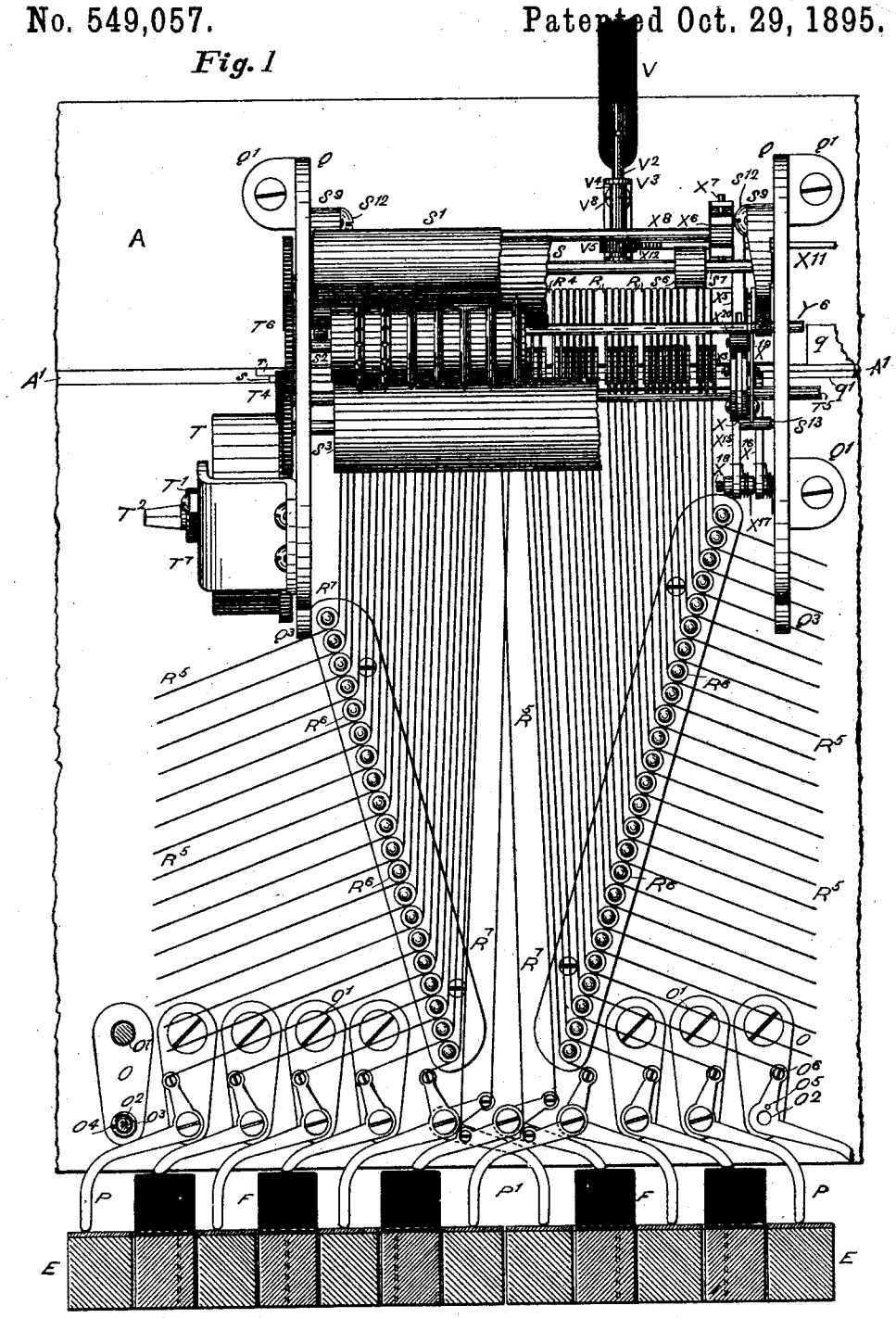
(No Model.) 4 Sheets—Sheet 1.

# J. L. CANTELO.

## MUSIC RECORDER FOR PIANOFORTES.

No. 549,057. Patented Oct. 29, 1895.

*Fig. 1*

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C. B. Bull.

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## MUSIC RECORDER FOR PIANOFORTES.

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*Fig. 2.*

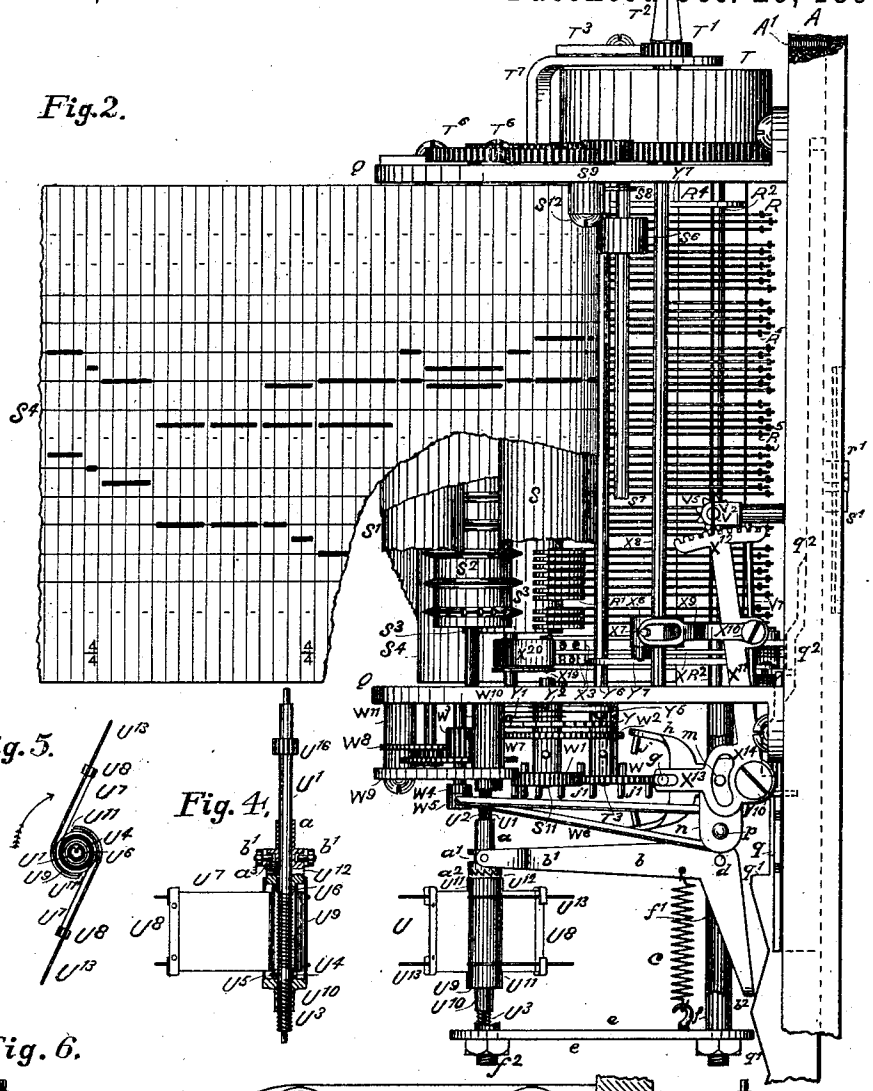


*Fig. 5.*

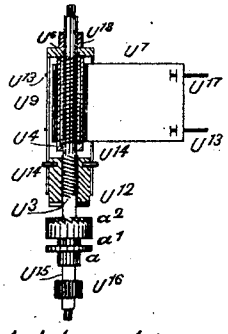


*Fig. 4.*





*Fig. 6.*



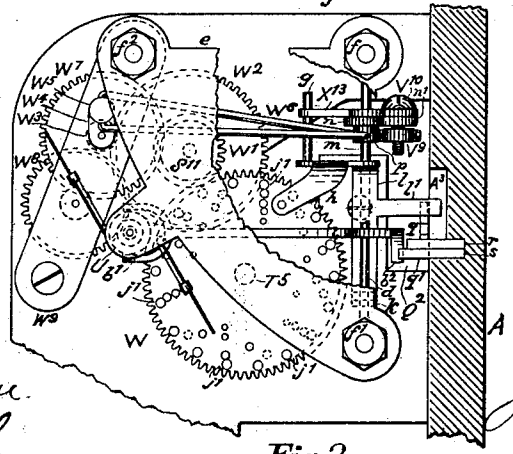


*Fig. 3.*

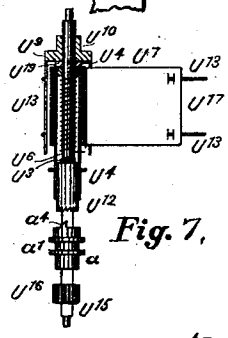


*Fig. 7.*

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## MUSIC RECORDER FOR PIANOFORTES.

