J. J. WALKER.

AUTOMATIC PLAYER FOR MUSICAL INSTRUMENTS.

APPLICATION FILED AUG. 24, 1906.

**911,789.**

Patented Feb. 9, 1909.

3 SHEETS—SHEET 1.

*Fig.1.*

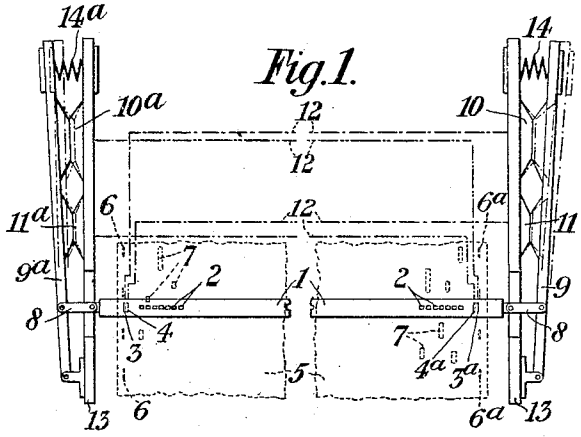



*Fig.2.*

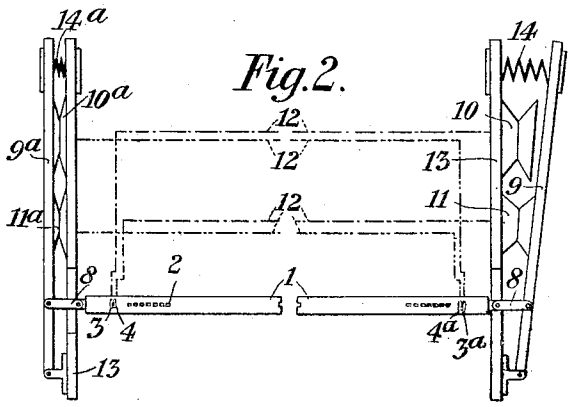
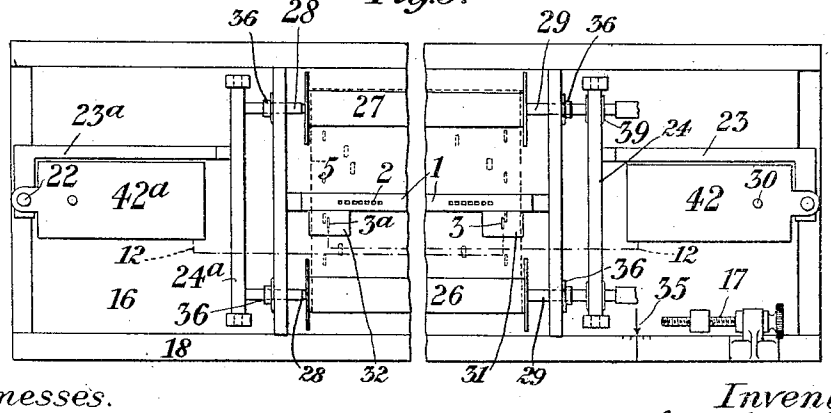



*Fig.5.*




Witnesses.

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3 SHEETS—SHEET 2.

Fig. 3.

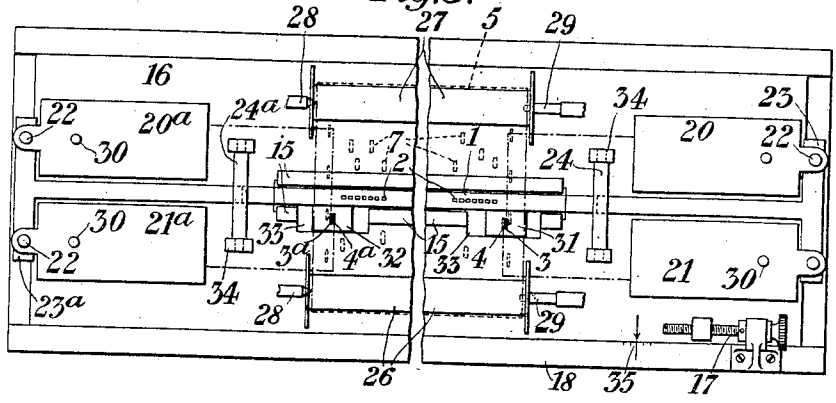



Fig. 4.

