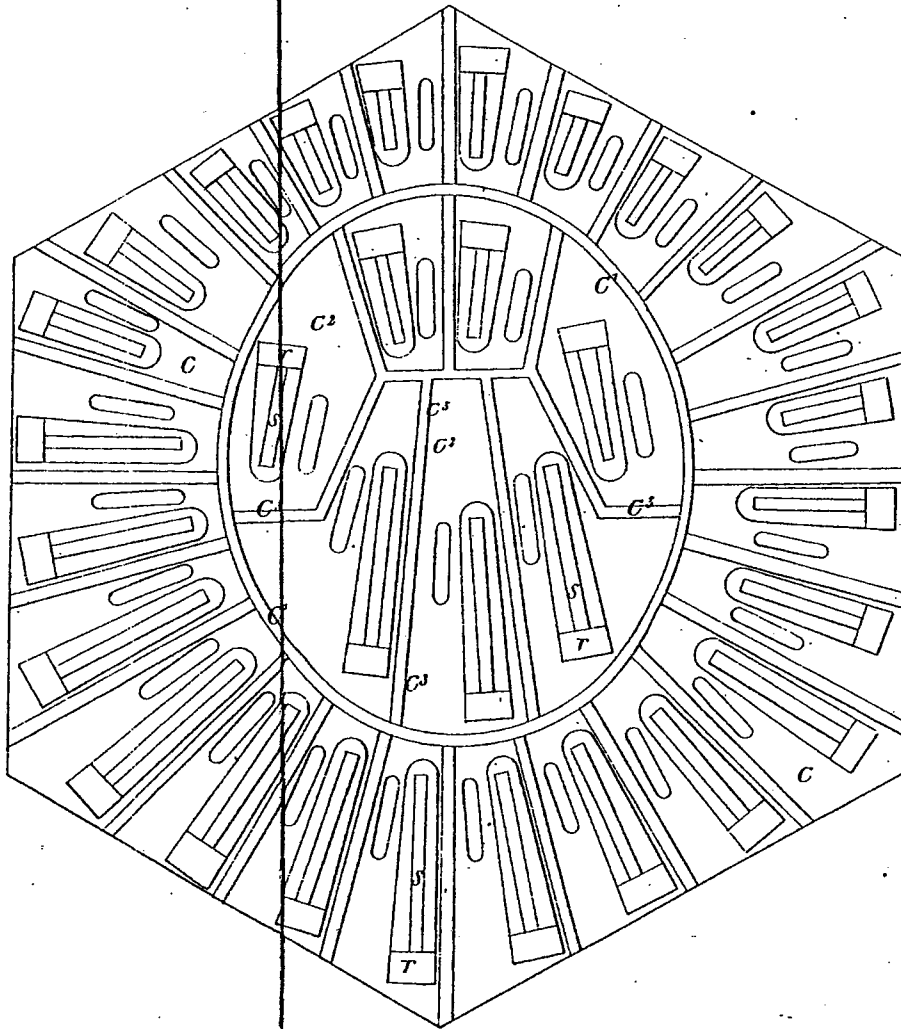
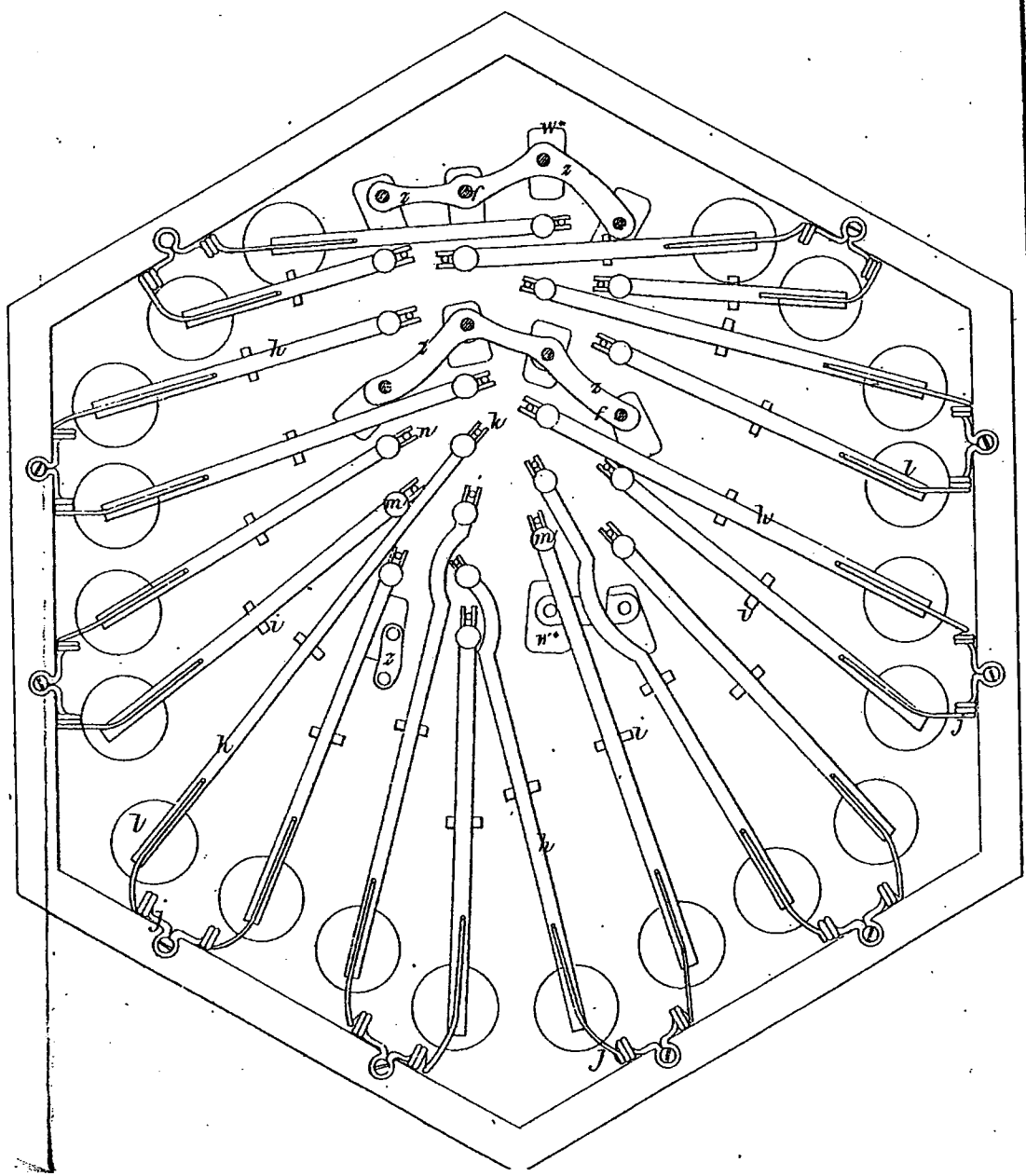
