

No. 750,517.

PATENTED JAN. 26, 1904.

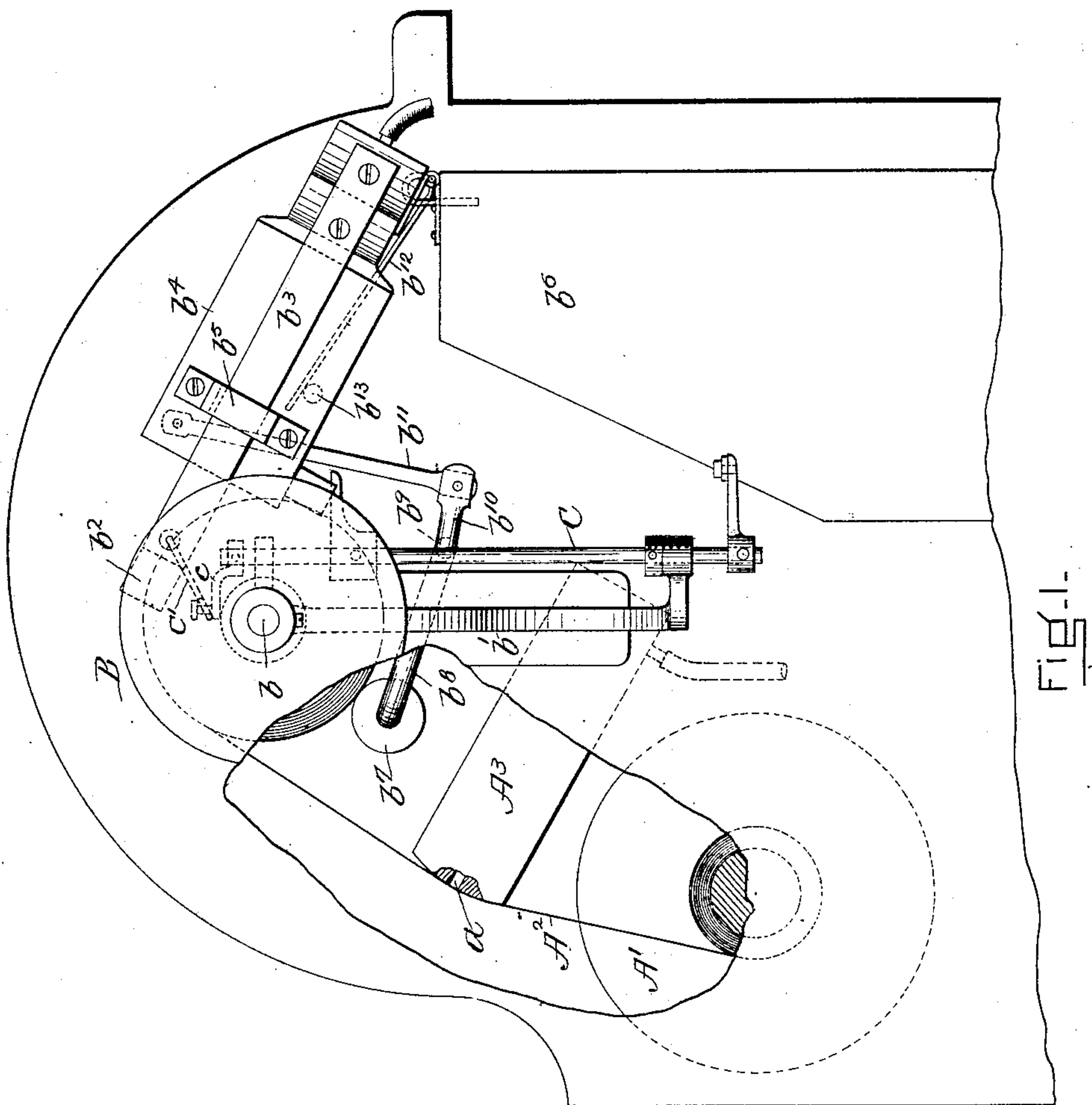
O. H. ARNO.