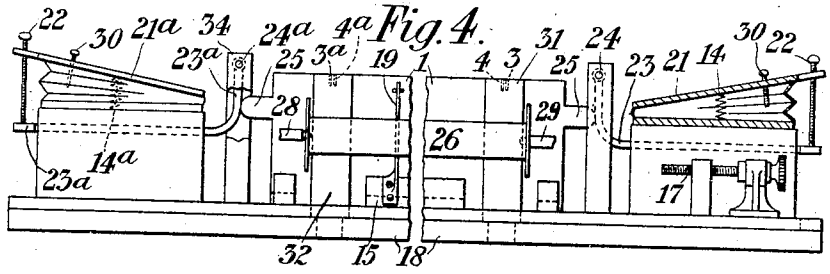



Fig. 6.

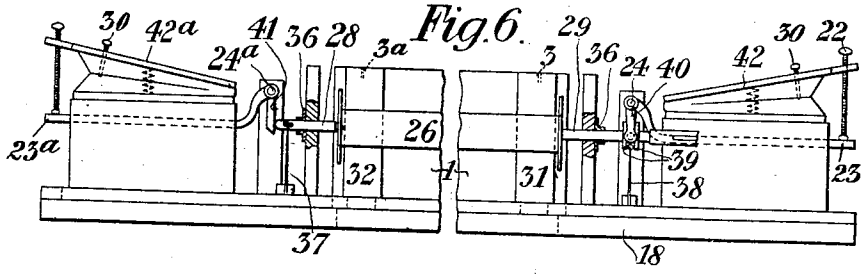
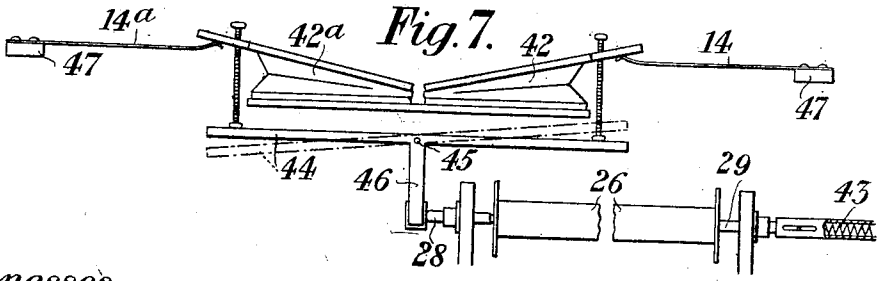



Fig. 7.

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3 SHEETS—SHEET 3.

Fig.9.

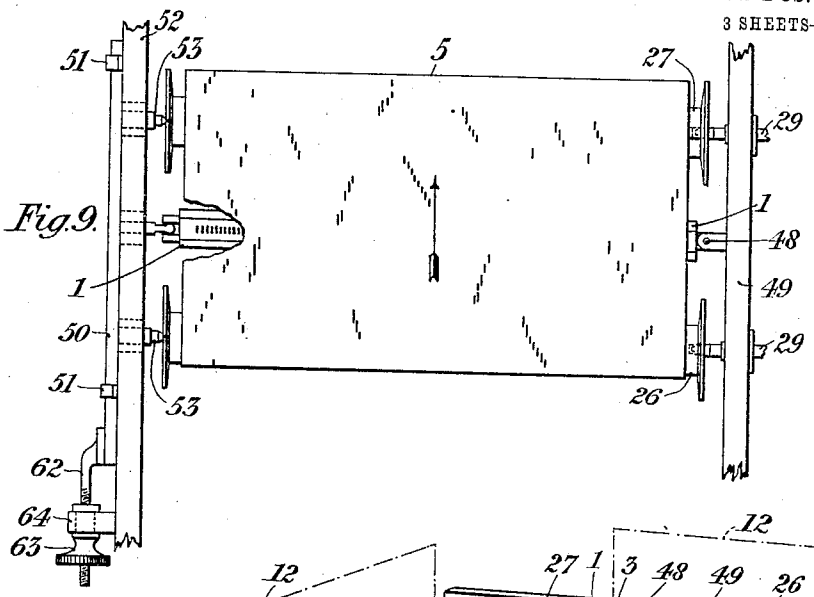



Fig.8.

