

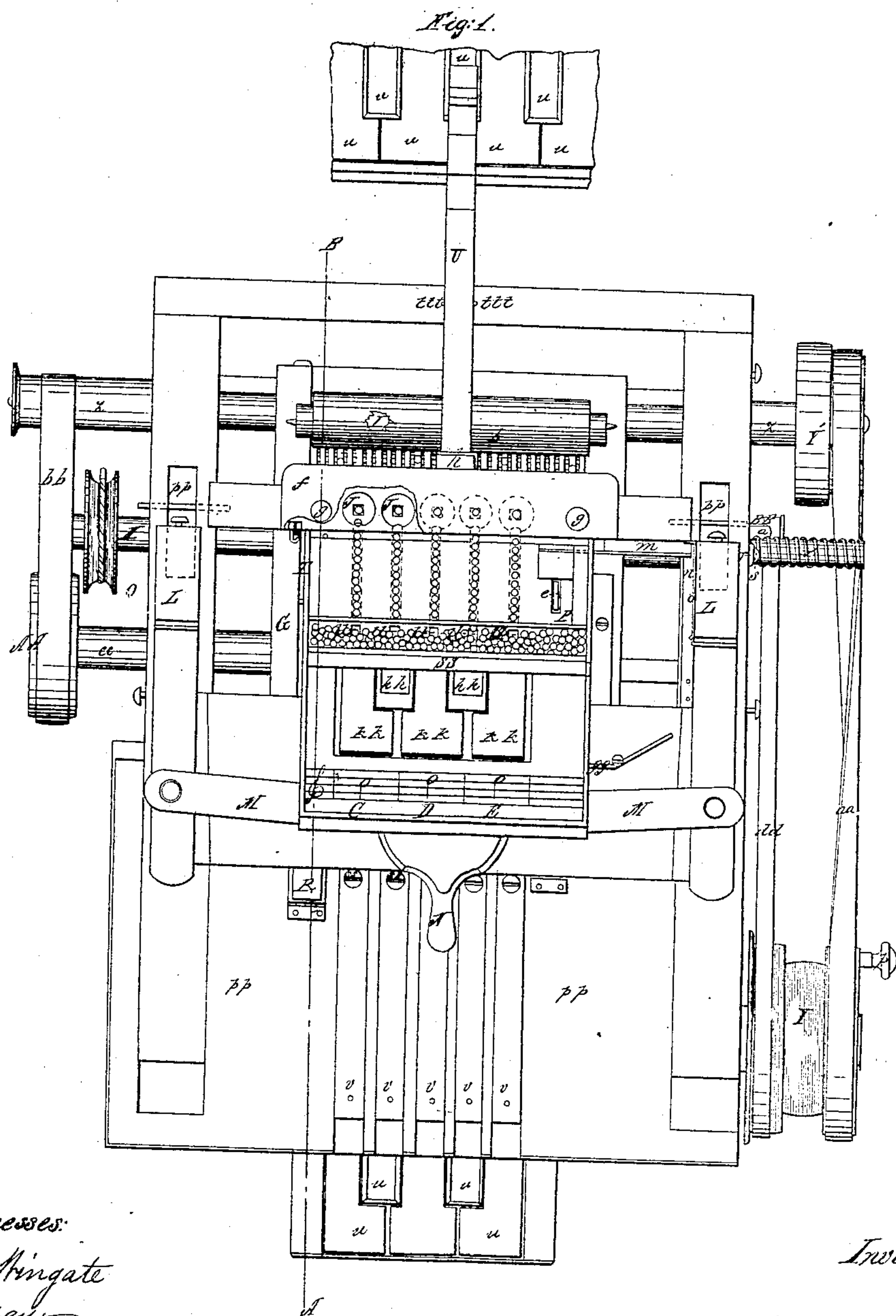
No. 30,955.

PATENTED DEC. 18, 1860.

E. D. BOOTMAN.

AUTOMATIC ATTACHMENT FOR KEYED MUSICAL INSTRUMENTS.

