

No. 773,598.

PATENTED NOV. 1, 1904.

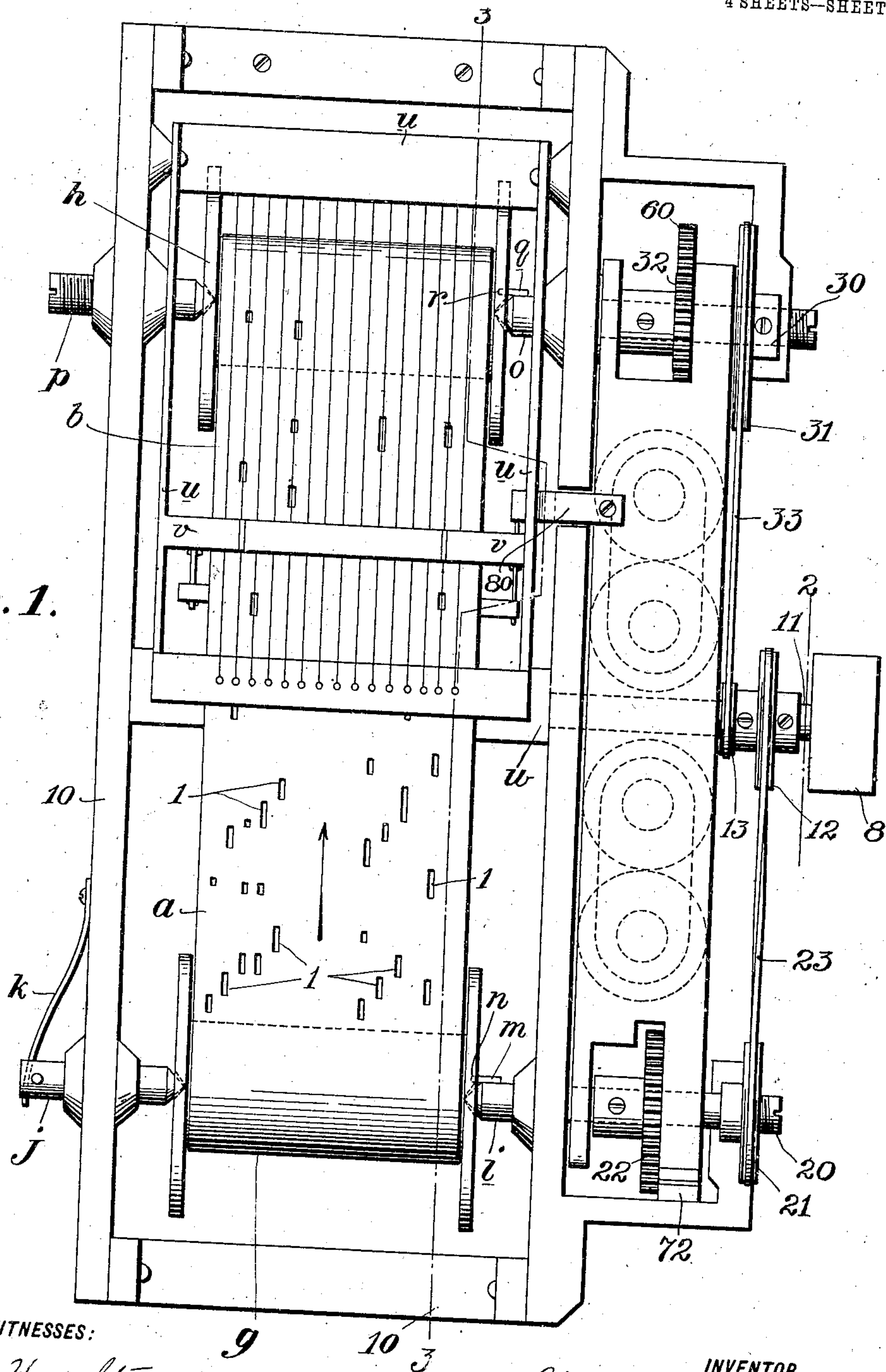
C. A. SHAFFER.
SELF-PLAYING MUSICAL INSTRUMENT.

APPLICATION FILED DEC. 9, 1903.

NO MODEL.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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William B. Marks.

INVENTOR

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4 SHEETS—SHEET 2.