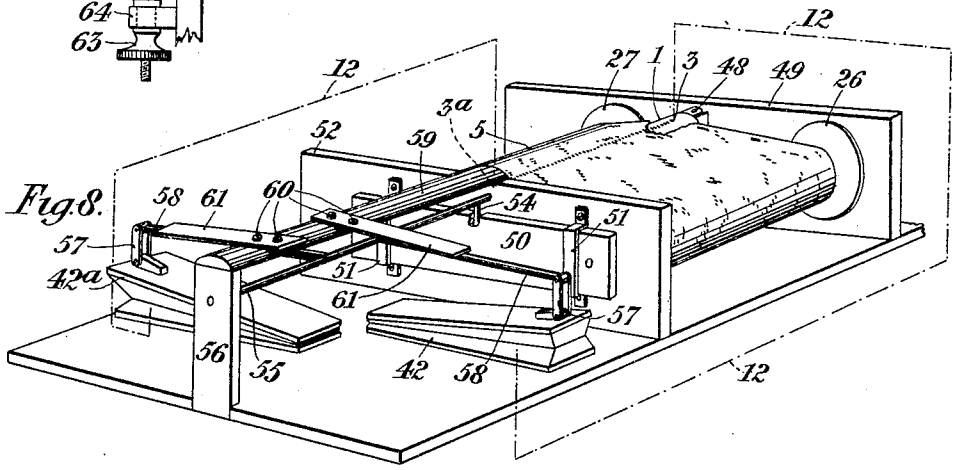
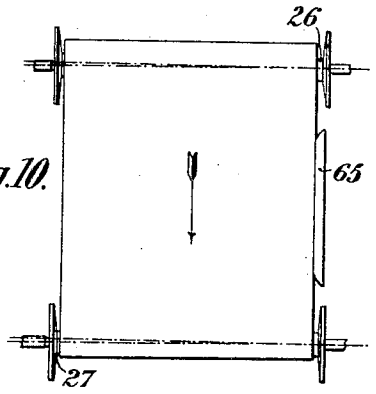



Fig.10.

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# UNITED STATES PATENT OFFICE.

JAMES JOHN WALKER, OF LONDON, ENGLAND.

## AUTOMATIC PLAYER FOR MUSICAL INSTRUMENTS.

No. 911,789. Specification of Letters Patent. Patented Feb. 9, 1909.

Application filed August 24, 1906. Serial No. 331,911.

*To all whom it may concern:*

Be it known that I, JAMES JOHN WALKER, of 27 Francis street, Tottenham Court Road, London, England, have invented new and useful Improvements Connected with Automatic Musical Instruments or Automatic Players for Musical Instruments; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements connected with automatic musical instruments, or automatic players for musical instruments, and consists in means for automatically and also non-automatically maintaining the proper register between a tune sheet and the pneumatic or electric tracker board over which it is caused to travel.

To avoid unnecessary reiteration the tracker board is hereinafter generally referred to, or regarded, as a pneumatic one, but it will be readily understood that the present invention is not restricted to any particular arrangement.

In the tune sheets as hitherto provided for effecting or controlling the automatic playing of pianos and like keyboard instruments, the various notes or tune slots or perforations are frequently found to be very irregularly punched, the various slots or perforations, in some cases being, as a whole, too near one edge, and in other cases too near the other edge of the tune sheet, and this, unless special means of adjustment be provided for neutralizing the effect of such irregularity, frequently disturbs the necessary register between the said perforations and the tracker ports or ducts over which the tune sheets are caused to travel.