DEVICE FOR AUTOMATICALLY PLAYING PIANOS.

APPLICATION FILED JUNE 18, 1903.

NO. MODEL.

2 SHEETS—SHEET 1.



WITNESSES:-

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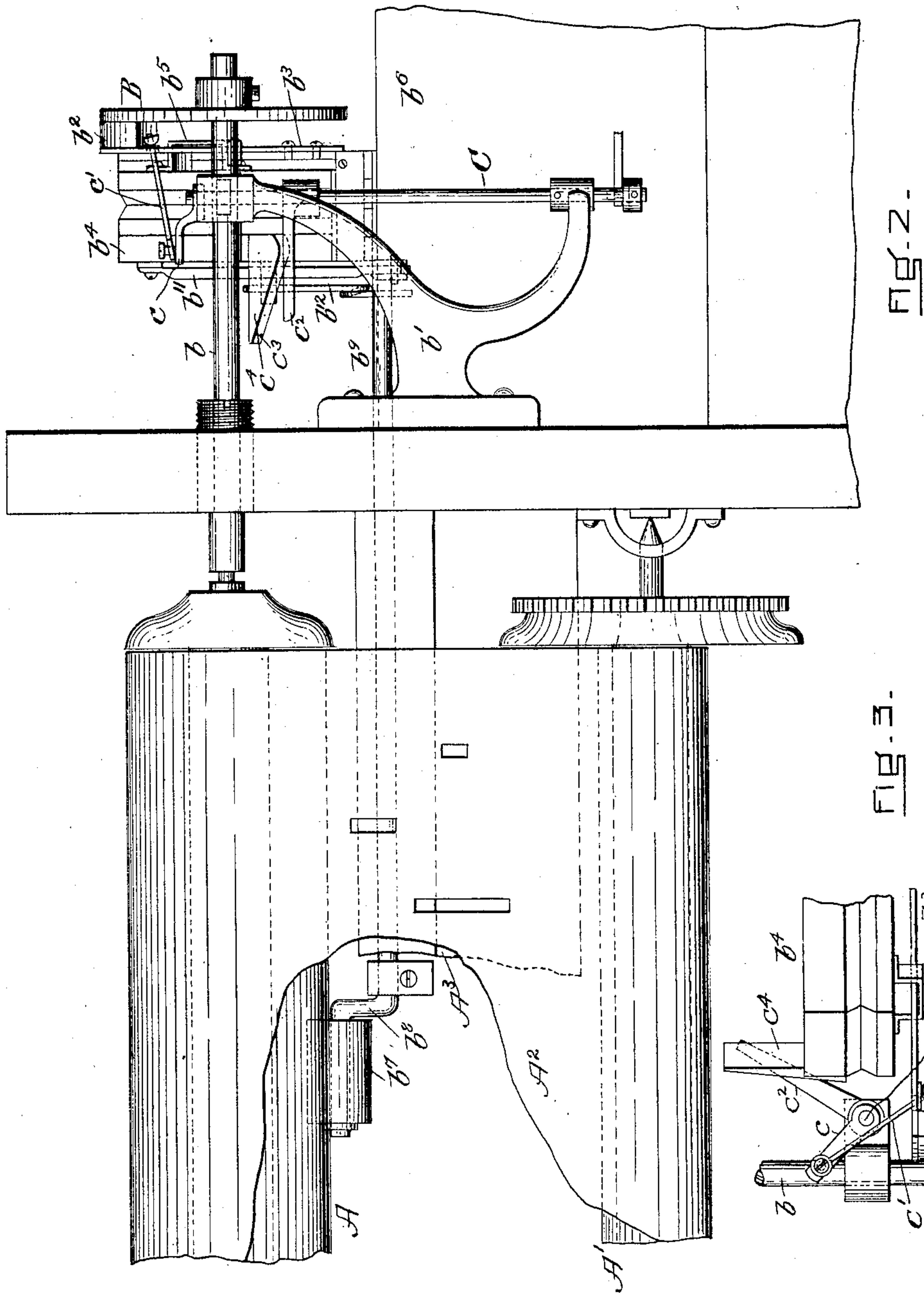
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J. E. R. Hayen
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UNITED STATES PATENT OFFICE.