No. 549,057. Patented Oct. 29, 1895.

*Fig. 8.*

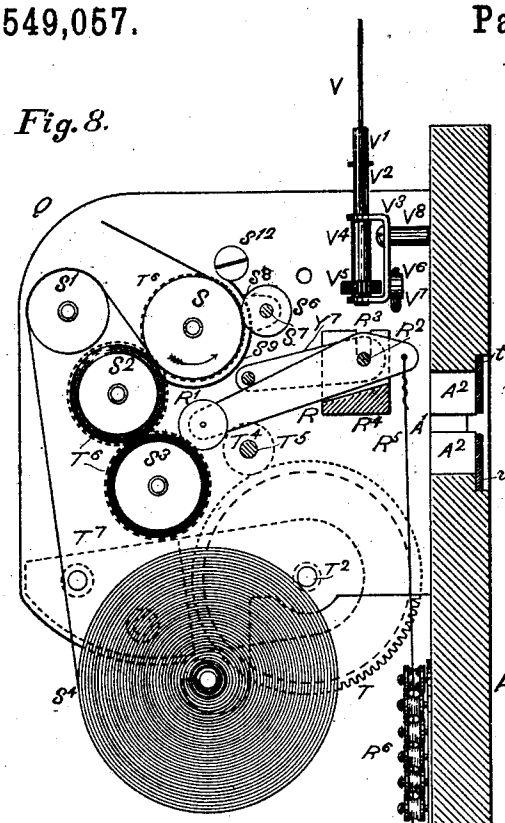


*Fig. 11.*

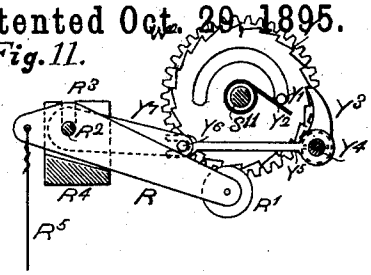


*Fig. 10.*

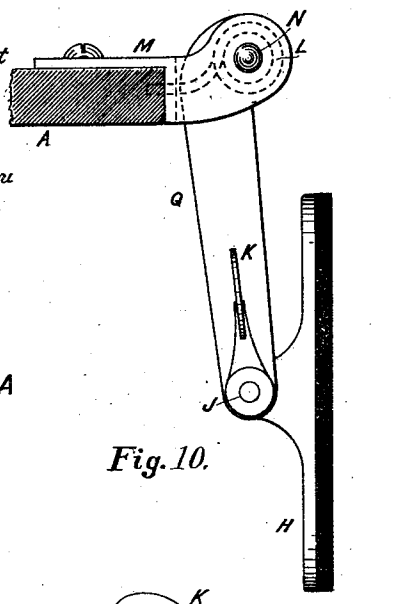
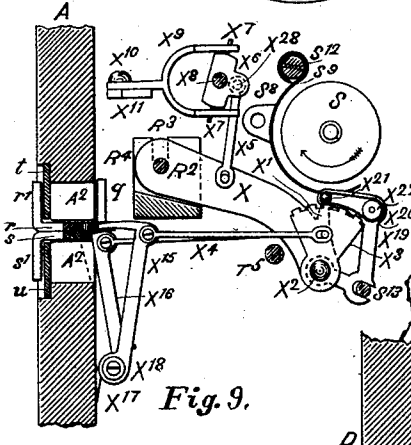
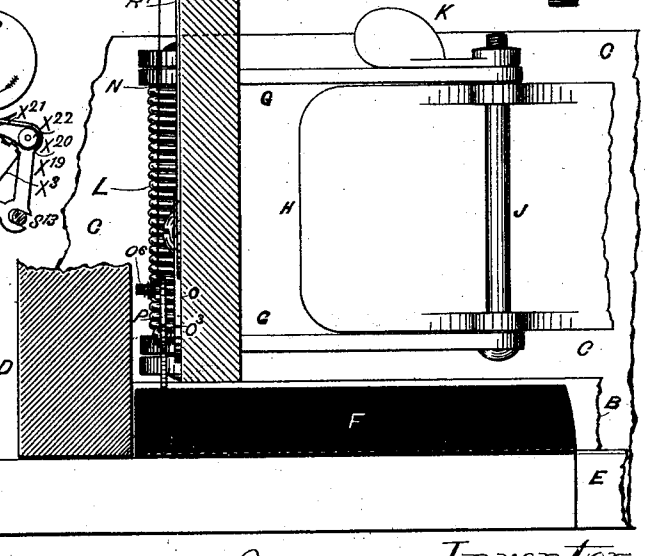


*Fig. 9.*





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# J. L. CANTELO.

## MUSIC RECORDER FOR PIANOFORTES.

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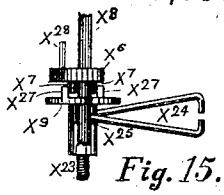


Fig. 15.

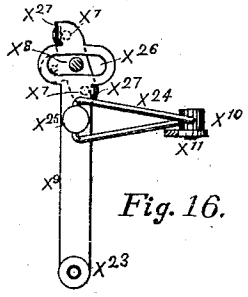


Fig. 16.

Fig. 17.

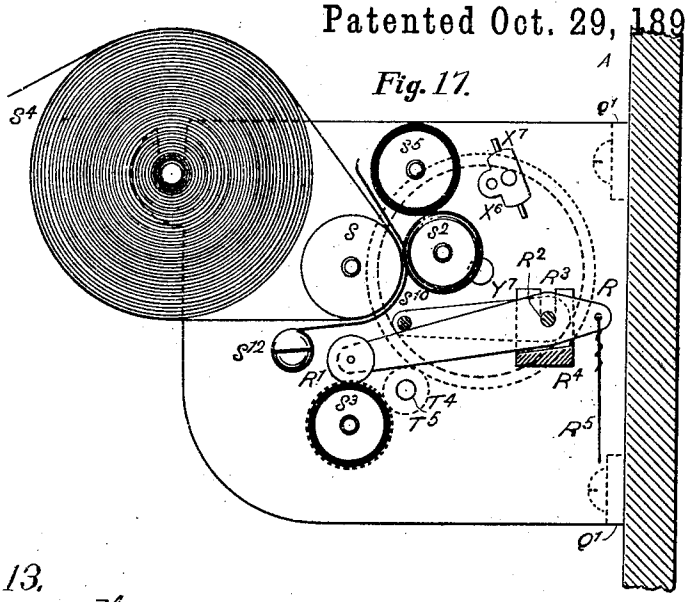


Fig. 13.

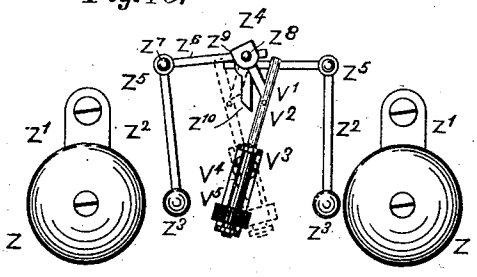


Fig. 14.

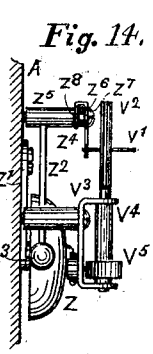
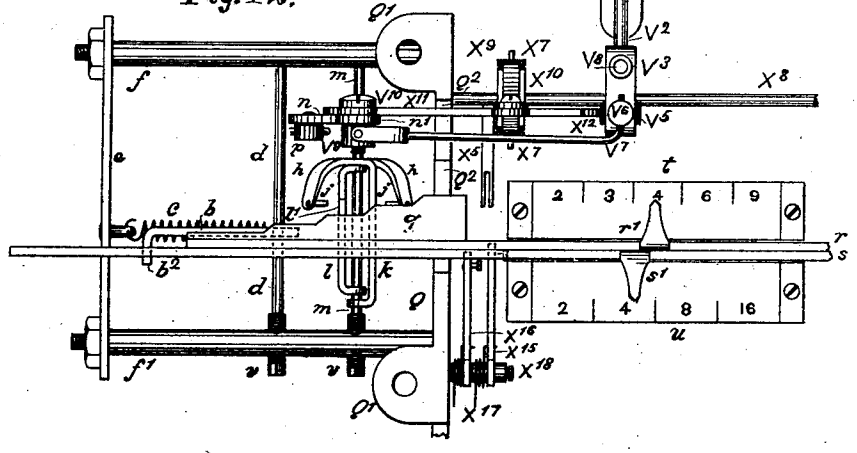


Fig. 12.



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by Dodge & Sons
Attys.

# UNITED STATES PATENT OFFICE.

JOHN LOUIS CANTELO, OF LIVERPOOL, ENGLAND.

## MUSIC-RECORDER FOR PIANOFORTES.

SPECIFICATION forming part of Letters Patent No. 549,057, dated October 29, 1895.