4 SHEETS—SHEET 1.



Witnesses:
John A. Kingate
J. M. May

Inventor:
Erastus D. Bootman

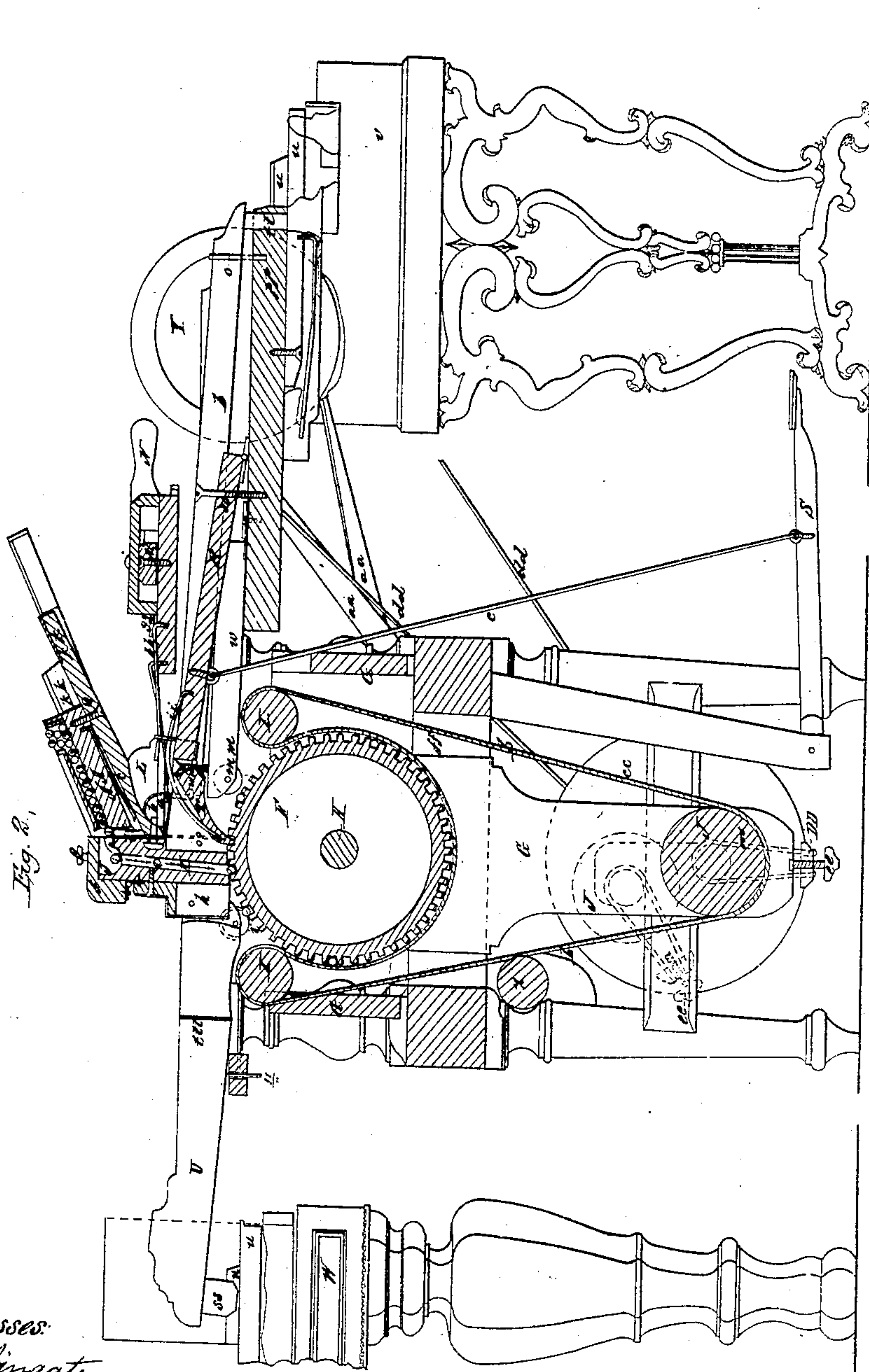
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4 SHEETS—SHEET 2.