OLIVER H. ARNO, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF
TO ALEXANDER STEINERT, OF BOSTON, MASSACHUSETTS.

DEVICE FOR AUTOMATICALLY PLAYING PIANOS.

SPECIFICATION forming part of Letters Patent No. 750,517, dated January 26, 1904.

Application filed June 18, 1903. Serial No. 162,029. (No model.)

To all whom it may concern:

Be it known that I, OLIVER H. ARNO, a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Machines or Devices for Automatically Playing Pianos and Similar Instruments, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

My invention relates to the herein-described improvement in machines or devices for automatically playing pianos and similar instruments; and it relates with more specific reference to a means or instrumentality for regulating the tension of the perforated music sheet or paper as commonly used in said machines, whereby the same may be made to run over the end of the tracker-board with a uniformity and regularity of movement.

According to the usual mode of operation in instruments of the kind referred to, the music-sheet is unwound from a "music-roll," so called, to pass over the end of a tracker-board, then to be taken up by being wound upon a take-up roll. It is the take-up roll which receives the motive power, its revolution tending to draw the music-sheet to unwind from the music-roll. With such a mode of operation it is mechanically obvious that the music-sheet normally unwinds more easily, drawing with lesser degree of tension, when there is a greater amount of paper on the music-roll than when there is a lesser amount left thereon, the ease of unwinding, and so the drawing tension, of the paper relatively varying with the amount of paper on the roll. The effect is that when the paper is first drawn off the music-roll it winds upon the take-up roll loosely, gradually winding tighter as the paper unwinds harder from the music-roll, whereby its tension is increased, as before referred to. The result is that as the paper gradually winds tighter on the take-up roll, due to its increased tension consequent upon its drawing harder off the music-roll, there is a slight giving back of the paper, or, in other words, the paper rolls with a slightly-lessen-

ing degree of speed over the tracker-board, 50 which is detrimental in the fact that the perforations in the paper would be relatively retarded in reaching the channels or ways in the tracker-board, so causing a relatively irregular time operation of the instrument. In 55 view of these considerations it is within the purpose of my invention to so vary the resistance of the music-roll against turning that the paper will be drawn therefrom over the ends of the tracker-board at a uniform tension, 60 and so from the manner of its operation with a uniformity and regularity of movement. This effect, with general reference, is obtained by providing the music-roll with a "compensating device," so called, consisting of an adjustable brake, which acts to oppose the turning 65 of the music-roll in such a manner as to impart to it a variable resistance to the unwinding of the music-sheet therefrom, the brake being so adjusted that the resistance of the 70 music-roll to the unwinding of the paper becomes gradually decreased as the paper unwinds therefrom, the gradually-decreasing resistance of the music-roll to the unwinding of the paper giving way to, and so compensating 75 for the gradual increase in the degree of hardness with which the paper normally unwinds from the music-roll, as before referred to.

It is within the further purpose of my invention to maintain the paper to have a uniform tension, and so a uniformity and regularity of movement whatever may be the condition of air-exhaustion in the instrument or, more strictly, in the channels or ways of its tracker-board. It is obvious that with the 85 channels or ways of the tracker-board exhausted of air the tendency is for the atmosphere on the outside to press the music-sheet tight against the tracker-board over which it is passing, or, in other words, a suction is induced in the channels or ways of the tracker-board which tends to hold or retard the paper as it passes over the ends thereof, or, at least, making it draw harder so increasing its tension to wind upon the take-up roll with 90 the disadvantages made mention of. This would be of no material consequence if the degree of exhaustion in the channels or ways