Application filed January 11, 1895. Serial No. 534,545. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN LOUIS CANTELO, a subject of the Queen of Great Britain, residing at Liverpool, in the county of Lancaster, in the Kingdom of England, have invented certain new and useful Improvements in Music-Recorders for Pianofortes or other Similarly-Keyed Musical Instruments, of which the following is a specification.

The object of my invention is to improve and render more generally useful and effective that class of recording attachments for pianofortes or other musical instruments having keyboards of similar form which enable a player to register the score of a musical composition on a running band of paper in such manner that it may be readily transcribed afterward into the ordinary musical notation.

In the accompanying drawings, Figure 1 is an elevation of the recording apparatus, looking from the back of the piano-keys, the paper-roll and motor-train being removed and other parts broken away. Fig. 2 is a plan view of same with the paper-roll, motor-train, and flying governor in place. Fig. 3 is a side view of the motor-train. Figs. 4 and 5 show the construction of the governor; Figs. 6 and 7, somewhat modified arrangements of same. Fig. 8 is a vertical section of the frame-board of the apparatus, showing also the manner in which it is attached to the piano and the means employed to impress note-marks upon the paper band. Fig. 9 is a side view of the means by which the time-fractions are impressed at the end of each measure. Fig. 10 is a plan view of a spring-arm, of which two pairs are used to attach the frame-board to the piano. Fig. 11 shows the ratchet and detent which stop and start the train. Fig. 12 is a front view, with the frame-board removed, of the sliding indices, with the time beating, regulating, and impressing parts to which they are related. Figs. 13 and 14 show a method of striking the time-beats audibly. Figs. 15 and 16 show an alternative method of transmitting movement to the time-printing lever at the end of a measure. Fig. 17 shows a variation which may be sometimes desirable in the relative positions of the paper-roll and the rollers connected with the feeding, marking, and ruling of the paper band.

In carrying out my invention I provide support for the mechanism by a frame-board A, which may be of wood, papier-maché, or other suitable material, its suitability consisting in its possession of the requisite strength, combined with the qualities of lightness in weight, durability, and freedom from any considerable tendency to warp under the influence of change in the temperature or moisture of the air. When in position, this board stands with the ends of its lower edge resting on the key-blocks of the piano, one of which is shown and marked B in Fig. 8. The board is placed as near the backs of the keys as possible and is held in its edgewise position with sufficient firmness by arms G G, Figs. 8 and 10, which, with their connected parts, are practically in duplicate at each end of the board. The arms G G are rigidly connected by a rod N, upon which is coiled a spring L, having one of its ends turned into a hole in an angle-plate M, as shown by the dotted lines in Fig. 10, and its other end secured in any suitable convenient manner to the rod N or to one of the arms G G. Through the free ends of the arms G G passes a bolt J, which has a thumb-lever K screwed upon its threaded end.

H is a sole-piece having perforated lugs projecting from its back, by which it is pivoted on the bolt J, between the arms G G. The face of the sole-piece bears a pad, as shown in Fig. 10, to prevent abrasion of and increase its adhesion to the piano-cheek, against which it normally rests.

In placing the frame-board with its attached mechanism upon the musical instrument the spring-arms G G are turned toward the front and middle of the board on their pivots in the lugs projecting from the angle-plates M, as shown in Figs. 8 and 10, against the pull of their helical springs L, by passing the fingers under and pulling upon the rods J at each end. The board is placed in position on the keyboard with the contact-levers, hereinafter to be described, resting upon their corresponding keys E and F. Each pair of spring-arms G G is then allowed to carry its attached sole-piece flatly against the cheek C at the corresponding end of the piano, and the thumb-lever K, being turned at each end, secures the sole-pieces by clamping them between the com-

pressible arms G G in each case. As long as the angles of the sole-pieces H relative to the corresponding pair of arms G G remain unaltered the frame-board will remain correctly in position on the keyboard of the piano. It will be seen that this arrangement allows of the same recording-instrument being used upon pianos of which the keyboards differ in length within certain limits. When the frame-board is removed, the spring-arms G G fold behind it, the sole-pieces H resting flatly against its back, provision of course being made to prevent their coming in contact with any of the mechanism secured thereto. Other suitable means of clamping the frame-board in the aforesaid position may, however, be adopted.

Upon the back of the frame-board are secured hangers O O by means of binding-screws O′ O′, Figs. 1 and 8, and these hangers bear at their lower ends fulcrum-screws $O^2$ $O^2$, upon which turn flat contact-levers P P. These levers P P are given a tendency to turn downward toward the keys E E F F by means of springs similar to $O^3$, bent round the fulcrum-screws $O^2$ $O^2$ and secured to the lever by turning up one end of the spring to form a short projection $O^4$, which enters a perforation $O^5$ in the contact-lever.

The other end of the spring is secured to the hanger O in a similar manner. When two contact-levers turn in opposite directions upon a single fulcrum-screw, a spring is secured in a similar way between them. This is the case at P′ in Fig. 1, where it will be observed also that hangers are dispensed with and the fulcrum-screws enter the frame-board itself. By deflecting the hangers the positions of the contact-levers may be adjusted to suit variations in width of keyboard which may arise from any difference in the key-width used by various makers. Those variations which occur in the positions of the black keys with respect to the white ones are also provided for by this arrangement.

There are fulcrumed upon the back of the frame-board A as many of the contact-levers P P as there are keys E E F F of which the action is to be recorded; but it has not been thought necessary in the drawings herewith to show more than one octave, as all the others are exactly similar in form and action.

In a suitable part of or projection from each contact-lever P is secured a wrest-pin $O^6$ in such manner by riveting or otherwise that it turns stiffly when a screwdriver or suitably-formed key is applied to its free end.

Brackets Q Q are secured to the upper part of the frame-board A by screws which pass through lugs Q′ Q′. These brackets Q Q carry a comb $R^4$, having leaf-like teeth, between which pass thin marking-levers R, pivoted on a rod $R^2$, lying in a series of notches $R^3$, cut downward into the leaves of the comb. Openings are made in the brackets Q Q, so that the rod $R^2$ may be wholly or partially withdrawn endwise from the comb $R^4$ to allow of a lever pivoted therein being removed without disturbing the rest. Said comb may be formed in any convenient manner either by building it up from separate pieces or by cutting a series of kerfs in a solid bar. It is fastened to the brackets Q Q by screws, the head of one being shown in dotted lines beneath the slide *l* in Fig. 3.

To the shorter arm of each marking-lever R is attached a cord or flexible wire $R^5$, which is carried down and secured to the wrest-pin $O^6$ in a corresponding lever P. The marking-levers are made in two sets having the holes for attachment of the cords $R^5$ at different distances from the pivot $R^2$. Said levers are arranged in the comb $R^4$ alternately from each set, as shown in Fig. 2, in order that neighboring cords may clear each other near the points of attachment. As in nearly all cases it is necessary to change the direction of the cord or wire at some point in its course, this is done by passing it partially round a grooved pulley $R^6$, as is shown in Figs. 1 and 8, the former figure also showing that the pulleys $R^6$ are arranged closely together as far as possible in order that the edge of one may prevent the wire or cord which passes round its neighbor from slipping out of its proper groove. The pulleys are preferably mounted, as shown in Fig. 1, on pins fixed in strips of metal $R^7$, which are afterward screwed to the frame-board A. The longer arm of each marking-lever R carries a pin on one side, which forms a pivot for a marking-disk R′. Said marking-disks rest normally upon an inking-roller $S^3$, pivoted between the brackets Q Q. The brackets Q Q also carry a roll of paper $S^4$ to be used in making the record, which roll is supported on hooks $Q^3$, Fig. 1, but shown more clearly in dotted lines, Fig. 8, a ruling-roller $S^2$, which makes contact with the paper $S^4$ and prints thereon the continuous staff and dotted leger lines shown in Fig. 2, being inked by the roller $S^3$, an impression-roller S, partially round which the paper $S^4$ is carried, and a roller S′, intended to keep the paper from contact with the rollers $S^2$ and $S^3$ on its way to the impression-roller.

In Figs. 1, 2, 8, and 9, $S^9$ are marginal guides, each held in place by a screw $S^{12}$, which guides assist in starting the paper band correctly on its way round the impression-roller. From the outer edges of the guides $S^9$ are turned back lugs $S^8$, in which is pivoted a rod $S^7$, bearing rollers $S^6$, intended to clip the paper in contact with the impression-roller S, thus securing its continuous movement therewith. The object of pivoting the rollers $S^6$ in this manner is that their pressure on the impression-roller may be adjustable and elastic.

On the outer side of one of the brackets Q is mounted a spring-drum T, which may be wound by the squared end $T^2$, projecting through and supported by a bracket $T^7$, Figs. 1 and 2.