Means have been provided for enabling the aforesaid register to be maintained, but they have always been such as to necessitate personal supervision on the part of the person operating, or controlling the general working of, the instrument; in one form these means have involved the longitudinal displacement of the pneumatic tracker board relatively to the tune sheet, and in another form, the transverse displacement of the tune sheet, relatively to the tracker board, but both of these adjustments have been manually effected.

According to the present invention the maintenance of the above-named register may be secured by causing the tune sheet to automatically effect its own registration. This result is attained by causing either the tracker board to be moved relatively to the direction of the width of the tune sheet, or the said sheet to be moved, in a direction transverse to its own length, relatively to the tracker board.

In the accompanying diagrammatic drawings which are to be taken as part of this specification and read therewith:—Figures 1 and 2 are plans, partly broken away, of one arrangement in which the tracker board is automatically adjustable relatively to the tune sheet, the said tracker board being shown in its normal position in Fig. 1, and in one of its adjusted positions in Fig. 2; Fig. 3 is a plan and Fig. 4 a front elevation partly in section of a portion of another arrangement in which the tracker board is automatically adjustable relatively to the tune sheet and which, in addition, is provided with means for enabling transposition of the music to be effected; Fig. 5 is a plan and Fig. 6 a front elevation of portion of an arrangement in which the tune sheet is automatically adjustable relatively to the tracker board and which is provided with means for enabling transposition of the music to be effected; Fig. 7 is a front elevation partly broken away of a modification of the apparatus shown in Figs. 5 and 6; Fig. 8 is a perspective view of another arrangement for automatically obtaining the same results as the arrangements shown in Figs. 1 to 7; Fig. 9 is a plan of a modification of Fig. 8 this arrangement being devised for enabling the adjustment of the register to be manually effected, and Fig. 10 is a diagrammatic view showing the manner of applying the invention to the maintenance of proper side register of a sheet passing through a music recording mechanism.

Throughout the several figures the same reference numerals are used to indicate like or corresponding parts.

In the arrangement shown in Figs. 1 and 2 the tracker board 1 has its several usual ports or ducts 2 connected to the respective motors by flexible tubes neither of which two latter devices are represented in the drawings because they are of ordinary well-known construction and constitute no part of the present invention. The tracker board 1 is at each end provided with one or more additional ports 3, 4, $3^a$, $4^a$, hereinafter called

"controlling ports", these ports, as shown, preferably being long and narrow, each pair 3, 4, or $3^a$, $4^a$, occupying a portion of the length of the tracker board 1 equivalent or substantially equivalent to the length of one of the ports 2.

At each edge of the tune sheet 5—of which only a portion is shown in dotted lines in Fig. 1—are provided controlling perforations 6, $6^a$ respectively, preferably situated at definite distances apart along the length of the said sheet, these perforations being formed in rows situated normally just outside of the controlling ports 3, $3^a$, and bearing a strict relationship, as regards their lateral position on the tune sheet, to the tune perforations 7, so that whenever the tune perforations become out of register with the tracker ports 2, one of the controlling perforations 6 or $6^a$ comes into register with the corresponding controlling port 3 or $3^a$, or 4 or $4^a$, according to the extent of such deviation, and is thereby immediately causative of the automatic return of the tune sheet 5 to its proper registering position as next described.

To each end of the tracker board 1 is pivoted one end of a link 8 whose opposite end is pivoted to a lever 9 or $9^a$ on which are adapted to act pneumatic motors 10, $10^a$, 11, $11^a$, respectively connected to the controlling ports 3, $3^a$, 4, $4^a$, by flexible tubes 12, shown diagrammatically in the drawings by dotted lines. The levers 9, $9^a$ are suitably pivoted to stationary boards 13 to which the motors 10, $10^a$, 11, $11^a$ are permanently attached, and between these boards and the said levers are provided compression springs 14, $14^a$ which hold the tracker board 1 in its normal position, allow it to be moved longitudinally in either direction, and also serve to return it to its normal position after it has been thus deflected. The motors 10, $10^a$, are adapted to move the levers 9, $9^a$ through the first portion of their operative stroke, and to remain at rest during the remaining portion of the stroke, this latter portion being effected by the motors 11, $11^a$. For this purpose the motors 10, $10^a$ may be caused to bear against the levers 9, $9^a$ respectively, without being permanently attached to them and the motors 11, $11^a$ may or may not be permanently attached to the said levers.