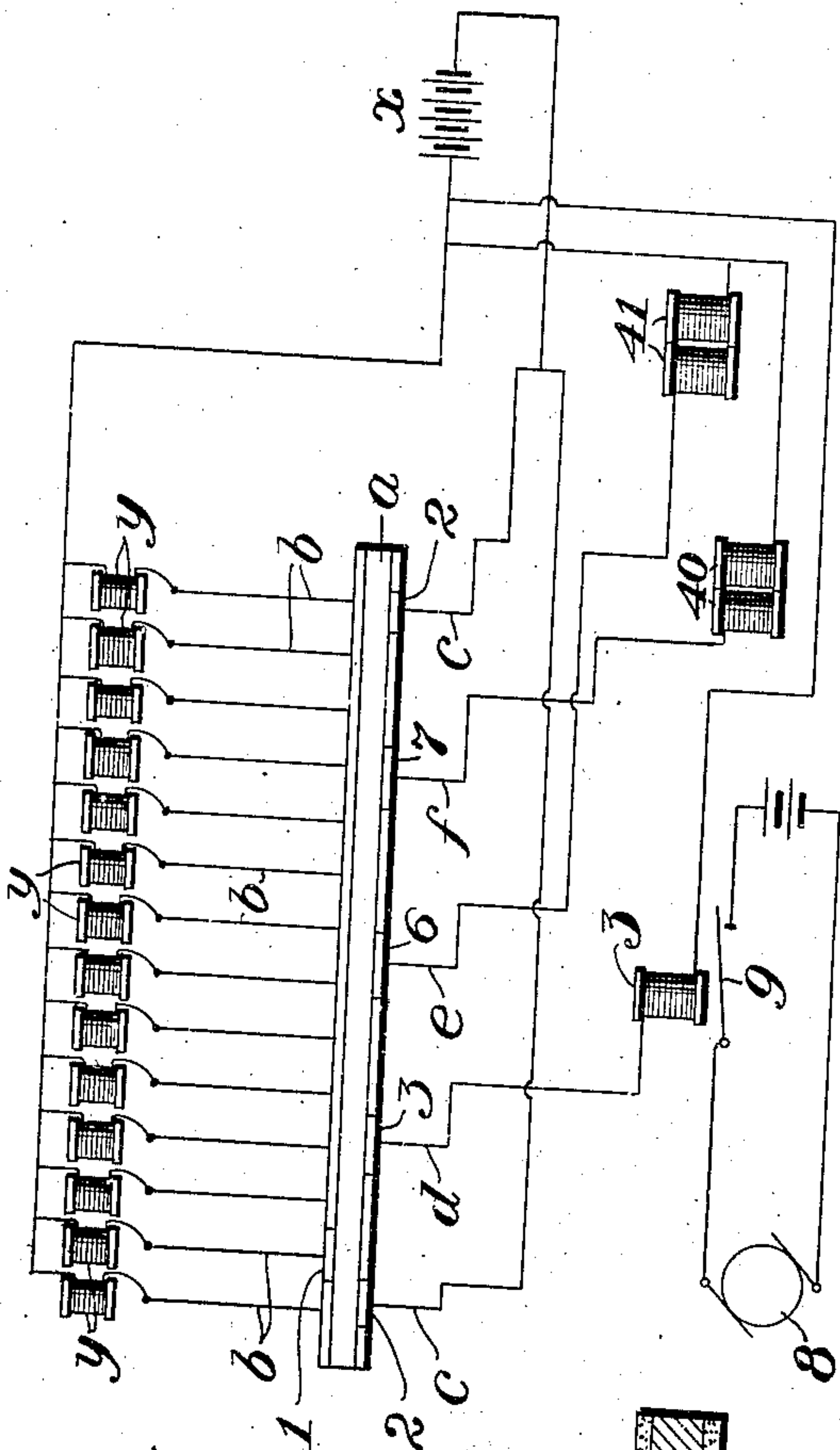


Fig. 5

Fig. 6