of the tracker-board was constant, for then any tendency to retard the paper at this point would be constant which would not interfere materially with its uniformity of tension, and
 5 so its uniformity and regularity of movement. The trouble is, however, that the amount of exhaustion is not a constant but a variable factor, being especially strong when it is desired to operate the instrument with increased
 10 force, which effect, of course, is obtained by a more perfect degree of exhaustion, with the result that the paper is pressed or drawn more tightly against the end of the tracker-board, and so its tension increased and its progress
 15 relatively impeded. Accordingly, it is my further purpose to offset such tendency to retard or impede the paper, and so to interfere with its tension and regularity of movement, by causing at the moment of any increased
 20 degree of exhaustion in the instrument, and so in the channels or ways of the tracker-board, the brake in my compensating device to ease up slightly in its opposition to the music-roll, the effect being to compensate for the tendency
 25 to retard the paper and the increased resistance given to the paper by the exhaust by lessening the amount of resistance of the music-roll to the unwinding of the paper from it, so keeping the paper at a uniform tension
 30 and resultantly giving it a uniformity and regularity of movement.

My invention pertains to various other incidents of construction which combine to make my device more perfect, all of which can best
 35 be seen and understood by reference to the drawings, wherein—

Figure 1 shows my device in side elevation. Fig. 2 shows the same in front elevation. Fig. 3 shows in plan a detail of construction to
 40 which reference will hereinafter be made.

Referring to the drawings, A represents the music-roll; A', the take-up roll from the one to the other of which runs the perforated music-sheet A² over the end of the tracker-board A³, having channels or ways *a*. A portion only of these parts are shown, and they
 45 are but arbitrarily arranged, their disposition only tending to show the relative manner in which my compensating device is combined
 50 to coöperate therewith, and especially with relation to the music-roll, to which it more specifically pertains.

Referring now to the elements constituting my compensating device, B is a friction-disk
 55 connected to rotate with the music-roll by being mounted upon the extended end of the shaft *b*, which furnishes the usual bearing for one end of the music-roll. The shaft *b* thus extended is supported by a hanger *b'*. Contacting with the inside face of the friction-disk is the friction piece or brake *b*². This
 60 brake is carried upon the end of a spring *b*³, which is fixed to the side of the pneumatic *b*⁴, whereby the friction piece or brake will
 65 be held to have frictional contact with tension

against the face of the friction-disk. It is also to be noted at this point that the movable side of the pneumatic is also provided with an arm *b*⁵, which loops around midway
 70 the spring *b*³ and is so arranged relatively to it as to draw in the spring, and so the brake *b*², fixed to the end thereof, away from its bearing against the face of the friction-disk or at least lessening its intensity of bearing
 75 thereagainst whenever the pneumatic is collapsed, the pneumatic being connected with the main wind-chest and being collapsed upon occasion, especially when the instrument is operated with increased force. The pneumatic *b*⁴
 80 is hinged to any suitable frame-support *b*⁶ and with such a disposition that the pneumatic may be moved upon its hinged support and the friction piece or brake carried by said pneumatic, or the spring fixed to the same may be
 85 moved from the point contacting with the disk nearer its outer edge or periphery to a point nearer its center or axis of turning or to any point intermediate between these points of contact, this depending upon and corresponding
 90 with the amount of paper in the music-roll, the friction piece or brake having bearing nearer the periphery of the disk when the roll is filled with paper and gradually moving radially inward therefrom for its bearing correspond-
 95 ingly as the paper becomes wound off the roll. Such relative disposition of the friction piece or brake is obtained by the intermediary means comprising the friction-roll *b*⁷, bearing
 100 against the paper wound upon the music-roll, the crank *b*⁸, carrying the same, the shaft *b*⁹, to one end of which said crank is fixed and to the other end of which reversely extending is the crank *b*¹⁰, to which crank is pivoted the
 105 link *b*¹¹, connecting the same with the fixed side of the pneumatic. The friction-roll *b*⁷ maintains a constant bearing against the paper wound upon the music-roll, the friction-roll being borne by the crank to follow the paper left upon the music-roll as the music-sheet
 110 unwinds therefrom, leaving the roll and the paper left thereon of lessening diameter. The position of the friction-roll being thus defined, the other parts are so related and combined to coöperate therewith that as the friction-roll moves inwardly upon its crank to
 115 follow the gradually-lessening amount of paper upon the music-roll the pneumatic will be correspondingly drawn down, turning upon its hinged support, and the friction piece or
 120 brake carried by the pneumatic or by the spring fixed thereto gradually moved radially inward for its bearing against the friction-disk nearer the center of its axis of turning. The parts are held in a normally operable position or with the friction-roll in continued
 125 contact with the paper wound upon the music-roll, whence the other combined parts are retained in proper operable position by means of the spring *b*¹², which bears with tension against the pin *b*¹³, fixed to the side of the
 130