The operation of the before described apparatus is as follows:—So long as the tune sheet perforations 7 are in proper lateral register with the ports 2, the controlling perforations 6, $6^a$, will not come into register with the controlling ports 3, $3^a$ or 4, $4^a$ and therefore the several motors 10, 11, $10^a$, $11^a$ and the tracker board 1 will remain in their respective normal positions, as represented in full lines in Fig. 1. When however, the tune sheet perforations 7 deviate towards the right or left of the tracker ports 2, the controller perforations 6 or $6^a$ are brought into register with their respective controlling ports and, pressure being thereby admitted into the corresponding motor, the tracker board is automatically moved to again bring its ports 2 into proper lateral register with the perforations 7.

In Fig. 1 the several motors and the levers 9, $9^a$, are shown in dotted lines in the position which would result from the rightward deviation of the tune sheet 5 to the extent of bringing the row of controlling perforations 6 into register with the corresponding port 3, and the consequent admission of wind pressure through that port to the motor 10. When the longitudinal travel of the tune sheet 5 carries a controlling perforation away from the port 3, and the supply of wind pressure to the motor 10 is thus cut off, the spring $14^a$ acts so as to return the several motors and the tracker board to their respective normal positions, this returning or leftward movement occupying a longer time than did the previous rightward movement owing to unperforated parts of the tune sheet then covering all of the controlling ports 3, 4, $3^a$, $4^a$ and practically closing the said motors to both ingress and egress of air; the air displaced during this return movement finds its way either through the flexible walls of the motors or through suitable minute vents provided for the purpose, these vents being fitted or not with adjustable valves which may serve to regulate the duration of the said return movement, it being preferred that the tracker board 1 shall reach its normal position at or about the time at which the next controlling perforations 6, $6^a$ reach the said board.

Fig. 2 shows the apparatus with the motors 10, $10^a$, 11, $11^a$ and the tracker board 1 in the positions respectively assumed by them when the tune sheet has deviated rightward so far as to bring the controlling perforation 6 into register with the corresponding tracker board port 4.

In the arrangement shown in Figs. 3 and 4 the tracker board 1 is free to move in the direction of its length in guides 15 provided upon a board 16, which, together with all the parts mounted thereon, is longitudinally adjustable as for example by a screw device 17, on a stationary base board 18. A blade or equivalent spring 19 Fig. 4, secured to the guides 15 or board 16 acts on the tracker board 1 so as to return it to its normal position after deflection therefrom in either direction. The several motors 20, $20^a$, 21, $21^a$ of this arrangement, are adapted to be operated by suction, their closing and opening movements taking place in vertical planes as distinguished from horizontal planes as in the previously described example. These motors are adapted, by adjustable screws 22, to depress the outer ends of bent levers 23, $23^a$, rigidly attached to

rocking shafts 24, 24ª respectively, these levers being adapted to bear against the outer ends of projections 25 extending from the opposite ends of the tracker board 1. 26, 27 represent the music or supply roll and receiving roll respectively, each of these rolls being supported between the usual center shaft 28 and the driving shaft 29 one or other of which is of telescopic construction as ordinarily to admit of the insertion and removal of the rolls 26, 27. The several motors 20, 20ª, 21, 21ª, are provided with adjustable stop screws or equivalent 30 which limit the collapse of each such motor to the extent necessary for moving the tracker board the width of one or two of the controlling ports 3, 4, 3ª, 4ª, the subsequent expansion of the said motors being effected by the usual springs 14, 14ª. The present example is one which provides for the transposition of the music and for that reason the last-named controlling ports are formed in subsidiary stationary tracker boards 31, 32, these ports, (like other ports—not shown in the drawings—appertaining to the soft and loud pedals of pianos and the swell pedals or levers and draw stops of organs, and which are not affected by the transposing shift) not requiring to participate in such transposition adjustment. The subsidiary stationary tracker boards 31, 32 are rigidly secured to the base board 18 and pass through slots 33, Fig. 3, in the sliding board 16, upon which latter are provided standards 34 in which the rocking shafts 24, 24ª are suitably journaled.