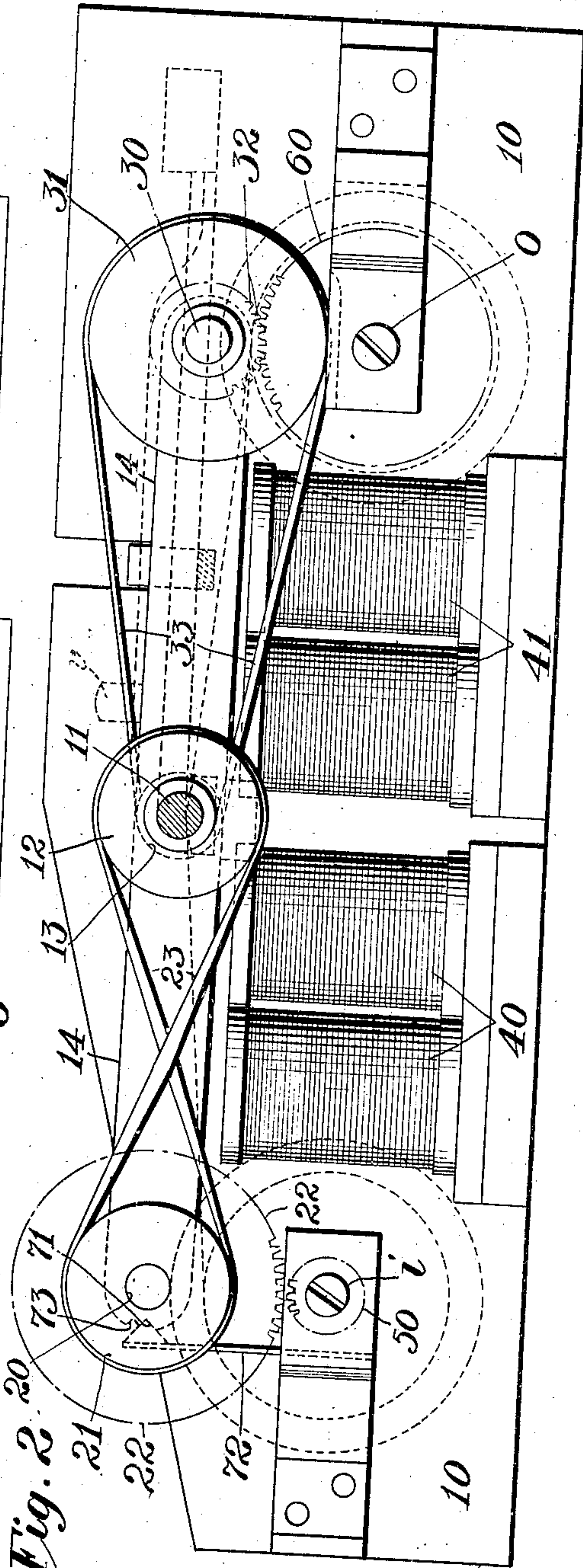
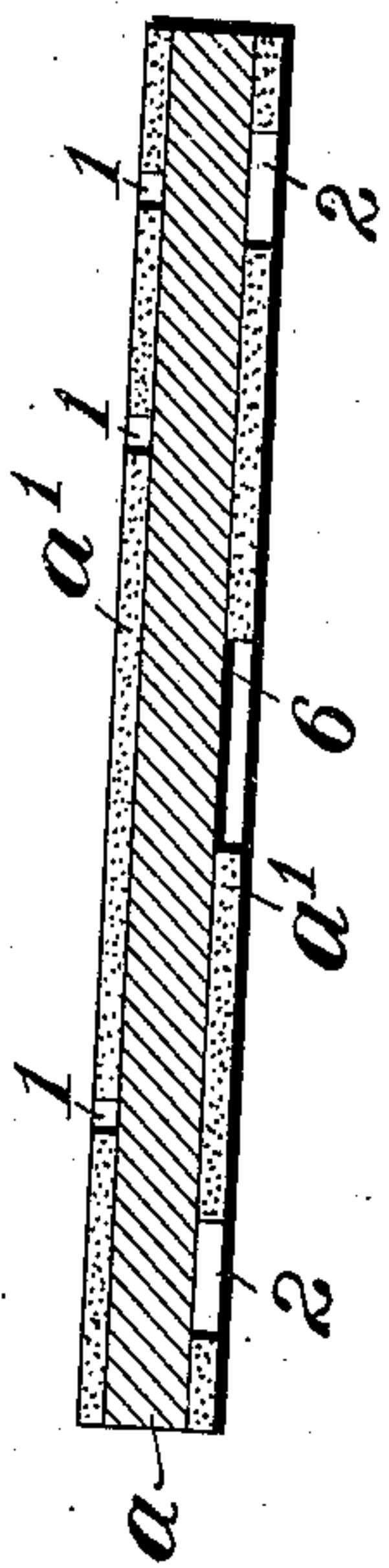