pneumatic, the effect being through the intermediary parts connecting the pneumatic with the friction-roll to throw the same into contact with the paper upon the music-roll and to hold said friction-roll in continuous contact therewith whatever the amount of paper upon the roll may be. The operable effect of the parts so constituting my compensating device is as follows: Inasmuch as the friction-disk is connected to turn at the same time as the music-roll A, it is mechanically obvious that when the friction piece or brake b^2 is in contact with the friction-disk at a point nearer its outer edge or periphery it has a greater influence to oppose the turning of the disk, and so of the music-roll connecting therewith, whereby it has greater resistance to the unwinding of the paper than if contacting against the friction-disk nearer its center or axis of turning and with a difference of frictional opposition gradually diminishing as the friction piece or brake in its bearing is drawn radially from the periphery of the disk. Now, as just referred to, the position of the friction piece or brake in its relative bearing against the friction-disk is made to correspond with the amount of paper on the music-roll, the friction piece or brake being nearest the edge or periphery of the disk when the music-roll is full of paper, so opposing its turning with a relatively maximum degree of opposition and imparting to the music-roll a relatively maximum amount of resistance to the unwinding of the paper from it, and which friction piece or brake in its bearing gradually moves in toward the center or the axis of turning of said friction-disk correspondingly as the paper gradually runs off the music-roll, so giving to the disk a gradually-lessening amount of frictional opposition, and therefore providing the music-roll with a gradually-lessening resistance to the unwinding of the paper therefrom; but with the music-sheet operating as it does to unwind from the music-roll by winding upon the take-up roll the music-sheet will unwind from the music-roll with gradually-decreasing ease as the paper becomes unwound from it, for when the music-roll is filled with paper it is mechanically obvious that the paper will unwind more easily than when there is a lesser amount of paper in the roll. Accordingly my device acts to compensate for the varying degrees of hardness with which the paper unwinds from the music-roll, and this is effected by its friction piece or brake b^2 bearing against the friction-disk near its edge or periphery, where its opposition tends to impart to the music-roll with which it is connected a maximum amount of resistance to the unwinding of the paper from it when the roll is filled with paper, as before explained, and which friction piece or brake in its bearing varies correspondingly with the lessening diameter of the music-roll as the music-sheet unwinds from it, moves in to-

ward the axis of the friction-disk, where its gradually-lessening opposition thereto causes the music-roll to turn with a less resistance to the unwinding of the paper, thereby compensating for the gradually-increasing hardness and added tension with which the paper normally unwinds from the music-roll, with the result that the music sheet or paper unwinds from the music-roll with a uniform degree of hardness and constant tension, which results in its winding evenly upon the take-up roll, whereby there will be no giving back by the paper, as is normally the case; but it will run over the end of the tracker-board with a uniformity and regularity of movement.

My compensating device acts upon the same general principle to reduce the resistance of the music-roll to the unwinding of the paper therefrom whenever there is an increased exhaustion in the instrument and so in the channels or ways of the tracker-board, which may happen on occasion, especially when it is desired to operate the instrument with increased force, as it were, as before referred to. At such moment the pneumatic b^4 , which connects with the wind-chest of the instrument, is collapsed, drawing in its movable side and also the spring b^3 , which is fixed to and combined with said movable side of the pneumatic to be drawn in thereby, as before explained, the effect being that the friction piece or brake, which is secured to the end of said spring, is drawn away from its bearing against the friction-disk, or at least its tension thereagainst is lessened by the withdrawal of the spring whence the friction-disk bears with less opposition, and so the music-roll connected therewith has less resistance to the unwinding of the paper, thereby instantly and automatically compensating for any tendency of the paper to be retarded by the increased exhaustion and preserving its uniformity of tension, and so its uniformity and regularity of movement over the end of the tracker-board.