Witnesses:
Jm Hingate
J. M. Gray

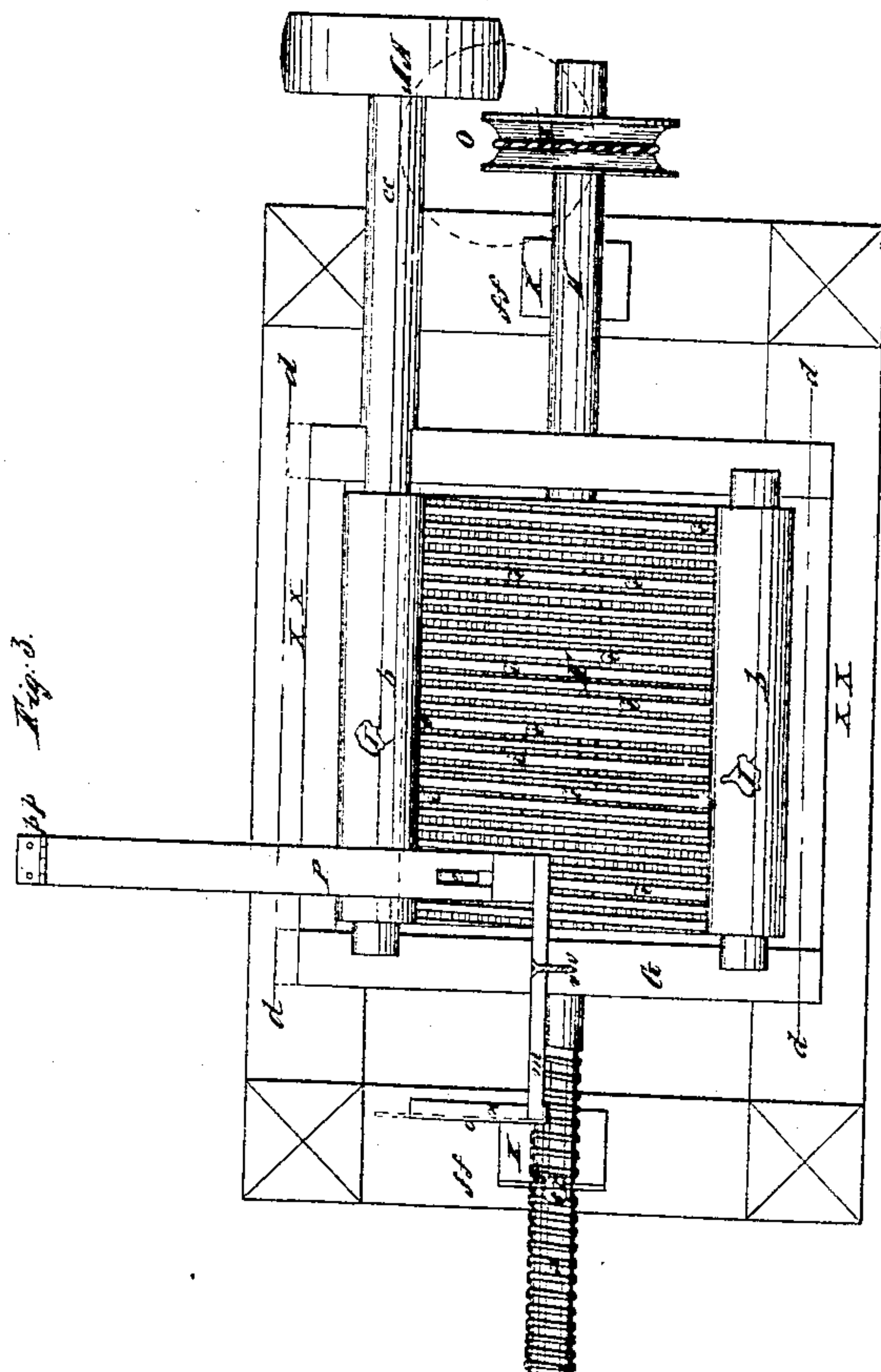
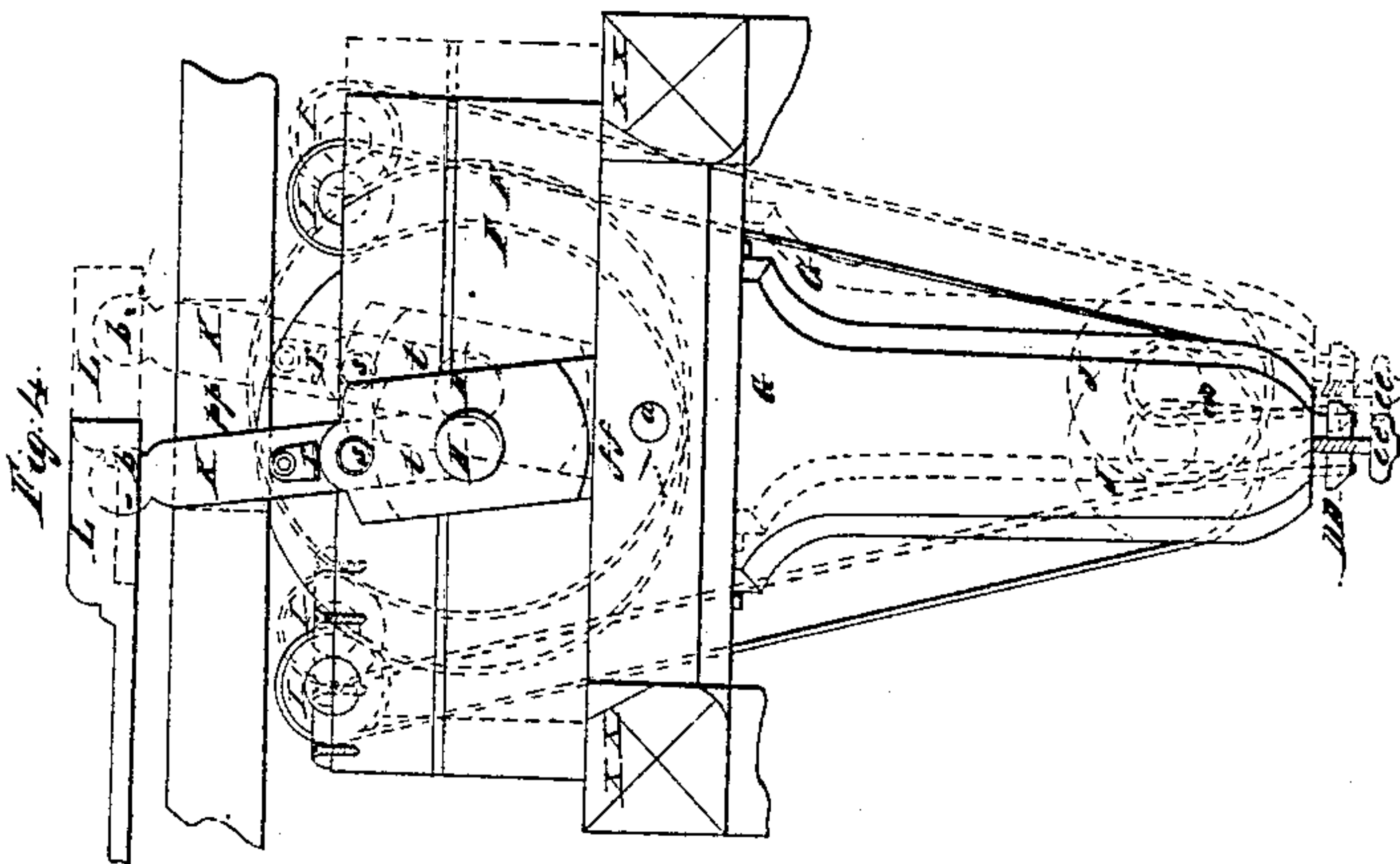
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4 SHEETS—SHEET 3.