Fig. 2

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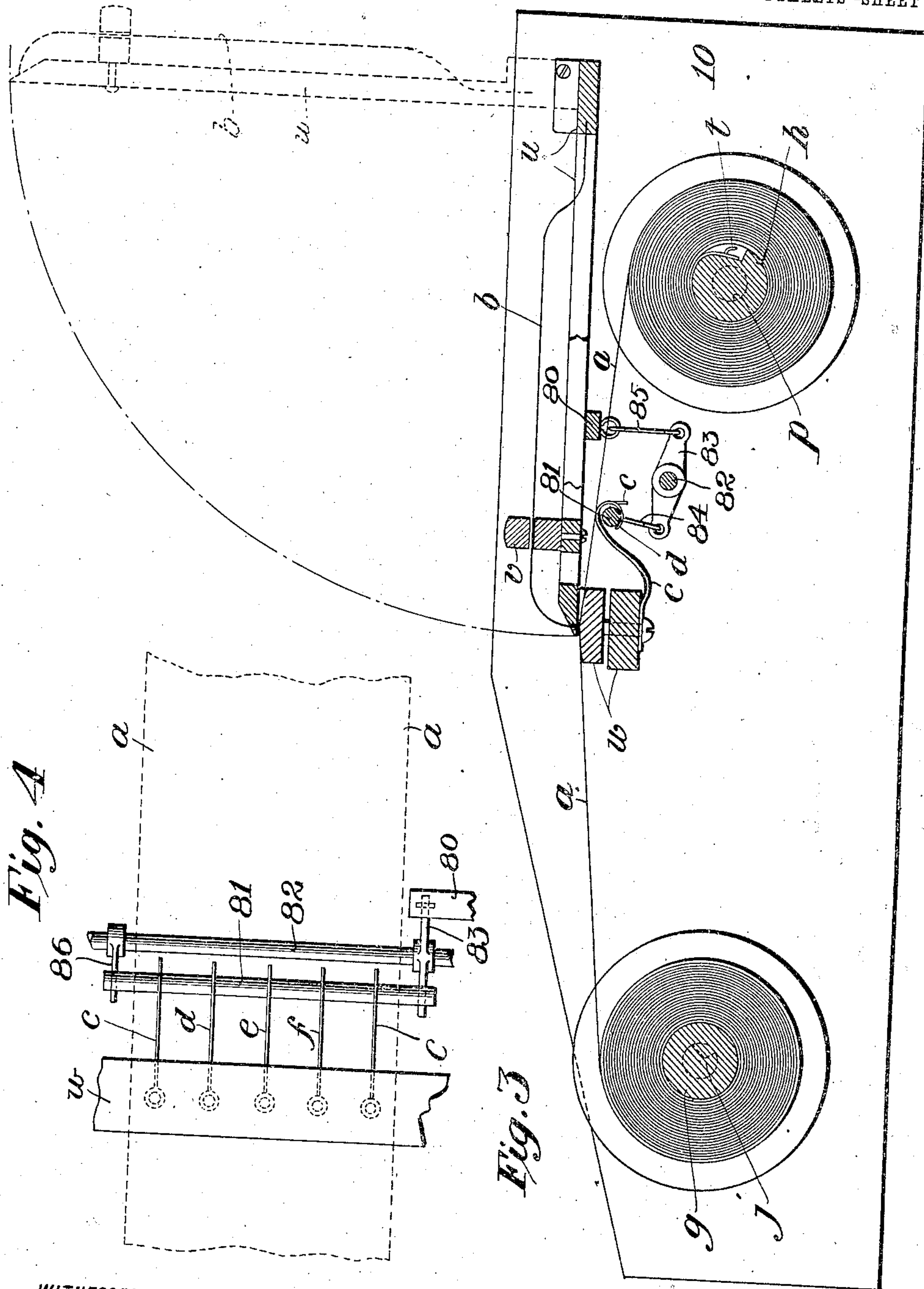
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4 SHEETS—SHEET 3.



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4 SHEETS—SHEET 4.