As tending to the further perfection of my compensating device I have provided it with means whereby it may be thrown out of operative relation with respect to the music-roll that the music-sheet may be rewound thereon freely and without opposition, and which means, with general reference, consists in drawing away the friction piece or brake from its bearing against the friction-disk and at the same time throwing back the parts, so that the friction-roll will no longer bear against the paper upon the music-roll, so freeing it in its turning from any stress of opposition. Such means comprises a shaft C, having bearings in the hanger b^1 , before referred to, upon the head of which shaft is a crank c , to which is secured a link c^1 , connecting with the spring b^3 , which bears the friction piece or brake. To this shaft C is also secured an arm c^2 , so disposed that it will engage with the inclined cam-surface c^3 of the cam c^4 , which is fixed to the un-

der side of the pneumatic b^4 . The operation of these parts is as follows: When the shaft is turned, which turning may be obtained by connecting the shaft by any suitable means with the running mechanism of the instrument, the crank c , secured to the head, is thrown around, drawing back the spring b^3 through the instrumentality of the connecting-link c' , whereby with the withdrawal of the spring the friction piece or brake upon the end thereof is also drawn away from its bearing against the friction-disk, wherefore the disk and the music-roll connecting therewith turn without opposition. At the same time as the shaft C is turned the arm c fixed thereto wears against the inclined surface of the cam c^4 , thereby raising the pneumatic, which through the intermediary connections throws the friction-roll back from its contact with the paper upon the music-roll, with the result that the music-roll turns freely without resistance to the re-winding of the paper and without the interference of any frictional stress or bearing. After the paper has become rewound upon the roll it may be taken out and another roll re-inserted, when by reversely turning the shaft C the parts may again be thrown into operable position, with the friction piece or brake bearing against the friction-disk and the friction-roll contacting with the music-roll filled with paper, so governing the position of the brake relatively to the friction-disk, as before referred to.

While such a device as I have described is especially adapted to be used in connection with "piano-players," so called, yet it pertains to any kind of an instrument which has a supply-roll, a take-up roll, and a perforated sheet.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States—

1. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, and means for opposing the rotation of said roll, the resistance of which to the unwinding of the music-sheet thereon will be gradually lessened as the sheet unwinds.

2. In an instrument of the character specified, the combination of a music-roll, a perforated music-sheet, and means for opposing the rotation of said roll, the resistance of which to the unwinding of the music-sheet thereon will be changed dependent upon the amount of paper upon said roll.

3. In an instrument of the character specified, the combination of a music-roll having normally a constant resistance against turning, a take-up roll, a perforated music-sheet, and means for graduating the resistance of the music-roll that the music-sheet may be unwound therefrom upon the take-up roll with a uniform tension.

4. In an instrument of the character speci-

fied, the combination of a music-roll having normally a constant resistance against turning, a take-up roll, a perforated music-sheet, and means for gradually decreasing the resistance of said roll to the unwinding of the paper that the paper may be unwound therefrom upon the take-up roll with a uniform tension.

5. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, a friction-bearing brake for opposing the motion of said music-roll, and means for regulating said friction-bearing brake that it may oppose the motion of said music-roll with a gradually-lessening degree of opposition dependent upon the amount of paper on the music-roll.

6. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, and means for opposing the motion of said music-roll to the unwinding of the paper, which means becomes lessened in its degree of opposition when the paper draws to wind upon the take-up roll with an increased tension.

7. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, a frictional means for opposing the motion of said music-roll to the unwinding of the paper, and means for regulating the said frictional means to oppose the motion of said music-roll with a less degree of opposition when the paper draws to wind upon the take-up roll with an increase of tension.

8. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, a friction-disk connected with said music-roll to turn therewith, a friction piece or brake adapted to bear against said disk, and means for regulating said friction-piece to oppose the motion of said disk and so the motion of the music-roll with a lesser degree of opposition when the paper draws to wind upon the take-up roll with an increase of tension, substantially as and for the purposes set forth.

9. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, a friction-disk connected with said music-roll to turn therewith, a friction piece or brake to bear with tension against said disk, a support for said friction piece or brake adapted to carry the same from a point contacting with the disk nearer its outer edge or periphery to a point contacting therewith nearer its axis of turning, and means for changing the position of said support and so of the friction-piece in its bearing against said disk dependent upon the amount of paper in the music-roll.

10. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, a friction-disk connected with said music-roll to turn therewith, a friction piece or brake to bear against

said disk, a friction roll or member contacting to bear against the paper upon said music-roll, and means connecting with and interposed between said friction roll or member and the friction-piece aforesaid having such relative arrangement that the friction roll or member is made to follow and so keep in contact with the paper on the music-roll as the same becomes unwound, and simultaneously the friction-piece be moved to where it will contact with the friction-disk with a correspondingly lessening degree of opposition.

11. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, a friction-disk connected with said music-roll to turn therewith, a friction piece or brake borne to bear with tension against said disk, a hinged support for said friction-piece adapted to carry the same from a point contacting with the disk nearer its outer edge to a point nearer its center or axis of turning, a friction roll or member to bear against the paper on the music-roll, means connecting said roll or member with said support for the friction-piece aforesaid, which means are adapted to carry said roll or member whereby it will keep in continued contact with the paper on said music-roll as the same becomes unwound, and simultaneously impart the movement thereof to the support for the friction-piece whereby the same will be changed in its position of contact against the friction-disk varying with the amount of paper upon the music-roll, and means for holding the parts in normally operable position.

12. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, frictional means for opposing the rotation of the music-roll to turn with some resistance to the unwinding of the music-sheet therefrom, and means for controlling the said frictional means, the opposition of which becomes eliminated or lessened when the exhaust in the instrument causes the music-sheet to wind upon the take-up roll with an increase of tension.

13. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, a frictional brake for opposing the turning of said music-roll to the unwinding of the paper therefrom, a pneumatic connecting with the wind-chest for regulating the frictional opposition of said brake to the said music-roll, means connecting said pneumatic with said wind-chest, and means connecting the same with said brake.

14. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, a friction-disk connected with said music-roll to turn

therewith, a frictional piece or brake adapted to bear with tension against said disk to oppose the turning of the same, a pneumatic connecting with the wind-chest with the movable side of which pneumatic the friction piece or brake aforesaid is connected, a friction roll or member contacting to bear against the paper upon the music-roll whereby its position is defined, means connecting said friction roll or member with said pneumatic, which means are adapted to carry said friction roll or member whereby it will keep in continued contact with the paper on said music-roll as the same becomes unwound and simultaneously will impart its motion to the pneumatic bearing the friction piece or brake whereby said brake will be changed in the position of its bearing against the friction-disk varying with the amount of paper upon the music-roll, substantially as and for the purposes set forth.

15. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, a brake for opposing the rotation of said music-roll to the unwinding of the paper therefrom, means for controlling said brake to oppose the rotation of said music-roll with a lesser degree of opposition when the paper draws to wind upon the take-up roll with an increased tension, and means whereby said brake may be thrown out of operable relation with respect to said music-roll or its frictional opposition thereto lessened.

16. In an instrument of the character specified, the combination of a music-roll, a take-up roll, a perforated music-sheet, a friction-disk connected with said music-roll to turn therewith, a frictional piece or brake normally bearing against said disk to oppose the same, a friction roll or member normally bearing against the paper upon the music-roll by which its position is defined, means connecting said friction roll or member and the brake aforesaid whereby said friction roll or member will follow the gradually-lessening diameter of the music-roll as the paper unwinds therefrom and simultaneously the brake be moved to where it will contact with the friction-disk with a correspondingly lessening degree of opposition, and means for throwing said frictional members aforesaid out of their normally operable bearing with respect to said music-roll whatever their relative positions may be, substantially as and for the purposes set forth.

OLIVER H. ARNO.

In presence of—

J. M. DOLAN,

SAUL SIPPERSTEIN.