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4 SHEETS—SHEET 4.

Fig. 3.

The figure displays musical notation on a grand staff. A bracket on the left side of the staff is labeled "General Scale". To the right of the bracket, there are six staves, each labeled with a number from 1 to 6. Above these staves, the text "Notes as written" is written. The notation includes various musical symbols such as notes, rests, and accidentals.

General Scale

Notes as written

Example 1.

1
2
3
4
5
6

Witnesses;

*John May—
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Inventor:

Erastus D. Bootman

UNITED STATES PATENT OFFICE.

E. D. BOOTMAN, OF JANESVILLE, WISCONSIN.

AUTOMATIC ATTACHMENT TO KEYED MUSICAL INSTRUMENTS.

Specification of Letters Patent No. 30,955, dated December 18, 1860.

To all whom it may concern:

Be it known that I, ERASTUS D. BOOTMAN, of the city of Janesville, Rock county, and State of Wisconsin, have invented a new and useful machine or attachment, which I call Bootman's automatic attachment for playing the organ, pianoforte, and melodeon or any instrument having a similar keyboard, and also use the same mechanical devices in the construction of a piano without using the usual keyboard by using the harp portion only of the piano; and I do declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the accompanying drawings and letters of reference marked thereon, the same letter representing the same part in each figure.

The nature of my invention consists in making a machine with a peculiarly constructed cylinder having mechanical devices for operating the same that may be attached to any organ, piano, or melodeon and may be set to play any piece of music that may be desired, and play all the parts correctly and will also play as many parts at the same time as can be written, and when once set through the twelve different keys without any change in the machine, or each piece may be repeated in the same key. A person without any knowledge of music or musical talent whatever can learn to use it with little practice.

A piano may be constructed at very little cost that can be played by my attachment, the iron frame, strings and sounding board only of the ordinary piano being used, the hammers of the attachment striking directly upon the strings of the piano.