Fig. 7

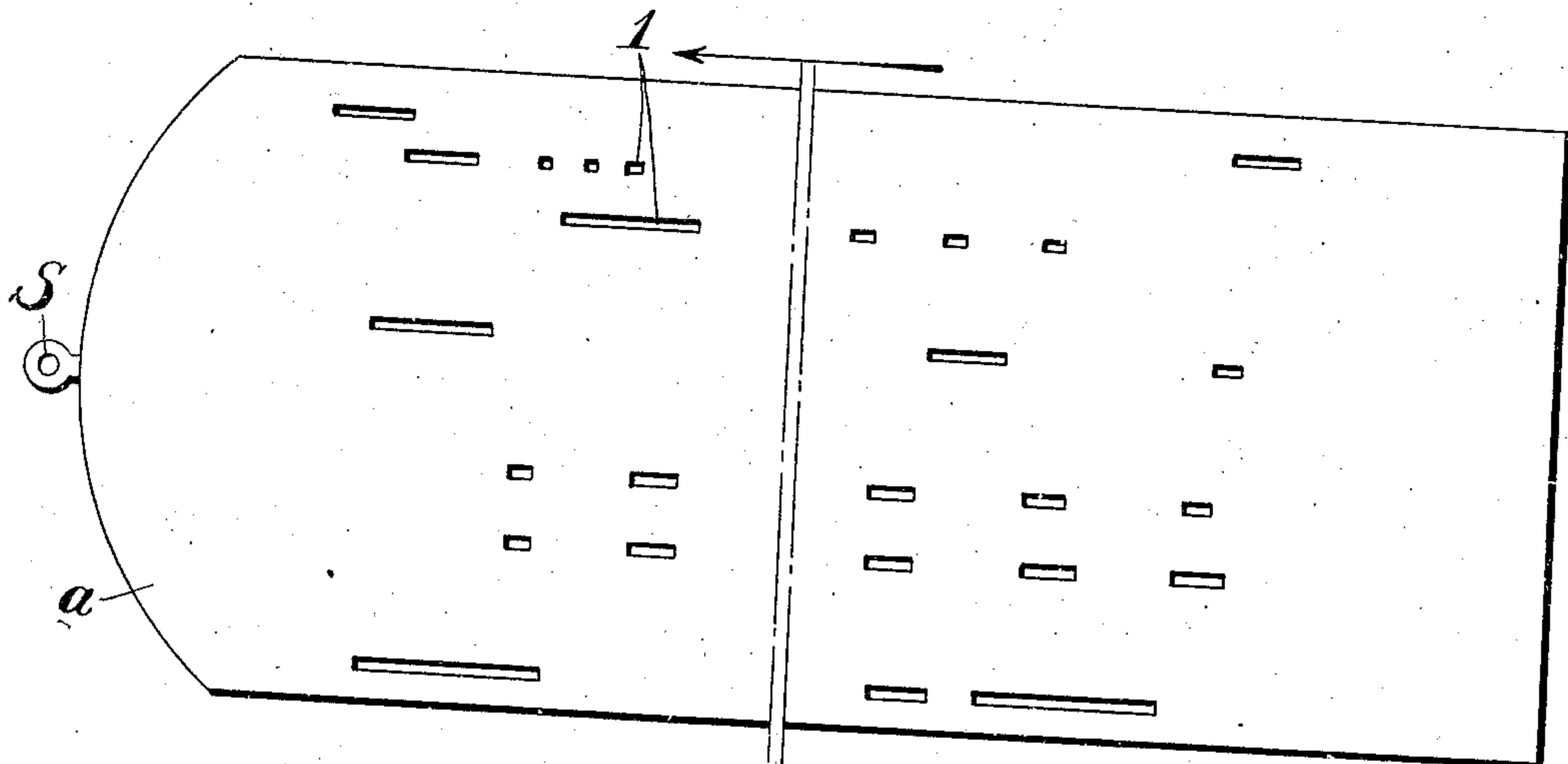
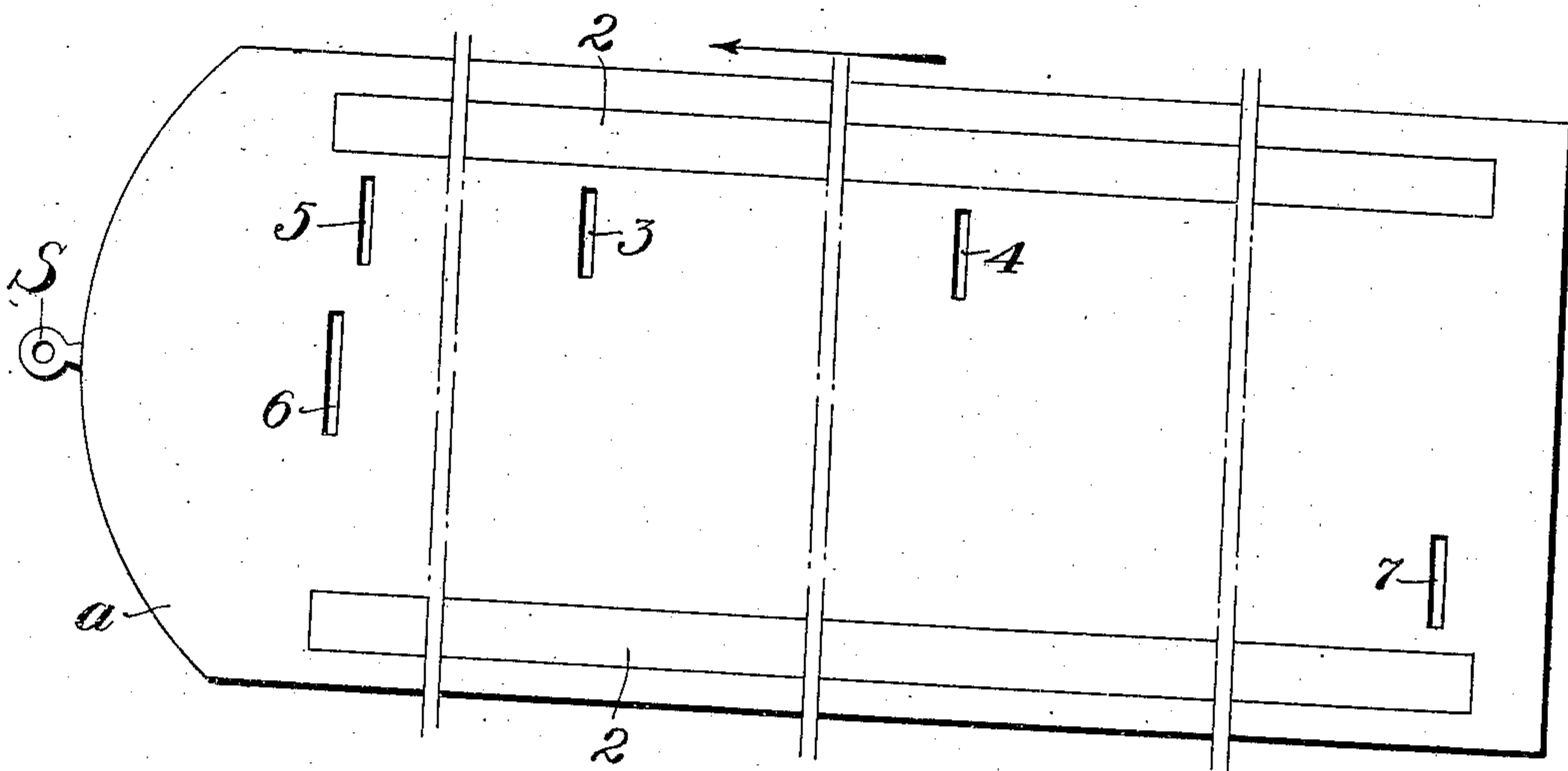


Fig. 8



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UNITED STATES PATENT OFFICE.