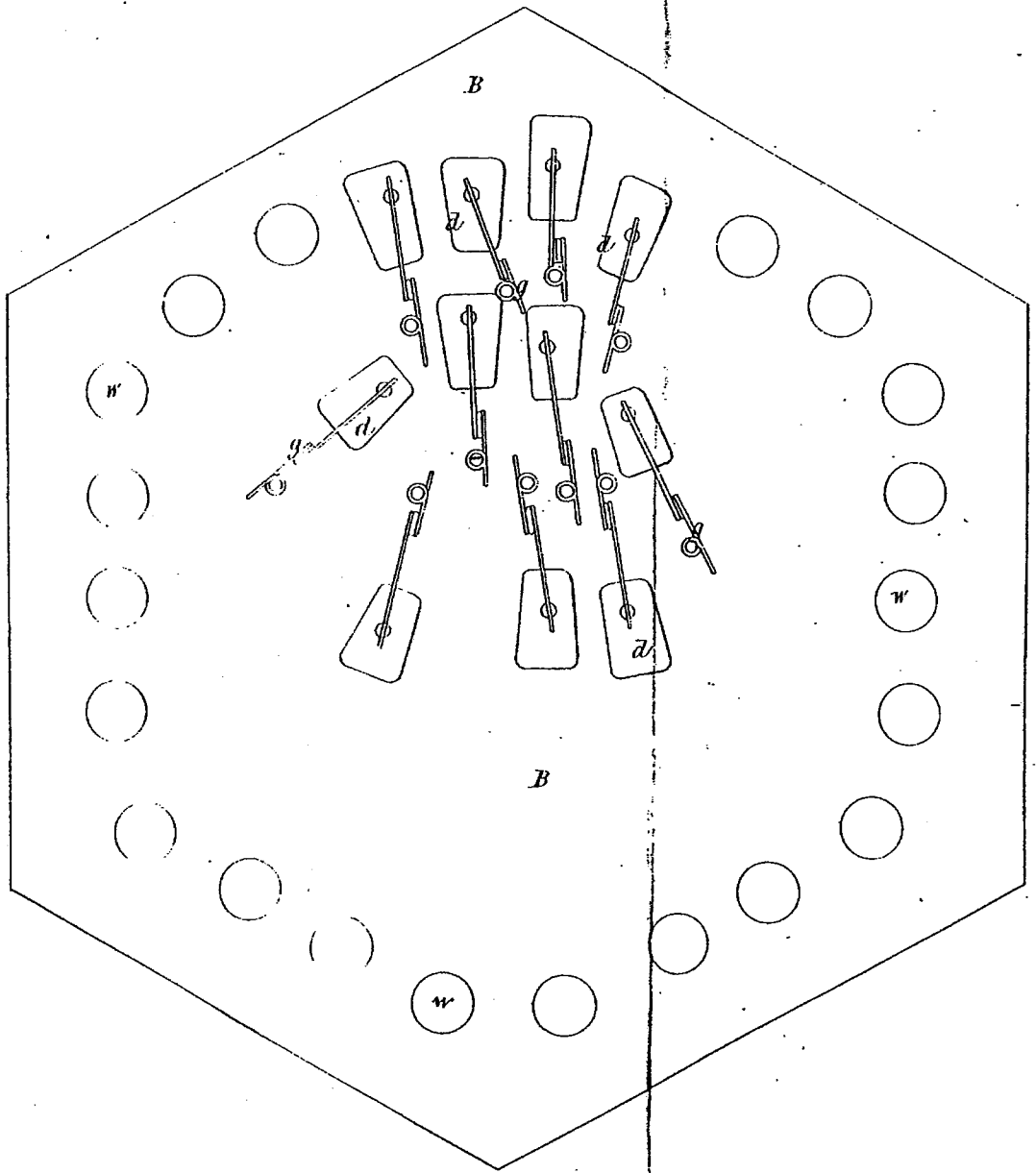