When in the operation of the last described example, and by reason of undesired and unintentional leftward lateral deviation of the tune sheet, controlling perforations are brought into register with say the port 3, the motor 20 is collapsed and the tracker board 1 is moved leftward sufficiently to bring the ports 2 thereof into register with the tune sheet perforations 7.

When it is desired to effect a transposition of music the screw device 17 is adjusted to the desired extent, as may be indicated by a suitable scale and index 35, Fig. 3, this adjustment serving to shift the tracker board 1 and the motors 20, 20ª, 21, 21ª, as one entity, in a direction transverse to the direction of travel of the tune sheet 5 and without in any way affecting the relationship between the controlling ports 3, 4, 3ª, 4ª and the corresponding perforations 6, 6ª.

Figs. 5 and 6 represent an arrangement in which the before-described automatic control involves the lateral adjustment of the tune sheet 5. In this arrangement the two co-axial shafts 28 and 29, between which, each of the two rolls 26, 27 is supported, are capable of being moved in the direction of their common axis so that the said rolls and the tune sheet may be moved in the same direction and simultaneously therewith. These shafts 28 and 29 are free to slide in stationary bearings 36 and are acted upon by blade springs 37, 38 respectively, Fig. 6, which tend to return the rolls 26, 27 to their normal position after they have been moved in either direction therefrom. The shafts 28 are non-rotating ones and the springs 37 may therefore be in direct engagement with them, but as the shafts 29 are caused to rotate for the purpose of transmitting rotary motion to the rolls 26, 27 the springs 38 appertaining thereto engage the said shafts through the intermediary of collars 39 with which also engage forked arms 40 fast to the rocking shaft 24. The outer ends of the shafts 28 are in operative contact with lever arms 41 fast to the rock shaft 24ª which, as also the shaft 24, is operated substantially in the manner hereinbefore described with reference to Figs. 3 and 4 although, as distinguished from the last-mentioned arrangement, in the present example the motors 42ª, 42 serve for compensating for, or correcting leftward and rightward deviation respectively of the tune sheet 5. The two shafts 29 are rotated by any of the well-known means and they may be, as ordinarily, of telescopic construction to enable them to yield when the rolls are inserted into and removed from their operative position. In this arrangement are shown only two motors for effecting the automatic adjustment of the tune sheet 5 and consequently only one controlling port 3 or 3ª is provided in each of the subsidiary tracker boards 31, 32, and as it is necessary that the relationship of the tune sheet 5 and controlling ports 3, 3ª shall not be disturbed by any adjustment made for transposing the music, the subsidiary tracker boards 31, 32 are rigidly attached to the sliding board 16 so that they will be moved along with the tune sheet when such transposing adjustment is made, the tracker board 1 being rigid with the base board 18 and therefore remaining stationary during such transposing adjustment.

In the alternative form of apparatus shown in Fig. 7 the two motors 42, 42ª are both arranged to act on the shafts 28, the telescopic shafts 29 being of the ordinary well-known construction. In this arrangement the springs 43 of the telescopic shafts 29 are utilized for moving the music and receiving rolls in one direction while the motor 42ª is adapted to move them in the opposite direction. For this purpose the two motors are adapted to act upon a normally horizontal lever 44 rocking, at its center, about a fixed pivot 45, and having a downwardly extending arm or board 46 in constant operative contact with the outer ends of both of the shafts 28. In the present example the motor returning springs 14, 14ª are in the form of blades attached to fixed supports 47 and, according as the respective

controlling ports in the tracker board become exposed, so will one or other of the motors become collapsed and move the rolls rightward or allow them to be moved leftward by the springs 43 of the telescopic shafts 29. When the last-named ports are thus again covered or closed by the unperforated parts of the tune sheet 5, the springs 14, 14ª, will slowly return the lever 44 to its normal position.