CHARLES A. SHAFFER, OF PHILADELPHIA, PENNSYLVANIA.

SELF-PLAYING MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 773,598, dated November 1, 1904.

Original application filed July 21, 1903, Serial No. 166,450. Divided and this application filed December 9, 1903. Serial No. 184,394. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. SHAFFER, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Self-Playing Musical Instruments, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to self-playing musical instruments.

The objects of the invention are to removably support the sheet or roll of music and to feed the sheet forwardly and backwardly and automatically reverse and stop it.

The invention consists in certain holding, feeding, stopping, and reversing devices adapted to cooperate with the music-sheet and the fingers engaging therewith to feed, stop, and reverse, constructed and arranged as hereinafter described and claimed.

In the drawings, Figure 1 is a plan view of the instrument. Fig. 2 is a section on the line 2 2 of Fig. 1. Fig. 3 is a section on the line 3 3 of Fig. 1. Fig. 4 is a plan view of the fingers engaging the under side of the note-sheet. Fig. 5 is a diagrammatic view showing the electrical connections. Fig. 6 is an enlarged transverse sectional view of the note-sheet. Figs. 7 and 8 are respectively top and bottom plan views of the note-sheet.

a is the music or note sheet. The same consists of a body of metal, such as copper, having an insulated surface a' on both sides. This insulated surface may be formed by coating the metal with a liquid non-conducting solution which hardens on setting or cooling, for which purpose a tough or brittle gum or varnish may be employed. I have found that a solution of commercial French varnish and alcohol is excellently adapted to the purpose. The insulated surface may also be formed by treating the metal body with an acid, causing the surface of the metal to corrode and rendering it non-conducting. The insulated surface may also be formed by attaching a sheet of insulating material to the metal body. The insulating-surface on one

side is scraped or cut off, as shown in Figs. 6 and 8, to form the notes, these cut-away portions 1 corresponding to the perforations of an ordinary music-sheet. On the other side the insulating-surface is cut away to form one or more long continuous strips 2 2, a series of short cut-away portions 3 4 5, a cut-away portion 6 at one end of the strip, and a cut-away portion 7 at the other end of the strip, all of which are adapted to be engaged by suitable fingers and to control the stopping and rewinding of the music-sheet, as well as the operation of the keys or strings of the musical instrument, as will be fully described.

10 is the frame of the machine.

g is the removable music-sheet-holding spool or roll, and h the music-sheet receiving or take-up spool or roll. The roll g , on which the sheet is wound when off the machine, is removably held in place by the following means: i is a shaft turning in a bearing on one side of the machine-frame. j is a stud longitudinally slidable in a bearing in the opposite side of the machine-frame and normally pressed inwardly by means of a spring k . The shaft and stud each has a conical head adapted to engage a conical depression in the end and on the line of the axis of the holding-roll g . It will be understood that the roll g may be readily and quickly inserted by seating one end of the roll on the end of shaft i and then moving it into substantially its operative position, the stud j first yielding outwardly and then springing inwardly into its seat at the other end of the roll, thus centering the roll, as well as securely holding it in position. The shaft i is driven by mechanism to be described, and its motion of rotation is imparted to the roll g by means of a projection m on the shaft engaging an orifice or slot n in the roll.

The take-up roll h is held in place at the other end of the machine in the same way that the holding-roll g is held in place, o representing the driven shaft, p the stud, and q and r , respectively, the projection and orifice for imparting the rotation of shaft o to the roll. As the holding-roll need not be removable, I prefer to provide the stud with a

screw-thread and screw the stud through a screw-threaded orifice in the frame instead of having it, like stud *j*, work loosely in and out. When the holding-roll is placed in position, the music-sheet thereon is partially unwound by hand and the ring *s*, on the front end thereof, slipped over the hook *t* on the take-up roll. The shaft *o* is engaged with its driving mechanism and the shaft *i* disengaged from its driving mechanism (hereinafter fully described) and the music-sheet wound upon the take-up roll *h* and unwound from the holding-roll *g*.

I will now describe the contact-fingers that engage the cut-away portions of the music-sheet hereinbefore described and the functions performed by each set of perforations and the fingers corresponding thereto.