FIG. 20.

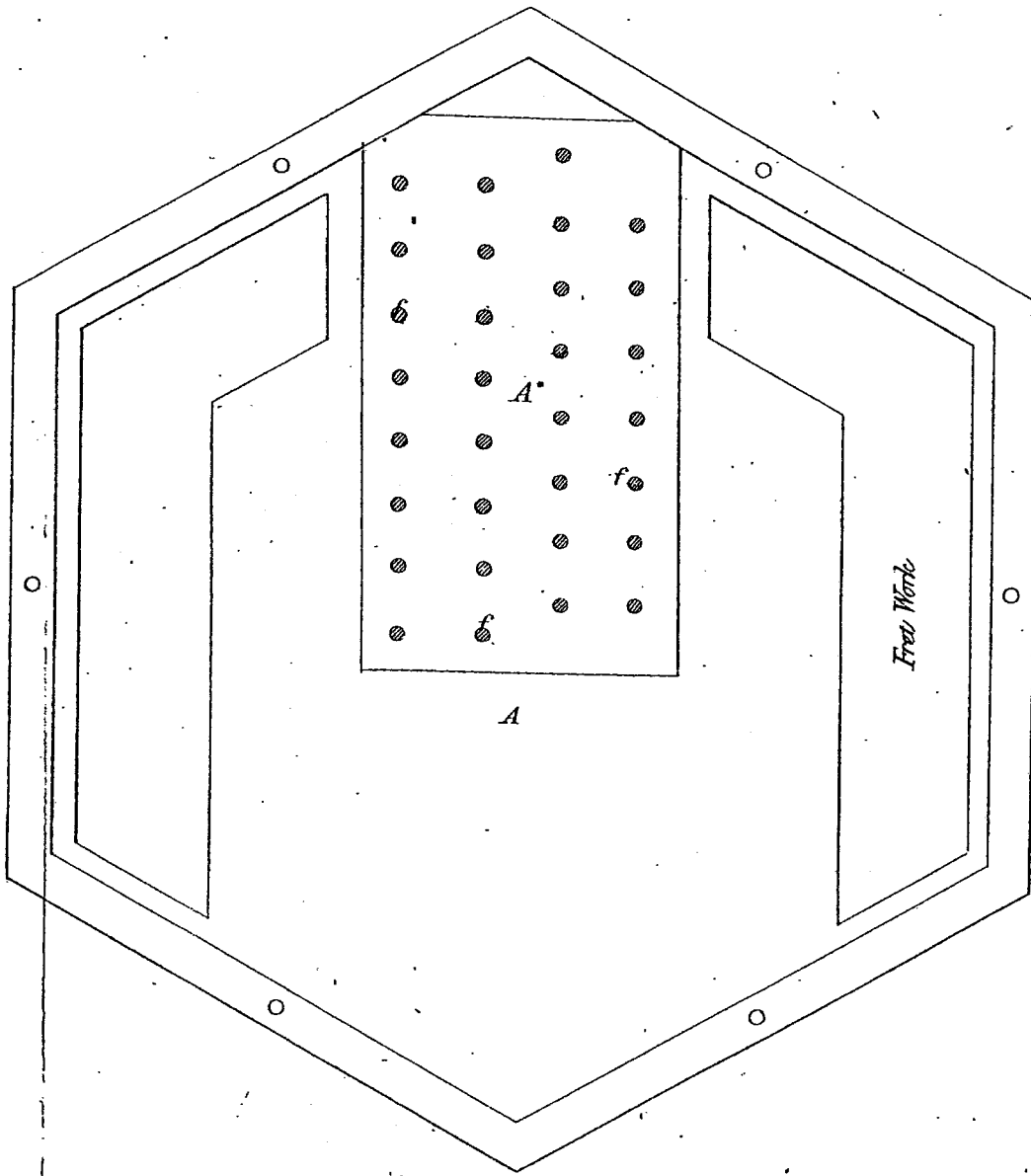




*The filed drawing is