It will be readily understood that besides the set of shafts 28, 29 and roll 26 represented in Fig. 7, a second set is employed as before-mentioned, this second set however is directly to the rear of, and therefore completely obscured by the set illustrated. The last-described arrangement, as compared with that shown in Figs. 5 and 6, provides for a more easy placing of the rolls 26, 27 into and out of their respective operative positions, the elasticity of the springs 43 sufficing for all such adjustments, whereas in the other arrangement, the insertion of the rolls into position involves a somewhat strained expansion of the motor 42. Instead of the two motors 42, 42ª being arranged as last described and shown in Fig. 7, the same result may be obtained by arranging them to act one above, and the other below, a lever pivoted at one end and having a board perpendicular to the length of the lever adapted to act upon the ends of the two shafts 28.

Instead of providing the before-described tracker board controlling ports and the corresponding tune sheet perforations in the positions in which they are respectively represented in the drawings, they may be provided at or near the middle of the tracker board and tune sheet respectively, one tune sheet perforation adapted to coöperate with two tracker board controlling ports, in some instances sufficing for this arrangement; or, in cases such as that indicated in Figs. 5 and 6, and that hereinafter described with reference to Fig. 8, the covering and uncovering of the tracker board controlling ports may be effected by the actual edges of the tune sheet instead of by perforations situated near those edges.

The automatic device illustrated in Fig. 8 is adapted to secure the registration of the tune sheets by causing the latter, or the part thereof extending between the supply roll 26 and the receiving roll 27 and over the tracker board 1, to be turned to an angle relatively to its normal position so that it will be automatically wound on the receiving roll 27 more towards one end than the other, and thereby caused to right its position relatively to the tracker board 1. In this arrangement the tracker board 1 is pivoted at one one end, as a 48, to say the wall 49, or other suitable parts of the tracker board chamber, and at the other end it is operatively connected, say in the manner illustrated in Fig. 9, to a slide 50, which is free to move in the direction of its length in guides 51 fast to say the outer side of the wall or partition 52 of the tracker board chamber, said wall or partition being suitably slotted to admit of the connection between the tracker board 1 and the slide 50 having free play in a horizontal direction, as is shown for example in Fig. 9.

The connections between the rolls 26 and 27 with their respective driving shafts 29, are such as to enable the said rolls to be moved angularly in relation to these shafts without disturbing the driving connection; this may be effected for example by slightly tapering the squared or other non-circular driving ends of the said shafts 29, as indicated in dotted lines in Fig. 9, so that they will engage with only the outer edges of the parallel sided square or equivalent recesses in the ends of the rolls. At their opposite or left-hand ends, the rolls 26, 27 are supported on spring-pressed and axially adjustable centers or center shafts similar to those marked 53 in Fig. 9, carried by the slide 50, and projecting through slots in the wall or partition 52. In this arrangement the slide 50 is provided with a notch or recess with which engages an arm 54 fast to, and extending downwards from, a rock shaft 55 suitably journaled in bearings provided in the wall or partition 52 and in a standard 56.

The two control ports 3, 3ª (the latter of which is represented dotted) are connected with the respective motors 42, 42ª by a pipe 12, also represented in dotted lines, and these motors, through short vertical links 57, are connected to the outer ends of lever arms 58, extending from opposite sides of the rock shaft 55. The upper end of the standard 56 is tied to the wall or partition 52, by a bridge bar 59 having a convex or curved upper surface to which are attached, each by two screws 60, two blade springs 61 adapted to bear upon the lever arms 58. These springs are capable of being adjusted by means of the screws 60, so as normally to retain the tracker board 1 and rolls 26, 27, in their respective normal positions and to return them to such positions after they have been deflected therefrom. So long as the tune sheet 5 of this last described arrangement occupies its proper working position, it maintains both of the two control ports 3, 3ª closed, and consequently the adjusting devices remain inoperative, when, however, the tune sheet becomes deflected from its normal path, say towards the left hand, it exposes the control port 3, and thereby allows the air to be exhausted from the motor 42 which, under external atmospheric pressure, collapses and cants the left-hand ends of the rolls 26, 27 and tracker board 1, to-