T′ is the usual ratchet, and $T^3$ the detent pertaining thereto, which is kept in place by

a spring or by a counterpoise, as shown. The motion of the spring-drum is transmitted by a pinion $T^4$ and rod $T^5$ to a train of wheels mounted on the outside of the other bracket, as shown in Figs. 2 and 3. Of this train the wheel W gives motion to the pinion W′, mounted on the impression-roller journal, which thus obtains rotary movement and transmits the same to the rollers $S^2$ and $S^3$ by means of toothed wheels $T^6$ at the other end. The outer pivots of the train-wheels $W^7$ and $W^8$ are carried by a narrow plate $W^9$, which is held at one end upon a hollow post $W^{10}$ by a shoulder formed on a post $f^2$ and at the other end on a hollow post $W^{11}$ by a screw, both screw and post $f^2$ entering the bracket Q.

The speed of the train is controlled by a flying governor constructed as follows: The wheel $W^3$, which is the last of the train, gears with a pinion $U^{16}$, and thus rotates a spindle U′. In this spindle is formed a longitudinal groove $U^2$, and upon it a helical thread $U^3$, as shown in Figs. 2 and 4. $U^4$ is a hollow roller having a stud $U^5$, which enters the groove $U^2$, so that the roller $U^4$ can only have a sliding movement relative to the spindle U′. Within the roller $U^4$ and surrounding the spindle U′ is coiled a helical spring $U^6$. To opposite sides of the roller $U^4$ are attached the inner ends of ribbons $U^7$, which ribbons may be made, preferably, of metal foil; but a somewhat stiff thin woven fabric or tough paper will in most cases serve almost equally well, save in respect of durability. The roller $U^4$ is inclosed within a cylindrical case $U^9$, and the free ends of the ribbons $U^7$ pass out through corresponding slits $U^{11}$, formed in opposite sides thereof. Through the solid end $U^{10}$ of the case $U^9$ is cut a thread, which is a counterpart of that on the spindle at $U^3$. The other end of the case is closed by a disk $U^{12}$, which is perforated for the passage of the spindle U′ and has crown ratchet-teeth formed on its outer face, as shown. A pair of parallel ribbon-supporting wires $U^{13}$ is attached to each side of the case and project outward therefrom near the sides of the slits $U^{11}$ therein. Each pair of supporting-wires $U^{13}$ passes through guide-hooks formed on a clasp attached to the outer end of each ribbon, as at $U^8$, or through loops formed in the ribbon end itself, as shown at $U^{17}$ in Figs. 6 and 7. Upon the spindle U′ is placed a sliding sleeve *a*, having teeth formed upon the end $a^2$ opposed to the ratchet-disk $U^{12}$. This sleeve *a* is kept from turning on the spindle U′ by a stud $a^3$, which enters the groove $U^2$; but its lateral position thereon may be altered by movement of a lever *b*, of which the forked end *b*′ engages the annular groove *a*′, as shown in Figs. 2 and 4. The helical spring $U^6$ is attached at one end to the hollow roller $U^4$, within which it lies, and at its other end to the ratchet-disk $U^{12}$, its tendency being to turn the case $U^9$, with the attached parts, in the direction toward which the fly normally turns when set in motion. (Shown in Fig. 5 by the curved arrow.) This rotary movement winds the ribbons one on the other round the hollow roller $U^4$, while the case travels laterally along the spindle away from the sleeve *a* owing to the helical thread $U^3$. The ribbon-roller $U^4$ also moves with the case, being pushed along the spindle by the back of the ratchet-disk $U^{12}$.

It will be seen that the mouth of the central hollow in the roller $U^4$ is closed by and turns upon a shoulder formed at the back of the crown ratchet-disk $U^{12}$. Normally a portion of each ribbon end protrudes through the slits $U^{11}$ in the case $U^9$, and when the train is set in motion the resistance of the air against these ends $U^7$ is sufficient to overcome the tension of the spring $U^6$, and the case $U^9$ consequently rotates upon the spindle, carrying the ratchet-disk $U^{12}$ spirally forward until its teeth meet and interlock with the similar ones opposed to it on the sleeve *a*. The rotary movement of the case $U^9$ relative to the spindle U′ is now arrested, and the ribbons, which have been more and more unwound, as a consequence thereof cannot be further protruded without altering the position of the sleeve *a* by moving the lever *b*. The protruding ribbon ends form the vanes of the fly, and as their spread is clearly governed by the position of the lever *b*, that lever is used, as will presently be shown, to regulate the speed of the motor-train. Upon stoppage of the motor-train the spring rewinds the ribbons within the case $U^9$. As the fly-vanes make their minimum speed at the beginning of motion, the motor-train is enabled the more quickly to overcome the inertia of the moving parts and ride to the maximum speed allowed by the regulating-lever *b*. More than two ribbons may be used in constructing the fly, if desired.

In Fig. 6 is shown a variation from the construction just described. Here the ribbon-case $U^9$ turns upon but has no lateral movement relative to the spindle U′, it being limited in this respect by the collar $U^{18}$ and the ribbon-roller $U^4$, which are both fixed upon the spindle. The spring $U^6$ is fastened at one end either to the roller, within which it lies, or to the spindle itself, and its other end is connected with the case, to which it gives the same tendency to wind up the ribbons as in the other construction just described. The ratchet-disk now becomes a sleeve having a thread cut within it to fit the one on the spindle and also bearing pins or studs $U^{14}$, which project through the slits in case $U^9$, the latter being made somewhat longer than that before described. As thus arranged the case simply rotates under spring-tension or air-pressure, while the crown ratchet-sleeve $U^{12}$ alone has the spiral movement along the spindle U′ relative to the annularly-grooved sleeve *a*. This construction may be somewhat simplified, when the spindle U′ is of sufficient length, by placing the spring $U^6$ upon the spindle behind the case $U^9$, near the fixed collar $U^{18}$. In this arrangement the ribbon-roller may be

dispensed with and the vane-ribbons wound directly upon the spindle, a collar, such as $U^{19}$ in Fig. 7, being placed within the case to prevent lateral forward traverse.

In Fig. 7 is shown still another modification of the fly construction which may be adopted without departing from the nature of my invention. Here the case $U^9$ is fixed upon the spindle U′, while the ribbon-roller has a simple rotary movement relative thereto, its lateral traverse thereon being prevented by the fixed collar $U^{19}$ within its cavity. The crown-ratchet is connected with the roller $U^4$ in the manner already described with reference to the case $U^9$ in Fig. 6, while the spring $U^6$, fastened at one end to the collar $U^{19}$ and at the other to the roller $U^4$, always tends to wind the ribbon within the case; but instead of air-resistance it is in this construction the pull of centrifugal force upon the normally-protruded ends that unwinds the vane-ribbons when the train is set in motion. In order to prevent jamming when the ratchets interlock, the teeth upon the disk $U^{12}$ and sleeve *a*, or upon one of them, should be so formed that their backs are parallel with the spiral threads of the screw $U^3$. Instead of a complete set of ratchet-teeth being formed both upon the disk $U^{12}$ and sleeve *a* a single tooth upon one of them can be used, as shown at $a^4$ in Fig. 7.

The constructions shown in Figs. 6 and 7 require no longitudinal groove in the spindle U′ if that part of it marked $U^{15}$, upon which the sleeve *a* slides, be squared. The fly is pivoted at one end in the bracket Q and at its other and outer end in a plate *e*, Figs. 2 and 3, said plate being partially broken away in the latter figure to show the parts beyond. This plate *e* is supported by the posts *f*, *f*′, and $f^2$, which project from the train-bearing bracket Q. In the post *f* is pivoted the upper end of a rod *m*, of which the lower end is carried by a hollow formed in the tip of a screw—one of two marked *v v* in Fig. 12. Near the upper end of this rod *m* is rigidly fixed a lever *n*, having a loose stud *p*, one arm of which stud *p* is connected by a link $W^6$, made of wire, with another similar loose stud $W^5$ in the arm $W^4$, attached to the pivot of the wheel $W^7$ and pinion $W^8$, as shown in Figs. 2 and 3. In consequence of this connection the lever *n* is reciprocated as the arm $W^4$ rotates when the train is in motion. Another arm of the lever *n*, which is marked *n*′, carries a screw $V^{10}$, and upon the projecting part of this screw $V^{10}$, below the arm *n*′, is screwed loosely a collar $V^9$. In this collar is pivoted the forked end of a link $V^7$, Fig. 12, of which the other end is bent upward and screwed through a loose stud $V^6$ in a Y-shaped carrier $V^3$, swinging upon a screw $V^8$, fixed in the frame-board A.