partly colored.*

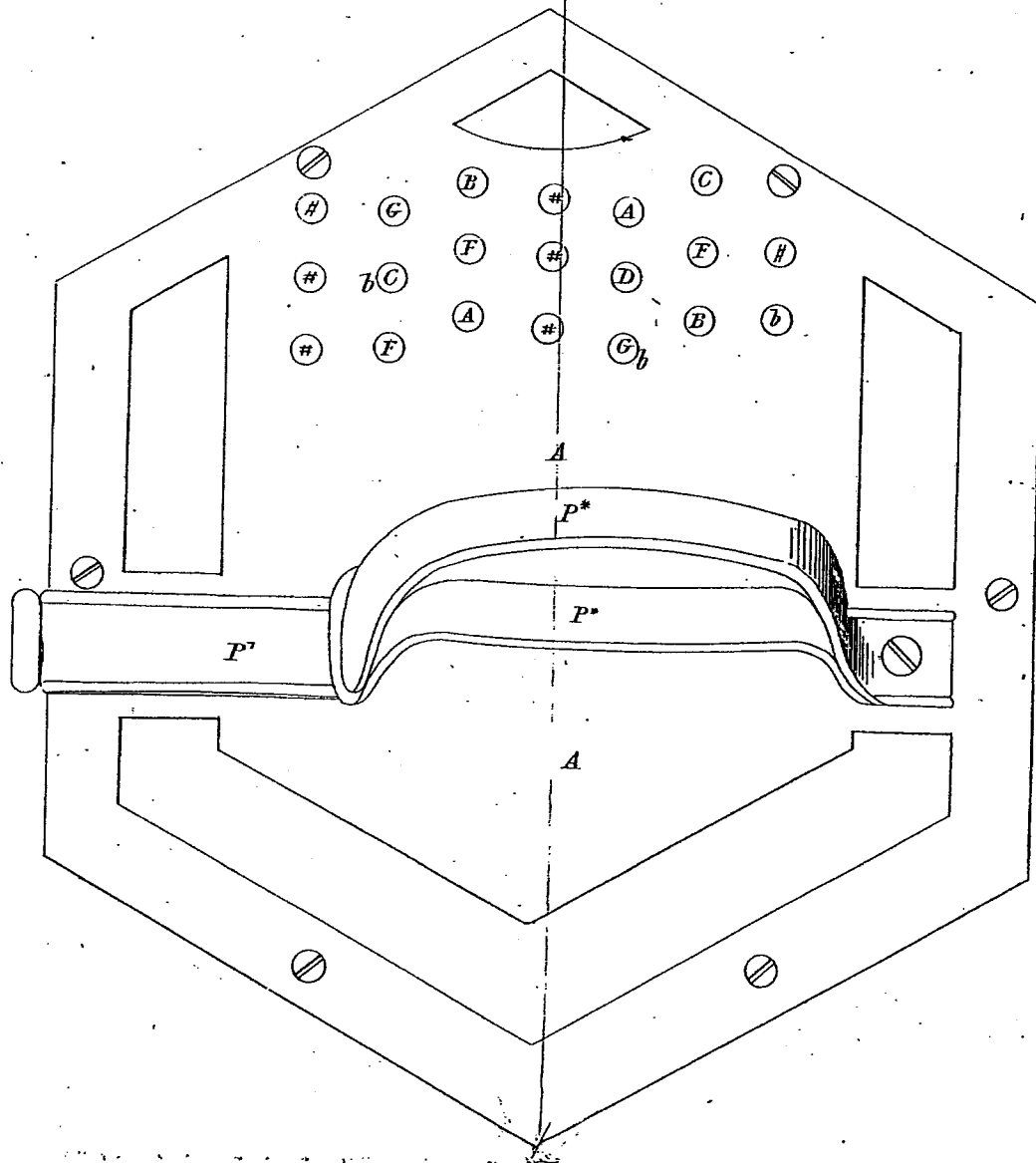


F I C . 2 3 .