One object of this invention is to bring music within the reach of those who cannot play in the ordinary manner the pianos melodeons &c. in common use. It enables a person with a little practice who has no knowledge of music to take a piece of music they never saw before and play it correctly. It may be used to great advantage in churches where they have no organist as with it church music can be played more correct than can be performed by hand, and by doubling the parts twice the power may be produced on the same instrument than when played by hand, and the machine may be set at one time, to play all the different

pieces necessary to use through the services of the day.

The main features of my invention consists in the construction of a cylinder with a continuous, spiral groove, or screw cut around it and crossed at proper distances by another like groove running parallel with the axis or shaft of the cylinder thereby forming at the crossings of the grooves a proper receptacle for spherical balls of the proper diameter which are placed therein and as the cylinder revolves these balls come in contact with certain levers, whose fulcrum is near the center and in passing under one end of them it raises them up thereby pressing down the end connected with the keys of the instrument, thus producing the desired sound. The balls are kept in their places as the cylinder revolves by means of a cloth or belt passing under the cylinder and over a roller each side of it, thence to another roller underneath the cylinder and also acts as a propelling belt in moving the same. At one end of the shaft to the cylinder, there is a screw cut corresponding exactly with the screw or spiral groove around the cylinder, this screw gives the cylinder a longitudinal motion as it revolves. And by means of this screw, we are able to play the pieces of music for which the machine is set, through all the different keys without any change in the machine.

Another feature is the arrangement for placing the balls in their proper places in the cylinder. This is done with a keyboard similar to the keyboard to the piano, so arranged that by pressing down either of the keys, it places one of the balls in its proper place, in the cylinder to make that sound. These balls represent the notes, and are placed in the cylinder the same as on paper, in regard to length and pitch. The number of balls in each successive groove regulate the length of the notes. When the balls have been placed in the cylinder for a certain note, or chord, the cylinder is moved just one groove by a lever operated with the foot ready to receive the next chord. To change the tunes you remove these balls from the cylinder, by loosening the cloth or belt that holds them in their places, and by turning the cylinder round they fall into the cloth or belt as it sags down under the cylinder, they are then scraped out into a box ready to use again. To repeat a piece of

music a number of times in the same key, a weight is attached to the shaft of the cylinder which is drawn up as the piece is played through, then by a backward movement of the cylinder it is thrown out of reach of the levers, and the weight draws it back to its starting point ready to play the piece through again.

Figure 1 is a top view; Fig. 2 is a vertical section on line A, B, Fig. 1; Fig. 3 is a top view of the cylinder and sliding carriage; Fig. 4 is an end view of the cylinder and sliding carriage Fig. 3 and shows the peculiar manner of obtaining the lateral motion of the same; Fig. 5 is a scale and examples showing the manner in which the balls are placed in the cylinder to make the different notes and rests.

F in Figs. 1, 2, 3 and 4 is a grooved cylinder attached to the shaft H and consists of one continuous, spiral, square groove or screw being cut around it and crossed at proper distances by like grooves running parallel with the shaft H, as seen in Fig. 3 forming at the crossings of the grooves proper receptacles for the spherical balls *i* which are kept in their places by the cloth or belt *b* as seen in Fig. 2 which passes under the cylinder F, and around the rollers I, and thence under roller J in Fig. 2, and acts upon the cylinder and rollers as a propelling belt in moving the same.

Figs. 1 and 3 is a screw cut on the end of shaft HC and corresponds exactly with the spiral groove or screw on the cylinder F.

Figs. 1 and 3 and 4 is a slide placed in the screw HC and acts as a nut to give the cylinder a longitudinal motion as it revolves.

s is a knob attached to slide *t* to move it with.

G is a sliding carriage that holds the two rollers I and roller J in their places and it slides upon the girt or way of the frame XX as seen in Fig. 3 and is moved with the cylinder F by means of the screw HC. By means of the screw HC we are able to use all the surface on the cylinder, otherwise we could only use the distance around it once. Now we use the distance round it four times, that being the number of spiral grooves in width on the cylinder that can be used to each key of the piano or melodeon, as each key to the instrument is five-sixteenths of an inch in width it can only have a corresponding width on the cylinder, which is four grooves. A different number of grooves may be made as the screw is made finer. And by means of this screw we are able to play the pieces for which the machine is set, through all the different keys, without any change in the machine, thus making a great variety. When the cylinder has passed round four times, it will have played the pieces all through, and is then ready to play them in the next key to it (either a semitone higher

or lower as the screw is made with a right or left hand thread) and thus you may go on as far as the length of the frame will allow the cylinder and carriage to move. When the cylinder and sliding carriage has passed through to one end of the frame by drawing the slide *t* from the thread of screw HC, they may be moved back to their starting point, and by placing the slide *t* in the thread of the screw HC it is ready to use again.