Pivotally secured to the rear end of the machine is a finger-frame *u*, carrying the note-fingers *b*, there being one finger to each key or string of the instrument to be operated. This frame may be uplifted on its pivot when access to the take-up roll is desired, as when securing the end of the music-sheet thereto. The cut-away portions 1 are of course arranged like the perforations of an ordinary music-sheet, so that when any particular note is to be struck a cut-away portion on the sheet is arranged in line with the particular finger controlling the particular key or string adapted when struck to produce that note. Each finger *b* is secured to the frame *u* near the latter's pivot and extends forwardly through an orifice in the bracket *v*, thence extending forwardly and downwardly through an orifice near the extreme free end of the finger-frame. The fingers *b* are light and elastic and tend to press downwardly against the moving music-sheet, so as to make certain contact with the cut-away portions. Beneath the ends of the fingers *b* the music-sheet passes over the smooth curved top of a cross-piece *w*, thus preventing any vertical oscillation of the sheet at the point where it is engaged by the fingers *b*.

c c are fingers secured to the cross-piece *w* and extending upwardly and contacting with the long cut-away strips 22. The fingers *c* are electrically connected with a battery *x*. The fingers *b* are electrically connected with magnets *y*, there being one magnet for each finger. The battery is electrically connected with each magnet. When any finger *b* engages one of the cut-away portions 1, the battery-circuit is closed, the current passing from the battery to fingers *c*, thence through the metal body of the music-sheet, finger *b*, corresponding magnet *y*, and back to the battery. When any magnet is excited, it attracts its armature, which is connected with one of the keys or strings of the instrument. The particular mechanism connecting the magnets and the musical instrument to be operated is not shown, as it forms no part of my invention. *d* is a finger secured to the cross-piece *w*

and extending upwardly and contacting with the music-sheet and in line of travel of the cut-away portions 3, 4, and 5. These cut-away portions are provided in case the sheet is cut away to form notes for two or more tunes, and one of these cut-away portions is placed at the end of the notes of each tune. In the drawings I have shown a sheet partially broken away, that is supposed to contain the notes of three tunes, and three cut-away portions 3, 4, and 5 are therefore provided. The object of these cut-away portions is to stop the machine at the end of each tune. To this end I provide in the circuit of the motor 8 a cut-out switch 9, forming the armature of a magnet *z*, one pole of the magnet being connected with the battery *x* and the other pole with the finger *d*. When the finger *d* contacts with either of the cut-away portions 3, 4, and 5, the circuit is closed, the current passing from the battery *x* to fingers *c*, to strip 2, through the metal body of the music-sheet to cut-away portion 3, 4, or 5, to finger *d*, to magnet *z*, and thence back to the battery *x*, thereby exciting the magnet *z* and opening the cut-out switch 9, thereby stopping the motor 8 and the machine. This feature is especially applicable to slot-machines in which the motor-circuit is automatically opened at the end of each tune. The machine is started by again closing the switch 9 by hand or by any well-known automatic mechanism such as is employed in slot-machines.

e f are fingers secured to the cross-piece *w* and extending upwardly and contacting with the music-sheet and in line of travel of the cut-away portions 6 and 7, respectively, the function and operation of which is hereinafter described.

The mechanism for operating the rolls *g* and *h* is as follows: 11 is the shaft of motor 8. 12 and 13 are pulleys on the motor-shaft. 14 is a tilting frame pivoted on the motor-shaft. 20 is a shaft journaled near one end of frame 14, said shaft carrying the pulley 21 and gear 22. 30 is a shaft journaled near the other end of frame 14, said shaft carrying the pulley 31 and gear 32. The pulley 21 is connected through a belt 23 with the pulley 12, and the pulley 31 is connected through a belt 33 with the pulley 13, thereby constantly revolving the gears 22 and 32. 40 and 41 are two double magnets, one double magnet being in one circuit and the other double magnet in another circuit, as hereinafter described. The tilting frame 14 acts as the armature of these magnets, and dependent upon which pair of magnets is energized one or the other end of the tilting frame 14 is drawn down and the opposite end drawn up. In the drawings the end of the tilting frame carrying the shaft 30 is drawn down, thus holding the gear 32 in engagement with the gear 60 on the shaft *o*. When the opposite end of the tilting frame is drawn down, the gear 32 is moved out of en-

gagement with the gear 60 and the gear 22 is moved into engagement with the gear 50 on the shaft *i*. It will be understood that by controlling the circuit to the magnets 40 and 41 either the holding-roll *g* or the take-up roll *h* may be actuated. To this end finger *e* is electrically connected with double magnet 40 and finger *f* with double magnet 41. When the music-sheet is nearly entirely unwound from the holding-roll *g* and the fingers *b* have passed over the last of the notes on the upper surface of the music-sheet, the finger *f* contacts with the cut-away portion 7, and the following circuit is established: from the battery to fingers *c*, cut-away strips 2 2, through the conducting-body of the music-sheet to cut-away portion 7, finger *f*, magnet 40, and to the battery, thereby moving down the end of the tilting frame, carrying the shaft 20, moving gear 32 out of engagement with the gear 60 and moving gear 22 into engagement with the gear 50 on the shaft *i*, thereby imparting rotation to the holding-roll *g* and rewinding the music-sheet thereon. The rewinding continues until the music-sheet is nearly entirely unwound from the take-up roll *h*, whereupon the finger *e* contacts with the cut-away portion 6, and the following circuit is established: from the battery to fingers *c*, cut-away strips 2 2, through the conducting-body of the music-sheet to cut-away portion 6, finger *e*, to magnet 41, and to the battery, thereby moving down the end of the tilting frame, carrying the shaft 30, moving gear 22 out of engagement with the gear 50 and moving gear 32 into engagement with the gear 60 on the shaft *o*, thereby again imparting rotation to the take-up roll *h*. The music-sheet now again feeds forward a short distance until finger *d* contacts with the cut-away portion 5, thereby causing the motor-circuit cut-out switch 9 to be opened and the machine to stop, as before described.