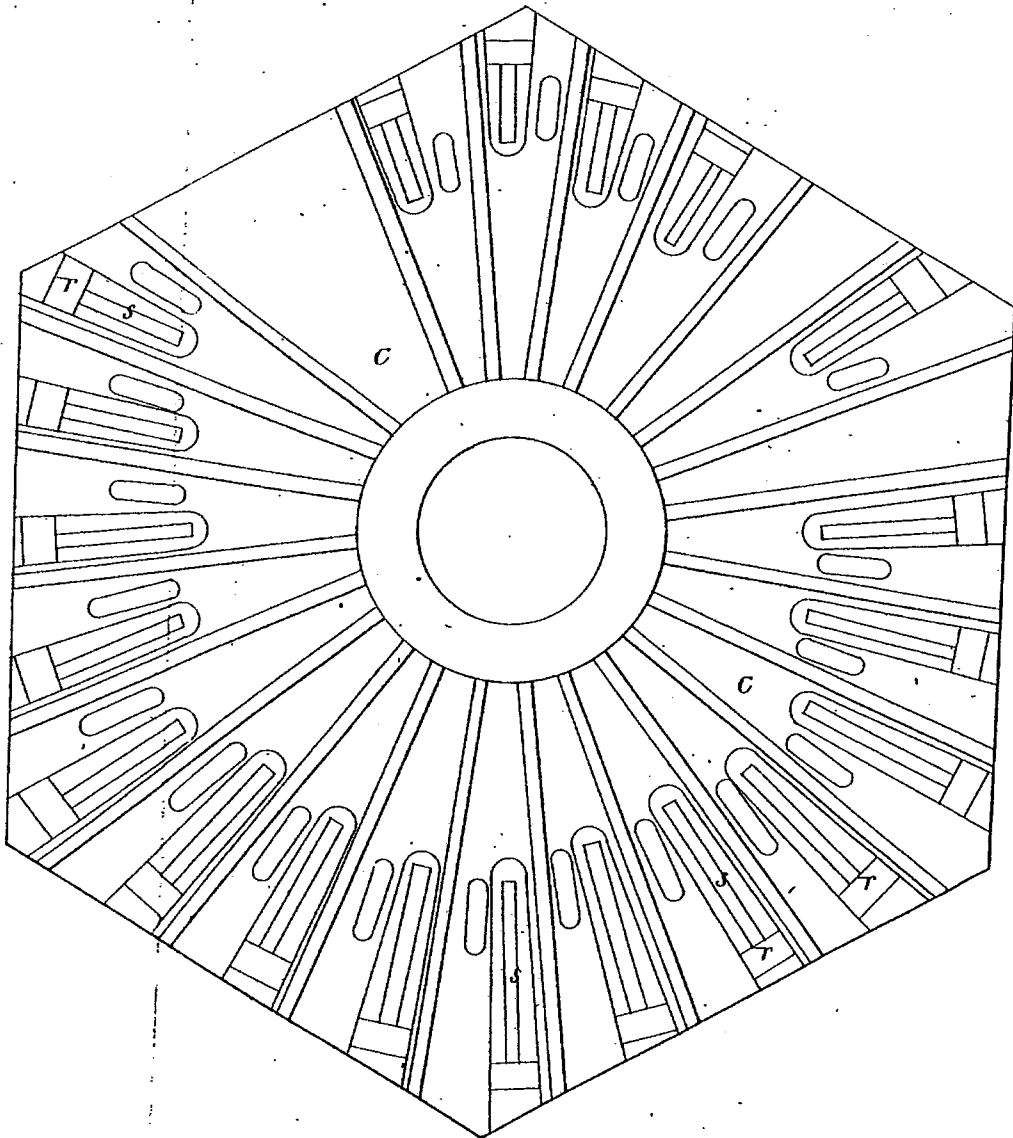


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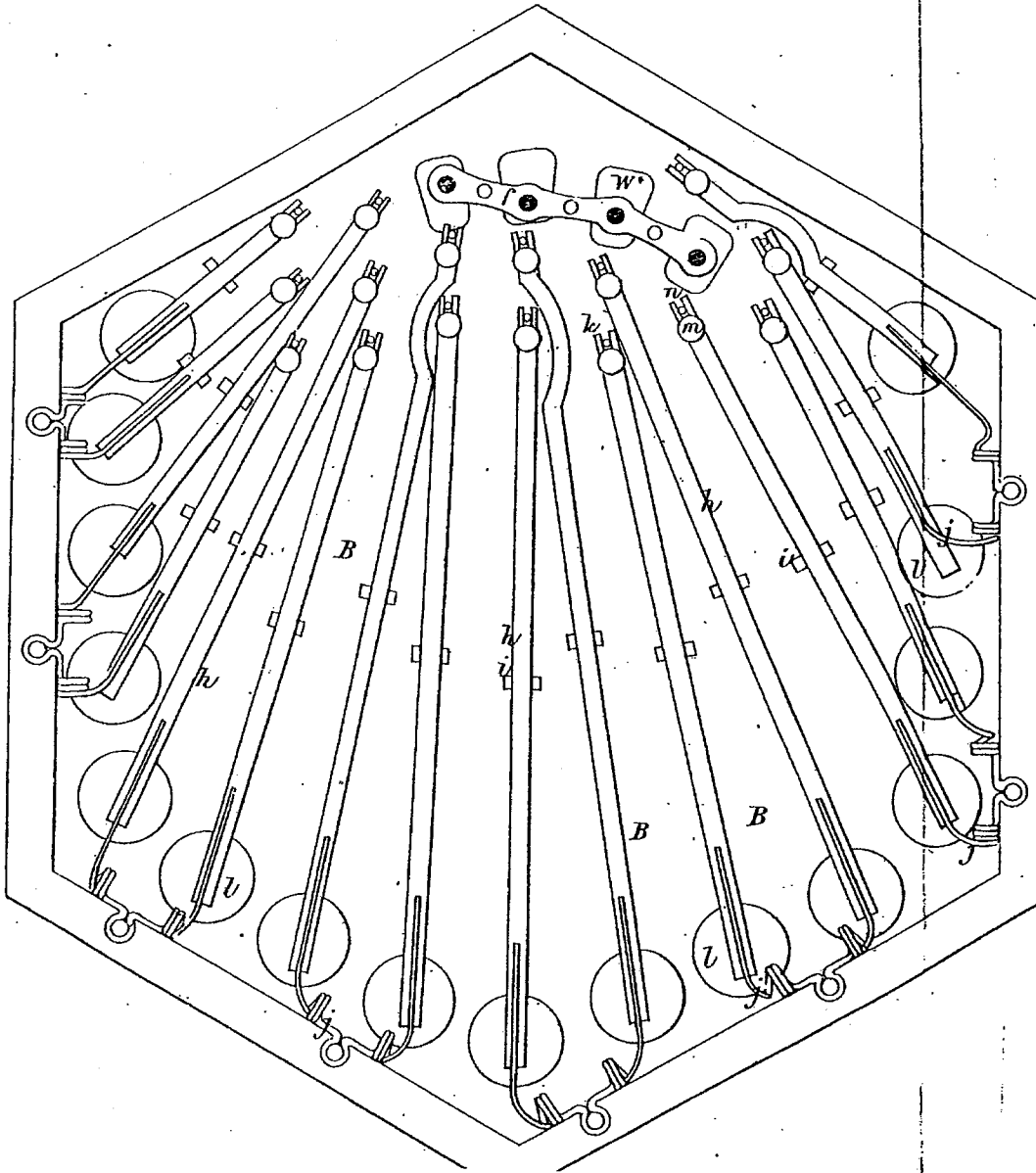
F I C . 2 4 .