V as represented in Fig. 2 is a melodeon and shows the application of the attachment to the instrument.

In playing the organ the attachment will stand directly in front of the keyboard, the same as when playing the piano (as seen in Fig. 2), and it may stand in the same place when playing the melodeon by placing the levers *w* and *v* on the other side of the cylinder from that, represented in Fig. 2. When the attachment is applied to the melodeon as in Fig. 2 it can be played upon by hand the same as before the attachment was applied to it.

u are the keys to the melodeon.

v Figs. 1 and 2 are a set of levers reaching from the cylinder F to the keys of the melodeon and operates upon them by means of the pin *t t* passing through the board *p p*. *o* is a guiding pin passing through the levers *v*.

s s is a screw passing through the levers *v*, the head of the screw acting as the fulcrum to the lever.

w Fig. 2 is another short lever placed directly under the levers *v*, and are secured at one end, by a hinge to the board *p p*, in the other end is placed a small wheel *m m*, which runs in the spiral groove on the cylinder F.

w w is a screw passing through the ends of levers *v*, and resting on levers *w*, which by turning up or down regulates the levers *v* to the keys of the instrument. As the cylinder revolves, the balls *i* in the cylinder pass under the wheels *m m* thereby raising the ends of levers *w*, and *v*, which are connected by the screw *w w*, consequently pressing down the end resting on the keys of the instrument.

M Fig. 1 is a compound lever.

N is a clasp that holds the ends of levers M.

K Figs. 3 and 4 is an oscillating lever on which the shaft H is hung. This lever is secured at one end to the girt *f f*, of the frame, by a mortise and pin, fitting loosely so as to allow it to be moved backward and forward. The top of this lever passes through a mortise *p p* Fig. 1 and is connected to the piece marked L Figs. 1 and 4 which piece also connects with the levers M, thus forming a set of compound levers by which we move the cylinder and sliding carriage backward and forward as seen by

dotted lines in Fig. 4, the object of this movement is to move the cylinder away from the levers *w* at certain times—

g g Figs. 1 and 2, is a wire spring that operates upon the levers *M*, throwing the cylinder out of connection with the levers *w*, and holding it there. When the cylinder is in this position, by drawing the slide *t* from the screw *HC*, the cylinder may be moved either way desired. The cylinder is brought in connection with the levers *w* again, by pressing against the clasp *N*, as the cylinder comes to its place the piece marked *L* is caught by the spring catch *n*, Figs. 1 and 3 which spring holds the cylinder in that position.

R Figs. 1 and 2 is a lever jointed to board *p, p*, for moving the cylinder while setting it, or preparing it for playing.

S is a lever used with the foot and is connected by the connecting rod *c* to the lever *R*.

T is a pawl hung to lever *R* with a hinge and fits into the grooves on the cylinder and when the lever *S* is pressed down with the foot, it moves the cylinder just one groove exactly under the conductors *K* Fig. 2 ready to receive the balls.

i i is a wire spring that presses the pawl into the grooves on the cylinder.

h h is a wire spring to bring the lever *R* to its place after being pressed down.

o o is a wire hook to hold the pawl up from the cylinder while playing.

k k Figs. 1 and 2 are the keys or levers for setting the machine.

C, D, E, Fig. 1 is the staff with the scale written upon it and the name of the notes marked under them, as seen in Fig. 1. To place a ball *i*, in the cylinder to make the sound represented by either of these notes, the key directly opposite, is pressed down.

S S Fig. 1 is a box or reservoir to hold the balls.

U are a set of grooves (one for each key to the piano or melodeon) elevated to an angle of about twenty degrees and filled with balls one above the other and connect the conductors *k*, with the box *S S*. These grooves are covered with glass so as to observe the passage of the balls through. At the bottom of these grooves, is placed an obstruction to prevent the balls from passing through except as they are raised over the obstruction, by the pin *u* passing through the setting board *A A* and secured to the end of the keys or levers *k k*.

J are cups formed in the top of the conductors *k*, to receive the balls as they are raised over the obstruction in the bottom of the grooves *u*.

Q is a screw passing through the keys or levers *k k*, the head of the screw acting as the fulcrum to it.

r r is a wire spring to bring the key back to its place after being pressed down. When

the keys or levers *k k* are pressed down it raises just one ball at the bottom of the grooves *u* over the obstruction into the cups *J* and through the conductors *K* to its place in the cylinder.