The screwed collar $V^9$, turning on the screw $V^{10}$ in arm *n*′, is used as a convenient means of insuring that the link $V^7$ shall turn upon the same vertical axis as a lever $X^{11}$, presently to be described. This lever should be approximately in line with the axis of the stud $V^6$ in the carrier $V^3$. The body of the link $V^7$ is preferably screwed into the fork which forms one of its ends in order that any slight variation in its length that may seem desirable can be easily made. In the Y-shaped carrier $V^3$ is a vertical rod $V^2$, upon which is fixed a sleeve $V^4$, bearing a pinion $V^5$, Fig. 8, the object of the sleeve being to keep the rod $V^2$ in place. In the upper end of the rod $V^2$ the arm V is hinged on a pin V′, passing through them both. This arm V beats back and forth after the manner of a metronome-arm when the train of wheels is in motion, owing to the reciprocating movement of the lever *n* being transmitted through the link $V^7$ to the hanging carrier $V^3$. The arm V is made of light and thin material, so that its normal edgewise oscillation may meet with but slight resistance from the air. The purpose of the hinged connection of the arm V with the rod $V^2$ is to permit of the arm being turned down below the edge of the frame-board A when the recording apparatus is not in use or is being moved about. The friction between the arm V and the sides of the slot in which it turns is sufficient to keep it in line with the rod $V^2$ when turned up.

The pinion $V^5$ is engaged by a toothed segment $X^{12}$, Fig. 2, terminating the longer arm of a lever $X^{11}$, which lever is pivoted on the screw $V^{10}$ in arm *n*′ of the reciprocating lever *n*, and consequently moves bodily therewith.

The shorter arm of the lever $X^{11}$ is slotted at $X^{14}$ for the passage of the rod *m* and is notched at $X^{13}$ for a rod *g*, rising from an oscillating fork *h h*, which is integral with and projects from a slide K, mounted freely upon the rod *m*, bearing the reciprocating lever *n*, Figs. 3 and 12. Within the oscillating fork *h h* and between pins *j j*, projecting therefrom, rotates the edge of a wheel W, forming one of the motor-train. This wheel has several concentric rows of pins J′ projecting from its sides. Upon the rod *m* is mounted a slide *l*, as is shown most clearly in Fig. 12, which slide *l* supports the slide *k*, carrying the oscillating fork *h h*, being itself supported by a projection *l*′, resting on a slide *r*. Movement of this slide *r* is made to regulate the height of the oscillating fork *h h*, so that the pins *j j* may be brought opposite the path of any one of the rows of pins *j*′ *j*′ in the sides of wheel W. The pins *j*′ *j*′ in the wheel W are so spaced in each row that one may be brought opposite one of those in the fork *h h* at regular intervals, which intervals correspond for each row with a different fixed number of beats of the metronome-arm V. This result is secured by giving the arm $W^4$ a certain suitable rate of speed relative to the wheel W. In the present case the arm $W^4$ makes eighteen revolutions for every one of the wheel W, and as a consequence thereof the arm V makes thirty-six beats in the same time. This number thirty-six is a common

multiple of the intervals of two, three, four, six, and nine beats, respectively, provided in the machine shown in the accompanying drawings. This invention, however, is not limited to these five intervals, but the number may be either diminished or increased by a suitable alteration of the size and relative speed of the train-wheels, the rows of pins $j'$ $j'$ and adjustable positions of the fork $h$ $h$ being made to correspond therewith. The pins $j'$ $j'$ in those rows on wheel W which correspond with intervals having an odd number of beats should be arranged alternately on opposite sides. A shaft $X^8$, turning in the brackets Q Q, carries a segment $X^6$, from which project radially the pins $X^7$, Fig. 9. At $X^{10}$, in the longer arm of the lever $X^{11}$, is pivoted a Y-shaped link $X^9$, and of the ends which form its fork one has a closed slot for the passage of the upper pin $X^7$ and the other a similar slot left open at its outer end for the lower pin $X^7$. The upper slot is shown clearly in Fig. 2. The parts are usually in the position shown in Figs. 1. 2, 9, and 12, and as a consequence thereof if the toothed arm of lever $X^{11}$ be moved inward from the frame-board the segment $X^6$ and shaft $X^8$ are pushed round by the lower pin $X^7$, which rests at the inner end of the open slot, and if the toothed arm be moved outward toward the frame-board A the segment and shaft are pulled round by the upper pin $X^7$, resting at the outer end of the closed slot shown in Fig. 2.

The shaft $X^8$ is always rotated in the same direction to whichever side the toothed arm may swing from its normal central position. A link $X^5$ connects a pin $X^{28}$ in the side of the segment $X^6$ with a time-lever X, as is shown in Figs. 1, 9, and 12. This lever X is pivoted on the rod $R^2$, and its weight being transmitted to the lever $X^{11}$ through the Y-shaped link $X^9$ serves to return that lever to its central position after a sidewise oscillation. This sidewise movement will be presently referred to again and its cause shown.

Instead of linking the lever $X^{11}$ directly with the segment $X^6$, as already explained, the construction shown in Figs. 15 and 16 may be adopted without departing from the nature of my invention. In these figures the lever $X^{11}$ is connected with a loose stud in another lever $X^9$ by a wire link $X^{24}$, similar to the link $W^6$ joining the arm $W^4$ with the lever $n$. The wire is passed through stud $X^{25}$ and is then bent, as shown in Fig. 15, so that its ends may be sprung into holes made in opposite sides of the stud $X^{10}$. The lever $X^9$ has a sleeve or boss at its lower end, through which passes a screw $X^{23}$, serving to pivot it on the train-bearing bracket Q. The tappets $X^{27}$, bent up from the edges of the lever, replace the slots formed in the link $X^9$ already described, but have precisely the same function and effect in rotating the segment and shaft by the pins $X^7$, which in this case project sidewise instead of radially therefrom. The pin $X^{28}$ is to carry the link $X^5$, as in Figs. 9 and 12. The lever $X^9$ is slotted at $X^{26}$ for the passage of the shaft $X^8$. By looking at Fig. 9 it will be observed that the weight of lever X, acting through the link $X^5$ and pins $X^7$, has a tendency to throw the single end of link $X^9$ upward, thus deflecting the toothed arm of lever $X^{11}$ in the same direction. This deflection is only material in so far as it slightly increases the friction at the points of connection between levers $X^{11}$ and $n$. By adopting the construction shown in Figs. 15 and 16 this deflection is avoided, but a little is lost in simplicity. However, when it is desired to place the shaft $X^8$ so far above or below the level of lever $X^{11}$ that such a link as $X^9$ cannot be easily used the intermediate lever $X^{11}$ may replace the link $X^9$ with advantage. The link $X^{24}$ or link $X^9$, as the case may be, is of such length relative to the radius of arm $n'$ that no material sidewise deflection of the toothed segment $X^{12}$ occurs as a consequence of the endlong reciprocation of the lever $X^{11}$ as the ordinary time-beats are being made.

The free end of the time-lever X extends below the impression-roller S, as shown most clearly in Fig. 9, and carries on each side type-segments $X^3$, bearing type-figures, of which some are shown in Fig. 2. The type-segments are pivoted on a rivet $X^2$ and are connected, as shown in Fig. 9, by light link-bars $X^4$ with corresponding levers $X^{15}$ and $X^{16}$, which levers are pivoted on a screw $X^{18}$, projecting from the neighboring train-bearing bracket Q. Springs $X^{17}$ hold the upper ends of the levers in contact with the edges of two related slides (marked $r$ and $s$) lying in a groove A', formed in the middle part of the frame-board A. At $q^2$, Fig. 2, in dotted lines, are shown the stepped edges of these slides, which actuate the levers $X^{15}$ and $X^{16}$ to set the time-fractions. From the slide $r$ a tongue $r'$ is turned upward, and from the slide $s$ a similar tongue $s'$ is turned downward, as shown in Figs. 9 and 12. These tongues $r'$ and $s'$ form indices which show upon the corresponding scales $t$ and $u$ the lateral position of the slides. Notches $A^2$ $A^2$, Fig. 9, are cut through the frame-board A behind the scales $t$ and $u$ to allow of the slides $r$ and $s$ being inserted in the groove A' after the index-tongues $r'$ and $s'$ have been formed on them. The slides are first inserted in the groove and the scales afterward slipped behind the indices and fastened by the screws, as shown in Fig. 12.