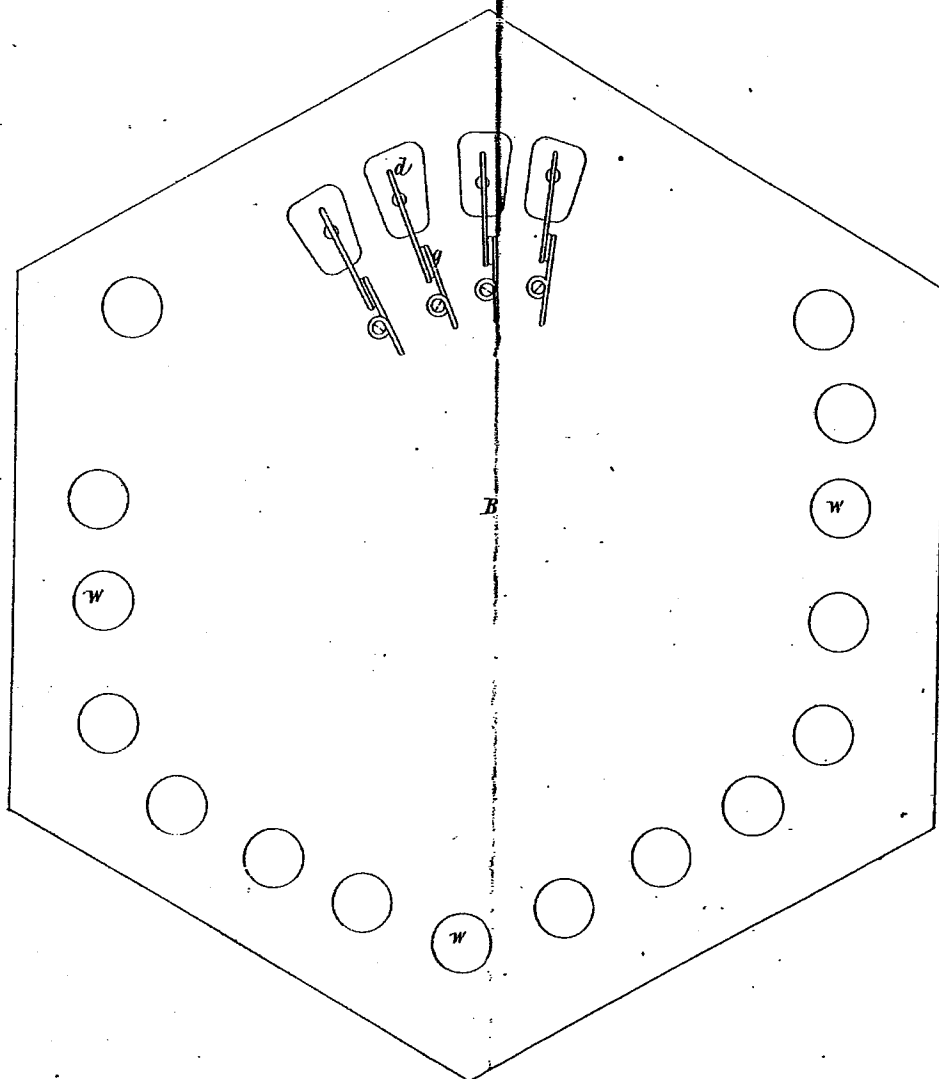


F I G . 2 5 .



F I G . 2 6 .