D D Figs. 2 and 4 is a bar of wood which extends across the bottom of the carriage *C*, and is suspended by the wire loops *o o o* which are fastened to this bar and pass over the bearings of the rollers *J*.

e e Fig. 2 is a set screw which passes through each end of the bar *D D*, the ends of the screws, resting against the bottom of the carriage *C*. The object of this screw and bar is to give proper tension to the belt, *v*. When we wish to remove the balls from the cylinder *F* we move the bar *D D*, to the side of the projecting arm of the sliding carriage *G*, that holds roller *J*, then by raising the roller *J* to a notch in the slot, as seen by dotted lines in Fig. 2, the belt *v* is loosened around the cylinder and by turning the cylinder round, the balls fall into the cloth or belt *v*, as it sags down under the cylinder, they are then scraped out into a box ready for distribution again.

P Figs. 1 and 3 is a lever secured at one end to the board *p p* by means of a hinge. In the other end which rests on the cylinder, is placed a small wheel *e* which runs in a groove on the cylinder.

m is a connecting lever to connect the lever *P* with the spring catch *n* that holds the cylinder in connection with the levers, *w*, as seen in Fig. 3.

v v is a screw that holds lever *m* and acts as a fulcrum to it.

When we wish to play a piece through a number of times in the same key, we use the weight *o* Figs. 1 & 3 as shown by dotted lines, which weight is attached to the pulley *X* on the shaft *H* by a cord and pin. As the cylinder revolves in playing the piece through it winds the cord round the pulley *X* thus raising the weight *o*. Now by placing a ball in its proper place in the cylinder as it passes under the wheel *e* in the end of lever *P* it raises lever *P* and by means of the connecting lever, *m*, it presses down the spring catch *n* at the moment the last note is played. Then the spring *g g* in Fig. 1 (by means of the compound levers *M*), throws the cylinder out of connection with the levers *w* this backward motion slacks the belt *b b* Fig. 1 the cylinder being thus freed the weight *o* draws the cylinder round to its starting point, and by pressing against the clasp *N* you bring the cylinder in connection with the levers *w* ready to play the piece through again.

f Fig. 1 is a lid hung with hinges to cover over the cups *J* when not in the operation of setting, to prevent any balls from accidentally dropping into the cylinder. In Fig. 1 a portion of it is broken away to show the

passage of the balls through the conductors *k*.

The spherical balls *i* represent the notes and they are placed in the cylinder the same as on the paper, in regard to length and pitch. The operation of setting the machine is similar to copying the notes from one paper to another with pen and ink. Instead of writing the note, a ball or balls are placed in the cylinder to represent that note. When a number of balls are placed in each successive groove as they pass under the wheels *m m*, they raise the end of levers *w*, and *v*, consequently holds the key down on the instrument while they are passing by, thus prolonging the sound. When all the notes of a piece of music are of the same length whether they be whole notes, quarters, or eighths, one ball may represent them, thus saving space on the cylinder, and the motion of the cylinder must be regulated accordingly. Such a piece may be set in a number of ways, thus, one ball may represent a note, or two, three or four.

The mode of setting the machine for different notes, rests &c. may be seen by referring to the general scale and examples, as shown in Fig. 5. The spaces between the lines that run across the staff as seen in Fig. 5 represent the grooves that run across the cylinder. The notes and dots represent the balls.

The general scale shows the number of balls, and the manner of placing them in the cylinder, to make the whole, half, quarter, eighth, and sixteenth notes.

Examples 1, 2, 3, 4, 5, and 6, show the notes as they are written on paper also show how the balls that represent the same notes are placed in the cylinder.

The examples 1, 3, 4, and 6, as shown in Fig. 5 are abbreviated from the scale so as to save space on the cylinder, and also time in setting it, which may be done with almost every piece of music. The number of balls to make a note or chord is usually one less than the number of grooves. The last groove being empty to allow the wheel *m m* to drop down to cut off the sound before striking the next note unless the notes are on different degrees of the scale, then it may be set as example 6 in Fig. 5. In setting the machine to play the piano, one ball represents all the different length of notes as the length of the notes depend upon the vibration of the string. When we wish to play a long note, or chord, we use the pedal to the piano which raises the dampers from the strings, thus allowing the strings to vibrate. So in setting it for the piano we place one ball in the cylinder to raise the hammer and then pass over the same number of grooves for the different length notes as in setting it for the organ or melodeon. When the notes are all of a length in a