wards the rear, that is to say towards the upper side of Fig. 8, with the result that the tune sheet will be deflected or caused to travel towards the right until it shall have again been restored to its normal position. When the tune sheet becomes deflected from its normal path towards the right-hand, the control port $3^a$ is exposed and the motor $42^a$ effects the restoration of the tune sheet to the said normal path, as will now be well understood without further explanation.

In the manually adjustable device represented in Fig. 9, the slide 50 is secured to the rear end of a screw 62 engaging with a nut 63 capable of being turned, without motion in the direction of its axis, in a bearing 64 fast to the adjacent wall or partition 52. By turning the nut 63 in one or other direction, the left hand ends of the tracker board 1 and rolls 26, 27 will be simultaneously moved forward or backward and consequently the tune sheet will be caused to deviate transversely to its normal path.

For effecting the before-mentioned side register in music recording mechanism, the supply and receiving rolls 26, 27 are, as shown to an exaggerated extent in Fig. 10, permanently biased or skewed to a slight extent so as to cause the sheet, extending from one to the other of them, to tend always to move towards one side where it is guided against a suitable glass or equivalent surface or guide 65.

Among the equivalents of the before-described tracker with the ducts therein, there may be mentioned a tracker board having an electrical conductor with which readers or fingers are adapted to make electrical contact through the perforations in the tune sheet, and, in an arrangement for mechanically controlling the transmission of the impulse the said tracker board may have a groove into which the readers or fingers fall through the tune sheet perforations.

I claim:—

1. In apparatus wherein a traveling sheet is wound from one roll on to another one constantly parallel therewith, the combination with the said rolls of means adapted to adjust them out of perpendicularity to the direction of normal travel of the sheet.

2. In apparatus wherein a traveling sheet is wound from one roll on to another one constantly parallel therewith and over a tracker board intermediate the two rolls, the combination with the said rolls and tracker board of means adapted to adjust them simultaneously out of perpendicularity to the direction of normal travel of the sheet.

3. In apparatus wherein a traveling sheet is wound from one roll on to another one constantly parallel therewith and over a tracker board intermediate the two rolls, the combination with the said rolls and tracker board of motor devices operatively connected with and adapted to adjust them out of perpendicularity to the direction of normal travel of the sheet said motor devices being controlled by the traveling sheet conjointly with the tracker board.

4. In apparatus wherein a traveling sheet is wound from one roll on to another, the combination with the said rolls, of center shafts supporting them at one end, a slide carrying these shafts and means adapted to adjust the said slide in a direction parallel with the direction of normal travel of the sheet.

5. In apparatus wherein a traveling sheet is wound from one roll on to another, and over a tracker board intermediate the two rolls, the combination with the said rolls and tracker board of a slide operatively connected to each of them at one end and means adapted to adjust the said slide in a direction parallel with the direction of normal travel of the sheet.

6. In apparatus wherein a traveling sheet is wound from one roll on to another, the combination with the said rolls of a slide operatively-connected to each of them at one end and motor devices operatively-connected to the slide adapted to adjust it in a direction parallel with the direction of normal travel of the sheet.

7. In apparatus wherein a traveling sheet is wound from one roll on to another and over a tracker board intermediate the two rolls, the combination with the said rolls and tracker board, of a slide operatively connected to each of them at one end and motor devices operatively-connected to the slide adapted to adjust it in a direction parallel with the direction of normal travel of the sheet, the said motor devices being controlled by the traveling sheet conjointly with the tracker board.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

JAMES JOHN WALKER.

Witnesses:
HENRY HART,
A. NUTTING.