The numerals upon each scale agree with the type-figures upon a related one of the type-segments $X^3$, and these figures represent in one case the denominators and in the other the numerators of the time-fractions commonly seen at the beginning of the staff in music. The slide $r$, which, acting upon the lever $X^{15}$, adjusts the numerator type-segment, carries the stepped edge $q$. Upon this edge is supported the tongue $l'$, forming part of the fork-adjusting slide $l$, which slide $l$ is kept from turning on the rod $m$ by the entry of its

tongue $l'$ into the vertical groove $A^3$ provided for that purpose in the frame-board A, Fig. 3. The steps on the edge $q$ are so regulated that when the tongue $l'$ rests on one of them the pins $j\,j$ in the fork $h\,h$ are brought opposite a corresponding row of pins $j'\,j'$ on the wheel W. The slide $s$, which, acting on the lever $X^{16}$, adjusts the denominator type-segment, also carries an edge $q'$, Figs. 2 and 3, having as many inclines thereon as there are numbers on the corresponding scale $u$. Against the edge $q'$ rests the end $b^2$ of the lever $b$, under impulse from a spring $c$, attached at one end to a hook fixed in the plate $e$, Figs. 2 and 12. The lever $b^5$ is carried by a rod $d$, turning in the post $f$ and screw $v$, being mounted similarly to the rod $m$. The spring $c$ may be replaced by a helical spring coiled on the rod $b$ if it be desired to make room for a greater spread of the governing-fly than that shown herein. Each of the inclines on the edge $q'$ is at such an angle that as the end $b^2$ rides along it the fork of the lever $b$ moves the stop-sleeve $a$ through a certain range, which may be the whole or only a part of its whole range of lateral movement on the spindle U'.

The inclines on $q'$ are opposed to each other in order to avoid having a considerable jump in passing from one to another. A ratchet-wheel Y is mounted loosely upon the journal $S^{11}$ of the impression-roller S; but its rotary movement relative thereto is limited by a pin Y', which is fixed in the wheel $W^2$ and projects through the curved slot shown in Fig. 11, the pin Y' forming both a back and front stop. Upon the boss of the ratchet-wheel is mounted a weak spring $Y^2$, of which the free tongue presses against the pin Y', and thus gives the ratchet Y a tendency to turn forward in the same direction as that in which the impression-roller usually rotates.

$Y^3$ is a detent so mounted on a screw $Y^4$ (shown in section in Fig. 11) as to engage the ratchet-teeth and connected by a notch in the end of a rigidly-attached arm $Y^5$ with a rod $Y^6$, as shown in Figs. 2 and 11. The rod $Y^6$ lies across the upper edges of the marking-levers R and forms with the ends $Y^7$ $Y^7$ a universal bail turning on the rod $R^2$.

Owing to the detent $Y^3$ engaging the ratchet-wheel Y the motor-train and connected parts are at rest until a key E or F is struck and is followed downward by a contact-lever P under the influence of spring $O^3$, bent round its fulcrum-screw $O^2$. This movement is transmitted along the cord or wire $R^5$ to the corresponding marking-lever R, which in carrying its attached marking-disk R' from the inking-roller $S^3$ against the paper $S^4$ on the impression-roller S raises the bail-rod $Y^6$ and detent-arm $Y^5$, thus removing the detent $Y^3$ from the teeth of ratchet-wheel Y.

When the depressed key E or F rises and the connected marking-lever R returns to its normal position, the detent $Y^3$ again enters the teeth of wheel Y; but as that wheel has been in the meantime thrown forward on the journal $S^{11}$ by the spring $Y^2$ the motion of the train is not at once arrested, but continues until the pin Y' arrives again at the forward end of the curved slot in the already-stopped ratchet-wheel Y. This interval between the return of a note E or F and the total stoppage of the motor-train and connected parts bridges any ordinary complete pause likely to occur in music and prevents waste of paper. Such pauses or the more common rests are indicated on the paper band by the appearance of a pronounced interval between the end of one and the beginning of the following note-mark.

Referring to the torn record in Fig. 2, the positions of the note-marks upon the staff approximate to those of the same notes as usually written, note-marks made by white keys appearing upon or midway between staff-line sand those resulting from movement of black keys immediately above or below staff-lines—that is to say, slightly above or below the note-marks made by white keys, of which they are the sharps or flats, as the case may be. This result is secured on a staff having lines uniformly far apart by arranging the marking-levers connected with white keys at equal distances apart in the comb $R^4$, even though the corresponding notes differ in pitch by a half-tone only, as in the case of E and F, B and C. This arrangement is apparent in Figs. 1 and 2. The duration of a note is indicated by the comparative length of the related line marked upon the paper band, and in order to facilitate comparison of one mark with another in respect of length when copying the record vertical lines are printed or ruled across the paper at equal intervals, as shown in Fig. 2, before the band is made into a roll. While music is being played the metronome-arm V beats at a rate dependent upon the speed at which the fly U has been set by movement of the denominator-slide $s$, and the figure in printing position on the connected type-segment $X^3$ will be that of the division on scale $u$, in which the indicator-point $s'$ rests. The number of beats to the measure is fixed by the position of the numerator-slide $r$, which acts upon the slide $l$ and oscillating fork $h\,h$, and also through the lever $X^{15}$ and link-bar $X^4$ sets the related type-segment so that the figure in printing position thereon agrees with the number of the division on scale $t$, in which the index-point $r'$ rests. When the metronome-arm V is finishing the last of the beats allotted to a measure, a pin $j'$ on the wheel W arrives in the path of one of the pins $j\,j$, carried by the oscillating fork $h\,h$, and arrests its movement, which movement results from the passage of the pin $g$ upward through the slotted arm $X^{13}$ of the toothed lever $X^{11}$. The slotted arm $X^{13}$ being thus also arrested, while motion still continues in the reciprocating lever $n$, the toothed arm of lever $X^{11}$ is necessarily swung to one side, which movement causes the toothed segment $X^{12}$, acting upon the pinion $V^5$, to give the metronome-arm V a

half-turn to indicate that a measure is complete.

When a pin $j$ is stopped by a pin $j'$, their ends should preferably remain in contact during a full half-turn and return of the arm V. This result can be secured by making the sizes of the pins $j'$ $j'$ proportional to their relative distances from the axis of wheel W. The said sidewise movement of the lever $X^{11}$ at the same time, through the Y-shaped link $X^9$, pulls or pushes the shaft $X^8$ round, thus causing the link $X^5$ and time-lever X to raise the type-segments so that the set time fraction is printed on the paper margin, as shown in Fig. 2, the mark dividing the two figures being made by the point X', forming part of the time-lever $x$. This time fraction on the paper margin thus shows the contents of a measure and also indicates the place of the dividing-bar.

The type-figures are inked in the following manner: A lever of the form shown at $X^{19}$ in Fig. 9 turns upon the pivot $X^2$ of the type-segments and has a notch $S^{13}$, through which passes in this case the pivot of the inking-roller $S^3$, but a pin fixed in the neighboring bracket Q may be employed instead. On one side of the lever $X^{19}$, at its upper end, are mounted a pin $X^{21}$ and a small inking-roller $X^{22}$, around which pin and roller passes an endless tape $X^{20}$. This tape conveys ink from the roller $X^{22}$ to the type in printing position, normally making contact therewith near the pin $X^{21}$; but when the time-lever rises at the end of a measure the arm $X^{19}$, turning upon the pivots $X^2$ and $S^{13}$, is thrown backward out of the path of the rising type-segments $X^3$. Friction between the face of the type and the endless tape tends to give the latter a slow movement round the pin and roller, so that a fresh inking-surface is being constantly presented to the type. In order to secure a clear impression of the time fraction on the margin of the paper band, the type-surface is allowed to move with the paper during the short time they are in contact.

The link $X^4$ is connected with the related segment $X^3$ by a pin in the latter, which passes through an elliptical slot in the former, thus making a somewhat loose connection between them, as is shown in Fig. 9. When the inking-arm $X^{19}$ is thrown outward, owing to upward movement of the time-arm X, the friction of the inking-tape $X^{20}$ tilts each type-segment until the fixed pin therein rests at the outer end of the elliptical slot through which it passes. Upon bringing the type against the paper band $S^4$ the segment $X^3$ is carried backward in contact therewith, the fixed connecting-pin moving toward the inner end of the elliptical slot in the link-bar $X^4$. The type-segments $X^3$ may be dispensed with and a mark made by the point X' of the lever X used to show the place of the bar alone, or a pair of levers may be used to make a mark on each margin, and in this case the denominator-segment may be attached to one and the numerator-segment to the other, so that a figure may be printed on each margin of the band $S^4$. The sections of scale $u$ may be divided, if desired, so that the motor-train may be at once set approximately at a predetermined rate of speed, so that the arm V may make a particular number of beats to each minute.

I preferably make the metronome-arm V with sides differing in color, as in Figs. 1 and 12, so as to show more distinctly the turn which marks the end of a measure. In Figs. 13 and 14 are shown the means employed to secure audible time-beats in conjunction with the beating-arm V or otherwise. In Fig. 13 is shown two bells Z Z, mounted at the ends of the hanging strips Z' Z', so that their positions may be adjustable relative to the corresponding hammers $Z^3$ $Z^3$ on the hanging arms $Z^2$ $Z^2$, united with the arms $Z^6$ $Z^6$ by the bosses or sleeves $Z^5$ $Z^5$, through which pivot-screws pass into the frame-board A. Through each arm $Z^6$ passes a pin or rivet on which turn the trips $Z^4$, bent up from sheet metal, as shown in Figs. 13 and 14. The pin V' in Fig. 13 projects on one side only and as the rod $V^2$ moves back and forth comes in contact with one of the trips, tilting it up on its pivot $Z^8$ in the arm $Z^6$ until the edge of the bend $Z^9$ strikes the edge of that arm.