piece of music a person who can play, can set the machine for such a piece by simply playing the piece through on the keyboard for setting it the same as on the instrument and it can be done in the same length of time. A person without any knowledge of music by learning the different length notes and rests can set any common piece of music by noticing on what line or space of the staff the note is placed which he wishes to play. Then by referring to the staff with the scale written upon it, which is placed in front of the keyboard for setting, he looks for the note in this scale upon the same line or space as the one he wishes to play, having found it he presses down the key directly opposite. That motion of the key places a ball in the cylinder to make that note. He then moves the cylinder with the foot lever *S*, just one groove ready for the next note or chord. Thus he may be as long as he pleases in finding the right notes and when he gets them all set by turning the machine they will all come in exact time and tune.

W Fig. 2 shows the position of the piano when played upon by this attachment.

u are the keys to the piano.

U is a hammer that strikes upon the keys.

s s is a piece of rubber or soft substance to strike upon the keys. The hammer *U* is raised by the balls, *i*, in the cylinder *F* passing under the wheel *n n* which is placed in the end of the hammer *U*, as the balls pass by, the hammer falls upon the key. The strength of the blow depends upon the weight of the hammer, which are regulated by properly loading the end of the hammer.

h is a block that holds the hammer in its place by means of a mortise and pin.

t t t is a guiding pin to keep the hammer in its proper place.

s s is a wire spring to raise the hammer from the keys as soon as it strikes them,

p in Fig. 1 is a knob or handle attached to one of the pulleys *Y* by which to operate the machine in performing music.

z is a pulley shaft passing through under the frame of the machine.

Y Y are a set of reverse pulleys on one of which is the knob or handle *p*, and are connected by belt *a a*.

c c is a shaft to one of the rollers *I*.

A A is a pulley on shaft *c c*.

b b is a belt connecting shaft *z* with pulley *A A*.

C C Fig. 2 is a balance wheel to steady the motion.

d d Fig. 1 is a belt to drive the balance wheel.

B B is the pulley to balance wheel.

In operating my attachment to perform music, after the cylinder has been properly supplied with the balls for the desired music, the pulley *Y* is revolved by means of the

knob or handle *p*, whereupon all the pulleys connected therewith by the bands are put in motion, and the cylinder is revolved bringing the balls at proper periods of time under the wheels *m m* in each of the levers *w*, whereby the end of the levers *v* is raised and its opposite end presses down the key on the melodeon or other instrument producing a tone and thus continuing: the tune is played (and other results accomplished) as hereinbefore more fully described.

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

1. The use and application of the spherical balls *i* or their equivalents, when used substantially as described, and for the purpose described.

2. The construction and use of a cylinder made of any suitable material with a continuous spiral groove cut around the cylinder similar to a screw, which groove is crossed at proper distances by like grooves running parallel with the shaft or axis of the cylinder, thereby forming at the crossings of the grooves proper receptacles for the balls *i* substantially as described and for the purpose described.

3. The employing a belt or cloth *v* in combination with rollers to keep the balls *i* in their places on the cylinder, and to propel the cylinder in performing music substantially as described or any arrangement accomplishing substantially the same object.

4. The side or lateral movement of the sliding carriage *G* in combination with the ways *X X* substantially as, and for the purpose set forth.

5. The combination of the keys or levers *k k* grooves *l l* pins *t t*, cups *J*, and con-

ductors *k* or their equivalents, when used substantially as shown and for the purpose described or any arrangement accomplishing substantially the same thing.

6. The arrangement of the compound levers *M* in connection with the oscillating lever *K* or their equivalents substantially as shown and for the purpose described.

7. The use and application of the screw *H C* and slide *t* or their equivalents when used in connection with a cylinder to give a longitudinal motion to the same as it revolves, substantially as, and for the purpose described.

8. The arrangement and combination of the lever *P* with the connecting lever *m*, spring catch *n*, weight *o*, and pulley *X* substantially as described and for the purpose set forth.

9. The manner of raising the hammer *U* to strike the strings or keys of a piano substantially as described or any arrangement substantially the same.

10. The method described of pressing down the keys upon the organ or melodeon by means of the levers *v*, and *w*, pins *t t* wheel *m m* or any arrangement accomplishing substantially the same thing.

11. The application and use of the devices composing my attachment substantially as described in combination with an organ, piano, melodeon or other instruments to which it may be applied to produce or perform music.

Dated Janesville Wis. June 7th 1860.

ERASTUS D. BOOTMAN.

Witnesses:

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J. H. WINGATE.