It will be observed that the sizes of pulleys 12, 13, 21, and 31 and gears 22, 32, 50, and 60 are so proportioned that the rewinding operation is a comparatively very rapid one.

In order to insure maintaining the tilting frame 14 in either of its two positions, I have formed on one end thereof two notches 71 and 73, one or the other of which is adapted to be engaged by the cam-head of a spring 72, secured to the frame of the machine.

As the frame 14 is tilting to place the holding-roll into driven engagement an arm 80, secured to the frame 14, engages the finger-frame *u* and raises it so as to raise the fingers *b* out of engagement with the music-sheet and hold them out of contact with the music-sheet until the latter is rewound. At the same time the finger *d* is depressed out of engagement with the music-sheet by the following means: The end of the finger is curved to form a hook through which extends a bar 81. 82 is a shaft pivoted in the side members of the frame. 83

is a lever secured between its ends to the shaft 82 and connected by means of links 84 and 85 with one end of the bar 81 and the arm 80, respectively. 86 is a connection from the shaft 82 to the other end of the bar 81. As the arm 80 rises through the mechanism just described the flexible end of finger *d* is drawn down out of contact with the music-sheet.

I do not herein lay claim to the music-sheet *per se* nor to the arrangements of fingers, electric devices, and electric circuits described, the latter forming the subject-matter of a separate application, Serial No. 166,450, filed July 21, 1903, of which this application is a division, and the former forming the subject-matter of a second divisional application, Serial No. 184,395, filed December 19, 1903. It will therefore be understood that so far as concerns the invention claimed herein the construction of the music-sheet and the particular arrangement of electric devices and circuits may be substantially changed without departing from the invention claimed herein.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. The combination, with a music-sheet, means for feeding the same forwardly and backwardly, mechanism for reversing the direction of travel of said sheet, a pivoted frame, fingers sustained thereon normally in engagement with the sheet, a tilting frame comprising a part of the reversing mechanism, and an arm connected with said tilting frame and adapted, in the operation of the latter, to raise said finger-frame, thereby raising said fingers out of engagement with said sheet.

2. The combination, with a holding-roll and a take-up roll, of a music-sheet, adapted to be wound from one roll to the other, said music-sheet containing cut-away portions forming notes and an additional cut-away portion at each end, fingers adapted to respectively engage said cut-away portions, a tilting frame, holding-roll-driving means at one end of the frame, and take-up-roll-driving means at the other end of the frame, one or the other of said driving means being in driving relation to its respective roll dependent upon the direction in which the frame is tilted, magnets in respective proximity to the ends of the frame, an electric circuit including one of said fingers and one of said magnets, and an electric circuit including the other finger and magnet.

3. The combination, with a holding-roll and a take-up roll, of a music-sheet adapted to be wound from one roll to the other, a gear adapted to drive the holding-roll, a gear adapted to drive the take-up roll, a motor and its shaft, a tilting frame pivoted between its ends on the motor-shaft, two pulleys on the motor-shaft, a pulley near each end of the tilting frame, one of the tilting-frame pulleys being in driving engagement with one of the mo-

tor-shaft pulleys, and the other tilting-frame pulley being in driving engagement with the other motor-shaft pulley, a gear on the shaft of each tilting-frame pulley, one of the tilting-frame gears engaging the holding-roll gear when the frame is tilted in one direction and the other tilting-frame gear engaging the take-up-roll gear when the frame is tilted in the other direction, and means for tilting the frame.

4. The combination, with a take-up roll and a holding-roll, each provided with a depression at each end on the line of its axis, two driven shafts, one having a head adapted to seat in the depression at one end of the take-up roll and the other having a head adapted to seat in the depression at the correspond-

ing end of the holding-roll, a stud having a head adapted to seat in the depression at the other end of the take-up roll, said stud being adjustable in the direction of its axis, a spring-pressed stud movable in the direction of its axis and having a head adapted to be yieldingly seated in the depression at the other end of the holding-roll, a driving-shaft, and means to bring the driven shafts alternately into engagement with the driving-shaft.

In testimony of which invention I have hereunto set my hand at Philadelphia on this 5th day of December, 1903.

CHARLES A. SHAFFER.

Witnesses:

M. F. ELLIS,

M. M. HAMILTON.