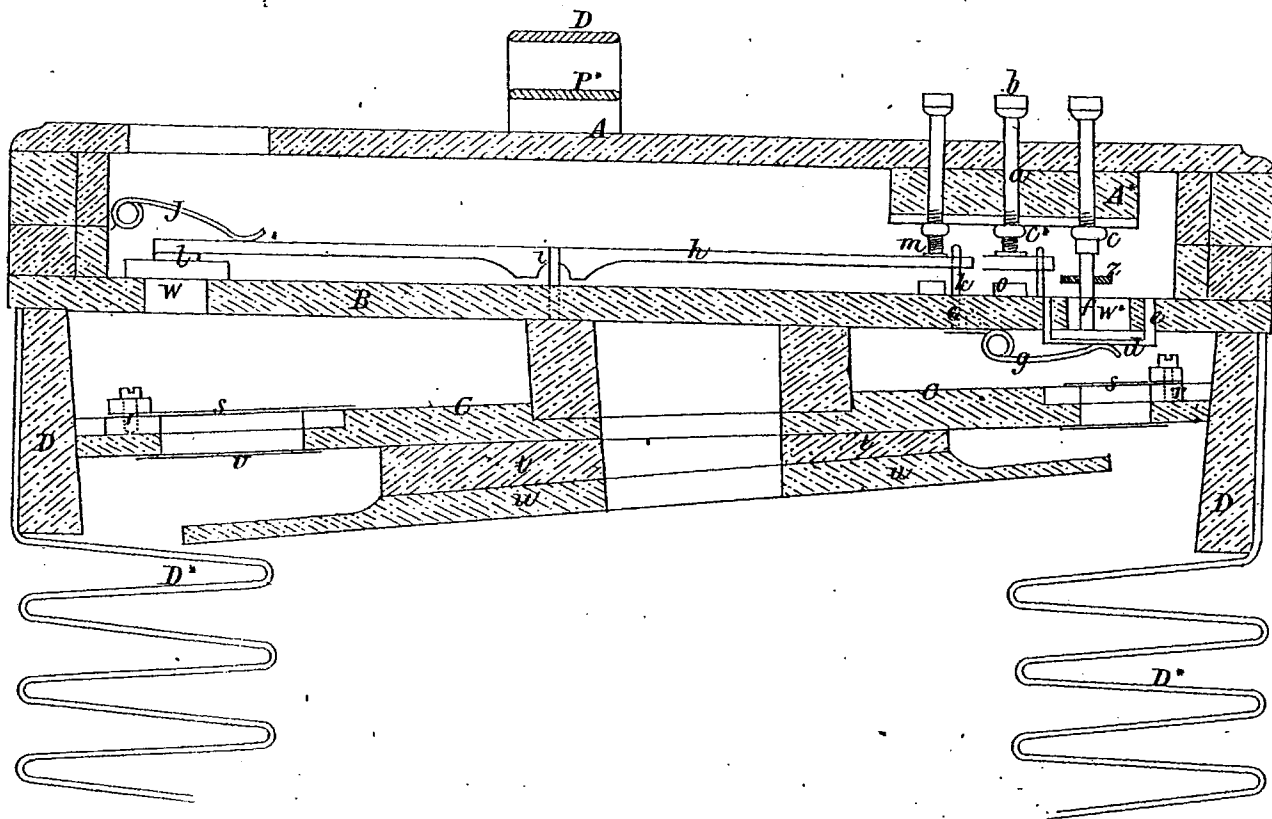




*The filed drawing is partly colored.*

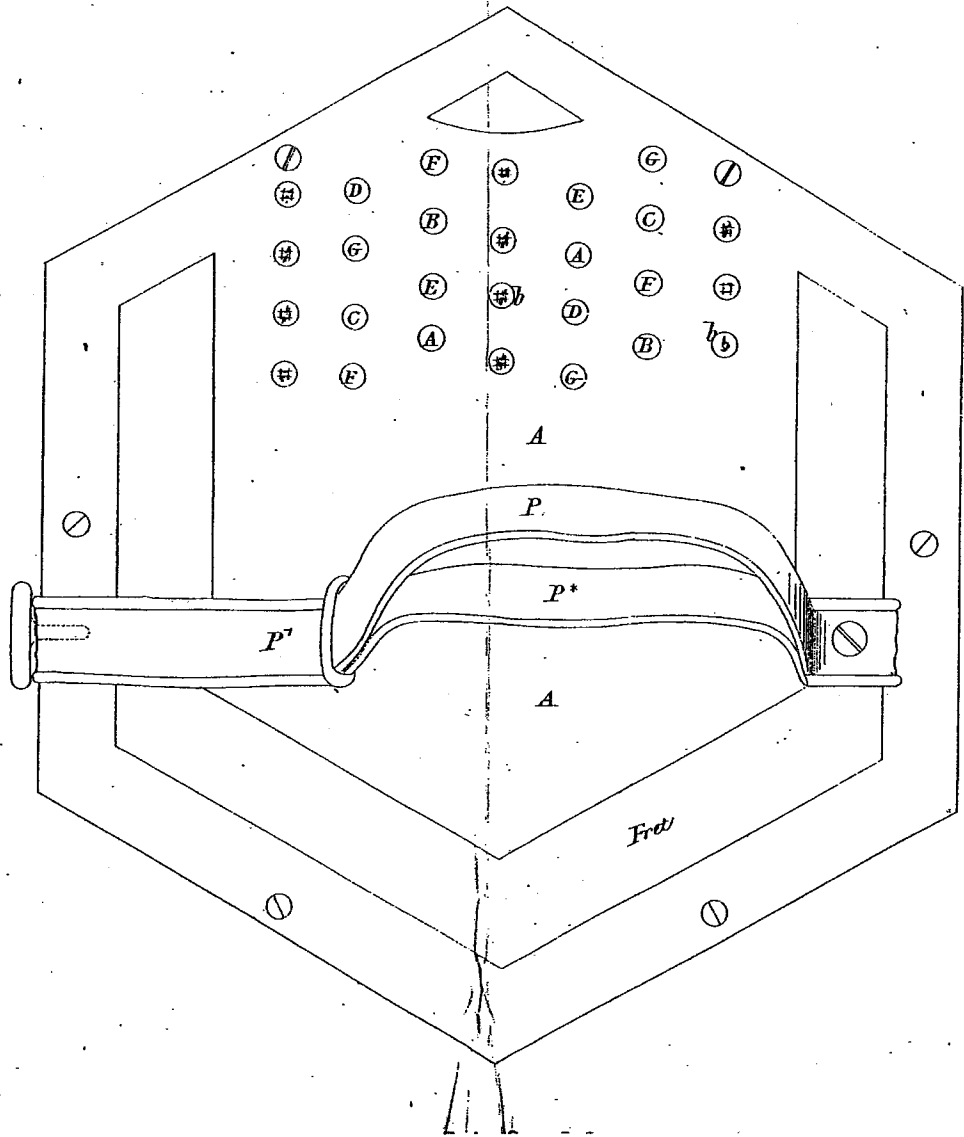


F I C . 2 8 .