As the rod $V^2$ continues its movement, the trip-point $Z^{10}$ rides across the pin V', carrying the arm $Z^6$ up, thus raising the bell-hammer $Z^3$. Near the end of sidewise movement in rod $V^2$ the trip slips over the pin V', allowing the hammer to fall and sound the bell. When the lever $X^{11}$ is deflected at the end of a measure and the rod $V^2$ is rotated by the toothed segment $X^{12}$, acting on the pinion $V^5$, the pin V' is carried round and acts in the manner just described upon the trip connected with the other hammer, causing that closing beat to be struck upon the fellow bell, which I make of a distinctive tone.

In Fig. 14 the pin V' is shown projecting on both sides of the rod $V^2$ and the beats are all made on a single bell. That end of the pin V' which turns to cause the closing beat should be slightly farther projected than the other, so as to be sure and catch the trip from its central position. The side to which the pin V' normally projects in the two-bell construction of Fig. 13 and the side on which the bell-trip is placed in the one-bell plan of Fig. 14 should be such that when the last beat of a measure is being produced, at the time of its contact with the hammer-trip, the movement due to the rotation and that due to the tilting of rod $V^2$ may both be carrying the effective part of pin V' in the same direction.

In Fig. 17 is shown a somewhat different arrangement in relative position of the paper-roll, ruling-roller, and impression-roller, by which the roller S' and the clipping-rollers $S^6$ may be dispensed with.

It will be observed that the ruling-roller is inked by a separate inking-roller $S^5$ and that

the disk-inking roller $S^3$ is rotated by a toothed wheel gearing with the pinion $T^4$ on shaft $T^5$, as shown in dotted lines. The paper after passing partially round the impression-roller S is allowed to rest on the paper-roll, being thus conveniently carried away. Paper-guides, such as $S^{10}$, take the place of the ones shown at $S^9$ in Figs. 1, 2, 8, and 9.

The height of the piano front D will to a great extent decide whether the arrangement of Fig. 8 or that of Fig. 17 is the better one in any particular case. If necessary, the recording mechanism may be put at one end of the frame-board instead of in the middle, and the height may be reduced, if so desired, by placing two or more of the pulleys $R^6$ on the same pivot-pin. The train-bearing bracket Q is cut away at $Q^2$, Figs. 3 and 12, for the passage of the slides, the forked link, the lever $X^{11}$, and the rod $Y^6$.

I declare that what I claim is—

1. In a music recorder, the combination with a vertical frame-board carrying the recording mechanism, of two pairs of spring arms pivotally connected to the frame-board, one pair at each end thereof, the free ends of each pair carrying a padded sole-piece between them adapted to bear against the cheeks of the musical instrument under the spring pressure of said arms, and to be clamped at a suitable angle relatively to said arms, substantially as and for the purpose set forth.

2. In a music recorder, a clamping device comprising a pair of arms G rigidly connected together at one end by a rod N turning in angle plates attached to the frame-board, a spring L coiled on said rod and tending to throw said arms outward, a padded sole-piece H carried between said arms by a bolt J passing through the free ends of the latter and through perforated lugs on said sole-piece, and a thumb-lever K screwed on the threaded end of said bolt, in combination, for the purpose set forth.

3. In a music recorder, the combination with a series of marking devices, and the keys; of a series of elbow levers pivoted above the keys in direct contact therewith and movable in a plane at right angles to said keys; and connections between the marking devices and the respective levers.

4. In a music recorder, a series of pivoted contact levers movable in a plane at right angles to the keys of the musical instrument, and adapted to follow the said keys downward under spring impulsion when the keys are depressed by the performer for the purpose set forth.

5. In a music recorder, a series of hangers secured to the frame by means of binding screws and capable of being deflected to and fixed at the desired angle, in combination with a series of contact levers turning on fulcrum screws attached to the lower ends of said hangers, said contact levers bearing against the keys of the musical instrument under spring pressure, substantially as and for the purpose set forth.

6. In a music recorder, a series of pivoted levers, each having an arm in contact with the keys of the musical instrument, a series of wrest-pins attached to said levers, and a series of cords or flexible wires each having one end secured to said wrest-pins and their other ends secured to a series of marking levers, in combination, for the purpose set forth.

7. In a music recorder, a series of pivoted levers each having an arm in contact with the keys of the musical instrument and adapted to follow the said keys downward under spring impulsion when the keys are depressed by the performer, a series of wrest-pins attached to said levers, and a series of cords or flexible wires secured to said wrest-pins and to a series of marking levers, in combination for the purpose set forth.

8. In a music recorder, a series of deflectable hangers secured to the frame, a series of contact levers turning on fulcrum screws attached to said hangers and bearing against and adapted to follow the movements of the keys of the musical instrument, a series of wrest-pins carried by said contact levers, cords or flexible wires secured to said wrest-pins and to a series of marking levers, and means for guiding said cords or wires, in combination, substantially as and for the purpose set forth.

9. In a music recorder, the combination with a series of cords or flexible wires connecting the contact levers with the marking levers, of a series of grooved pulleys guiding the said cords or wires, and arranged closely together with the object of preventing the cords or wires from slipping out of their proper grooves, substantially as set forth.

10. In a music recorder, a series of pivoted marking levers made in two sets, and having means for actuating them attached at a distance from their center of oscillation different in one set to that in the other set, said levers being arranged side by side alternately from each set, substantially as and for the purpose set forth.

11. In a music recorder, the combination with the comb $R^4$; of the rod $R^2$ lying in notches $R^3$ in said comb; marking levers R pivoted on said rod between the teeth of the comb; marking disks R′ carried by said levers; and means for actuating the levers.

12. In a music recorder, a fly having its vanes formed of two or more ribbons wound upon each other substantially as and for the purpose set forth.

13. In a music recorder, a fly having its vane or vanes formed of a ribbon or ribbons wound upon itself or upon each other and adapted to be spread or extended by the action of air resistance, substantially as and for the purpose set forth.

14. In a music recorder a fly having its vane or vanes formed of a ribbon or ribbons

wound upon itself or upon each other and adapted to be spread or extended by the pull of centrifugal force, substantially as and for the purpose set forth.

15. In a music recorder, a fly having its vane or vanes formed of a ribbon or ribbons wound upon itself or upon each other within a casing and having its end or ends protruding through a slit or slits in said casing and supported by projecting wires, substantially as and for the purpose set forth.

16. In a music recorder, a fly having its vane or vanes formed of a ribbon or ribbons wound within a casing by means of spring impulsion, substantially as and for the purpose set forth.

17. In a music recorder, a fly having its vane or vanes arranged at a minimum spread when motion begins, but adapted to increase such spread to the desired limit as the desired speed is attained, whereby the motor train is enabled to readily overcome the inertia of the moving parts and to more quickly rise to the desired speed, substantially as set forth.

18. In a music recorder, a fly comprising a spindle formed with a longitudinal groove, a hollow roller mounted on said spindle and having a stud engaging in said groove, said roller being free to move only longitudinally on said spindle, a cylindrical case mounted and turning on said spindle and inclosing said roller, and formed with longitudinal slits, one end of said case being provided with crown ratchet teeth, and having a thread cut within its other end adapted to engage with a helical thread formed on the corresponding end of the spindle, a helical spring within the roller and surrounding the spindle and tending to turn the case relatively to the roller in the same direction as that in which the fly normally rotates, ribbons attached to said roller and wound thereon and upon each other within the case under the impulse of said spring and having their ends protruding through the slits in said case, wires projecting from the case and supporting the ribbon ends, the latter being free to slide thereon, and a stop sleeve adjustable on the spindle and held against rotation thereon by a stud engaging in the groove in the latter, said sleeve having teeth opposed to and adapted to engage the teeth of the crown ratchet end of the case when the fly attains the desired speed, in combination substantially as and for the purpose set forth.

19. In a music recorder, the combination with a fly having its vane or vanes automatically extended or increased in spread when the fly rotates, of a stop sleeve adjustable on and rotating with the spindle of the fly and adapted to limit the spread of the vanes, a pivoted lever engaging with and adapted to adjust said stop sleeve longitudinally on the spindle, and means for operating said lever, substantially as and for the purpose set forth.

20. In a music recorder, the combination with a fly having its vane or vanes automatically extended or increased in spread when the fly rotates, of an annularly grooved stop sleeve $a$, a pivoted lever $b$, and a slide $s$ carrying a tongue as an index in front of a scale, said lever having one arm forked to engage with the groove of said sleeve, and its other arm bearing under spring impulsion against a stepped edge $q'$ formed on said slide, substantially as and for the purpose set forth.

21. In a music recorder, the combination with a motor train, of a metronome arm adapted to beat time under the impulse of said train, and means for automatically rotating said arm upon its own axis for the purpose of emphasizing certain time intervals, substantially as set forth.

22. In a music recorder, the combination with a motor train, of a metronome arm adapted to beat time under the impulse of said motor train, said arm having its sides differently colored, and means for rotating said arm upon its own axis substantially as and for the purpose set forth.

23. In a music recorder, the combination with a motor train, of a pivoted rod $m$ carrying a lever $n$ rigidly fixed thereto and receiving an oscillating movement from the motor train by means of a link pivotally attached to said lever and to a crank arm on a spindle of said train, an arm $n'$ on said lever carrying a screw, a collar loosely screwed on said screw, a link $V^7$ having one end forked and pivotally connected to said collar, and its other end pivotally connected to a carrier $V^3$ swinging upon a screw or pin fixed to the frame, and a vertical rod $V^2$ carried by the said carrier and bearing a metronome arm, substantially as and for the purpose set forth.

24. In a music recorder, the combination with a motor train, of a carrier swinging upon a screw or pin fixed to the frame, means for oscillating said carrier from the motor train, a vertical rod carried by said carrier and oscillating therewith, and a metronome arm of light and thin material hinged to said rod, substantially as and for the purpose set forth.

25. In a music recorder, a motor train having a wheel W provided with several concentric rows of pins $j'$ projecting from its sides, a pivoted rod $m$ carrying a lever $n$ rigidly fixed thereto, means for imparting an oscillating movement from the motor train to said rod and lever, a carrier $V^3$ swinging upon a screw or pin fixed to the frame and oscillated synchronously with the lever $n$ by means of a link connection between said carrier and an arm $n'$ of said lever $n$, a metronome arm supported on a vertical rod $V^2$ carried by the said carrier, said rod being free to turn on its own axis therein, a pinion $V^5$ fixed on said vertical rod, a lever $X^{11}$ pivotally connected with the arm $n'$ of the lever $n$ and having its free end formed as a toothed segment $X^{12}$ adapted to engage the pinion $V^5$, a shorter arm on the lever $X^{11}$ slotted to clear the rod $m$ when in motion and having a notch $X^{13}$ at its outer end, a slide $k$ mounted freely upon the rod $m$,

an oscillating fork $h$ integral with and projecting from the said slide, said fork being adapted to receive within it the edge of the wheel W and bearing pins $j\,j$ adapted to engage the pins $j'$ of the said wheel W, a rod $g$ fixed to and rising from said oscillating fork and engaging in the notch $X^{13}$ formed in the shorter arm of the lever $X^{11}$, a slide $l$ mounted on the rod $m$ but held against rotation thereon and supporting the slide $k$, and a slide $r$ supported in the frame and having a stepped edge $q$ on which bears a projection $l'$ formed on the slide $l$, the said slide $r$ carrying a tongue as an index in front of a scale; in combination, substantially as and for the purpose set forth.

26. In a music recorder, the combination with a motor train, means for governing and adjusting the speed of said train, a metronome arm oscillated by the motor train, a lever $X^{11}$ having a toothed segment engaging with a pinion on the metronome rod, means for oscillating said lever at predetermined intervals so as to turn the metronome arm on its own axis, and means for adjusting the length of said intervals; of a shaft $X^8$ turning in suitable supports and carrying a segment $X^6$ having pins $X^7$ projecting radially therefrom, a Y-shaped link $X^9$ pivoted to the lever $X^{11}$ and having the ends which form its fork provided the one with a closed and the other with an open slot adapted to receive the said pins $X^7$, a pivoted time lever X, a link $X^5$ pivotally connected at one end to the segment $X^6$ and having its other end engaging a pin on the time lever, a pair of type segments $X^3$ pivotally connected to said time lever, means for inking said type segments, slides $r$ and $s$, supported in the frame, levers $X^{15}$ and $X^{16}$ pivoted on a suitable support and having their free ends bearing under spring impulsion against stepped edges $q^2$ formed on the slides $r$ and $s$, and light link bars $X^4$ pivoted at one end to the levers $X^{15}$ and $X^{16}$ and having their other ends formed with elliptical slots in which engage pins fixed to the type segments, substantially as and for the purpose set forth.

27. In a music recorder, the combination with a motor train, mechanism for governing the speed of said train, a metronome arm oscillated by the motor train, mechanism for emphasizing certain time beats of the metronome arm, and mechanism for printing the time fractions; of two slides $r$ and $s$ supported in the frame board and having stepped edges $q\,q'\,q^2$ adapted to adjust the speed governing mechanism of the motor train the emphasizing mechanism of the metronome arm and the mechanism for printing the time fractions, and having tongues standing as indices in front of fixed scales indicating respectively the numerators and the denominators of the time fractions, substantially as set forth.

28. In a music recorder, the combination with a motor train, an impression roller rotated thereby, a series of marking levers pivoted to a rod $R^2$, and means for operating said marking levers; of a ratchet wheel Y mounted loosely on the journal of the impression roller and free to move backward and forward between stops relatively to the wheel $W^2$ of the motor train, said ratchet having a tendency under spring impulsion to turn forward in the same direction as that in which the impression roller usually rotates, a detent $Y^3$ engaging said ratchet, and an arm $Y^5$ rigidly connected to said detent and having its free end notched to engage with a bail rod $Y^6$ lying across the upper edges of the marking levers, the rod $Y^6$ being carried by arms $Y^7$ at its ends turning on the rod $R^2$, substantially as and for the purpose set forth.

29. In a music recorder, the combination with a pair of type segments and means for operating them, of a lever $X^{19}$ turning on the pivot $X^2$ of the type segments and having a notch $S^{13}$ engaging with a suitably fixed pivot said lever carrying at its upper end a pin $X^{21}$ and a small inking roller $X^{22}$ and an endless tape $X^{20}$ passing round said pin and roller, substantially as and for the purpose set forth.

30. In a music recorder, the combination with the metronome; of a device for marking time-fractions; and intermediate connections, whereby the time-fraction to be printed is varied to correspond to the beat of the metronome.

31. In a music recorder, the combination with a metronome, and a device for printing time-fractions; of connections between said device and the metronome; a motor; and means for adjusting the motor to vary the beat of the metronome and the time to be printed.

32. In a music recorder, the combination with a series of marking devices operated by the white keys; of a series of marking devices operated by the black keys; one set or series of marking devices being spaced differently from those of the other set, whereby the notes represented by the two sets of keys may be determined without the use of a special staff.

33. In a music recorder, the combination with a bell adapted to beat time audibly, a bell having a distinctive tone adapted to be sounded to emphasize certain beats, of means for printing note-marks, substantially as set forth.

34. In a music recorder, the combination with a motor train, a rod $V^2$ oscillated by said train and means for turning the said rod on its own axis at predetermined intervals; of the two bells Z having distinctive tones and mounted on deflectable hangers suitably supported, hanging arms $Z^2$ pivoted to the frame and carrying hammers $Z^3$ adapted to strike the said bells, arms $Z^6$ rigidly attached to the hanging arms near their pivots, trips $Z^4$ pivoted on the free ends of the arms $Z^6$ and a pin V′ carried by the oscillating rod $V^2$ and adapted to engage with one of said trips in order to sound one of the bells as the said rod oscillates, and to engage with the other of

said trips when the rod turns on its own axis, in order to sound the other bell, substantially as and for the purpose set forth.

35. A music recorder comprising a vertical frame-board adapted to stand edgewise on the keyblocks of a pianoforte or similarly keyed musical instrument, means for clamping same in such position, a series of pivoted marking levers, means for actuating said marking levers when the keys of the musical instrument are depressed, a motor train, means for governing and adjusting the speed of said train, means for automatically beating time visibly and audibly under the impulse of said motor train, a roll of paper adapted to receive printed impressions, means for feeding guiding and ruling said paper, an impression roller, an inking roller, means for controlling and adjusting the duration of the time measures and the number of beats to a measure, and means for indicating the time fractions and for printing said fractions on the paper band, in combination substantially as hereinbefore described and illustrated in the accompanying drawings.

36. A music recorder having its marking levers arranged in groups,—said groups being divided by intervals which correspond to those points on the keyboard where two white keys are not separated by a black,—whereby said levers when actuated shall print on a paper band having an ordinary staff the white-key note-marks in the center of the spaces or directly on the lines of the staff, and the black-key note-marks appreciably above or below their respective staff lines, thereby avoiding the use of a special staff with unequally spaced lines.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN LOUIS CANTELO.

Witnesses:
JOSEPH J. ROYDEN,
H. P. SHOOBRIDGE.