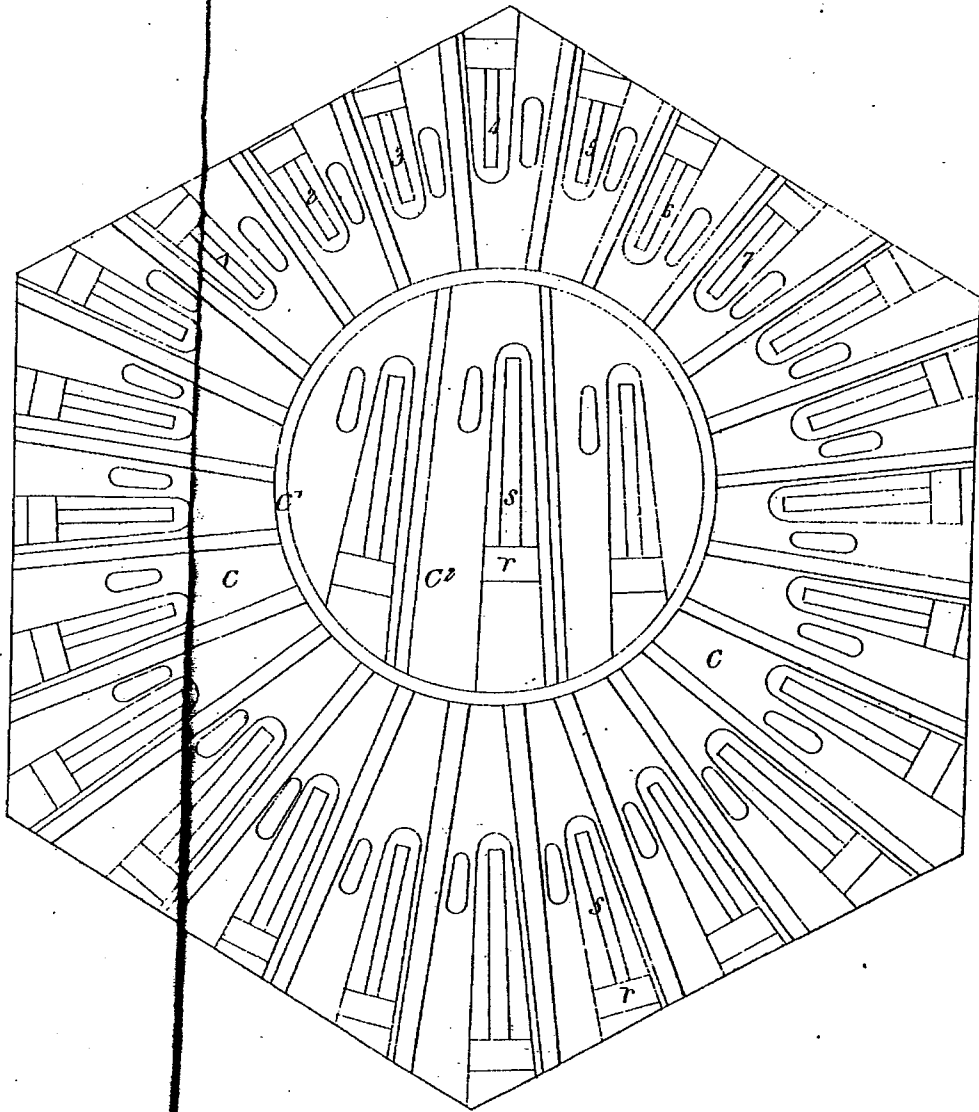


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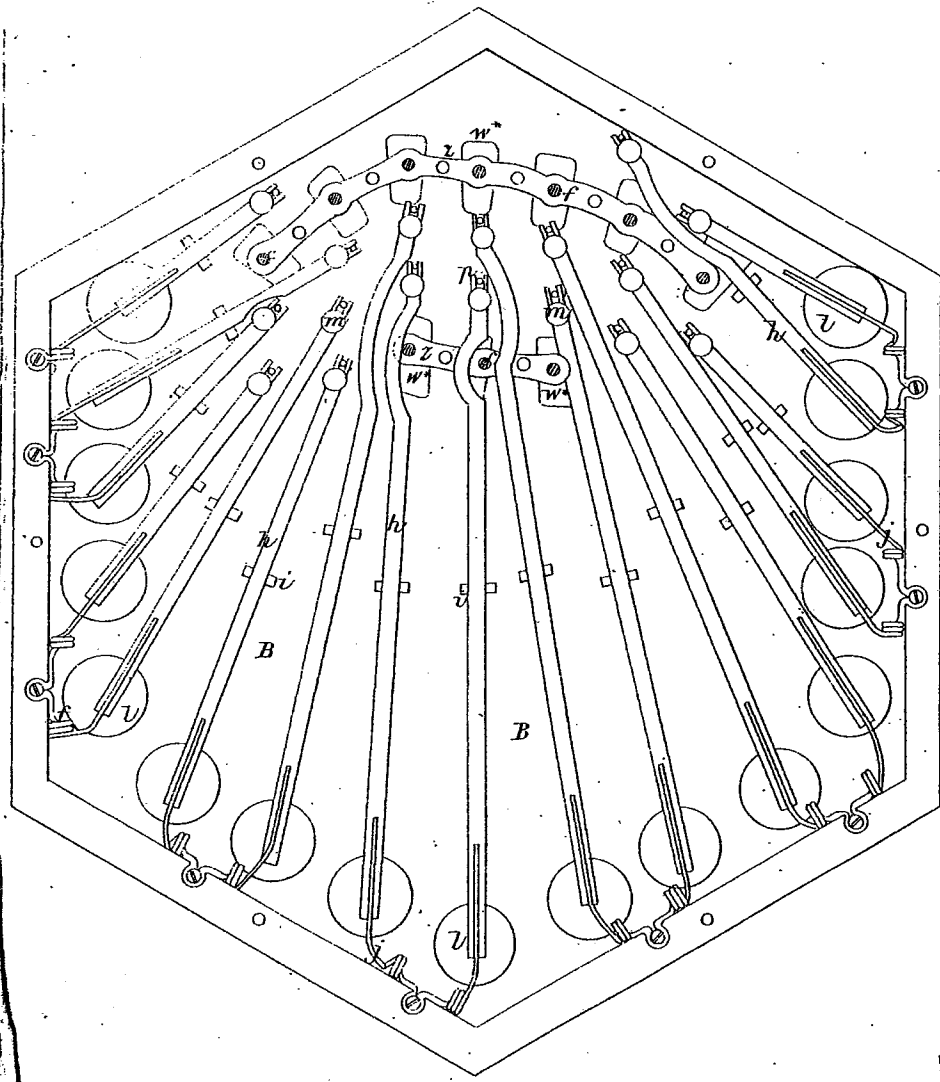
F I C . 29 .



F I C . 3 0 .



F I C . 3 1 .





F I G . 3 3 .

