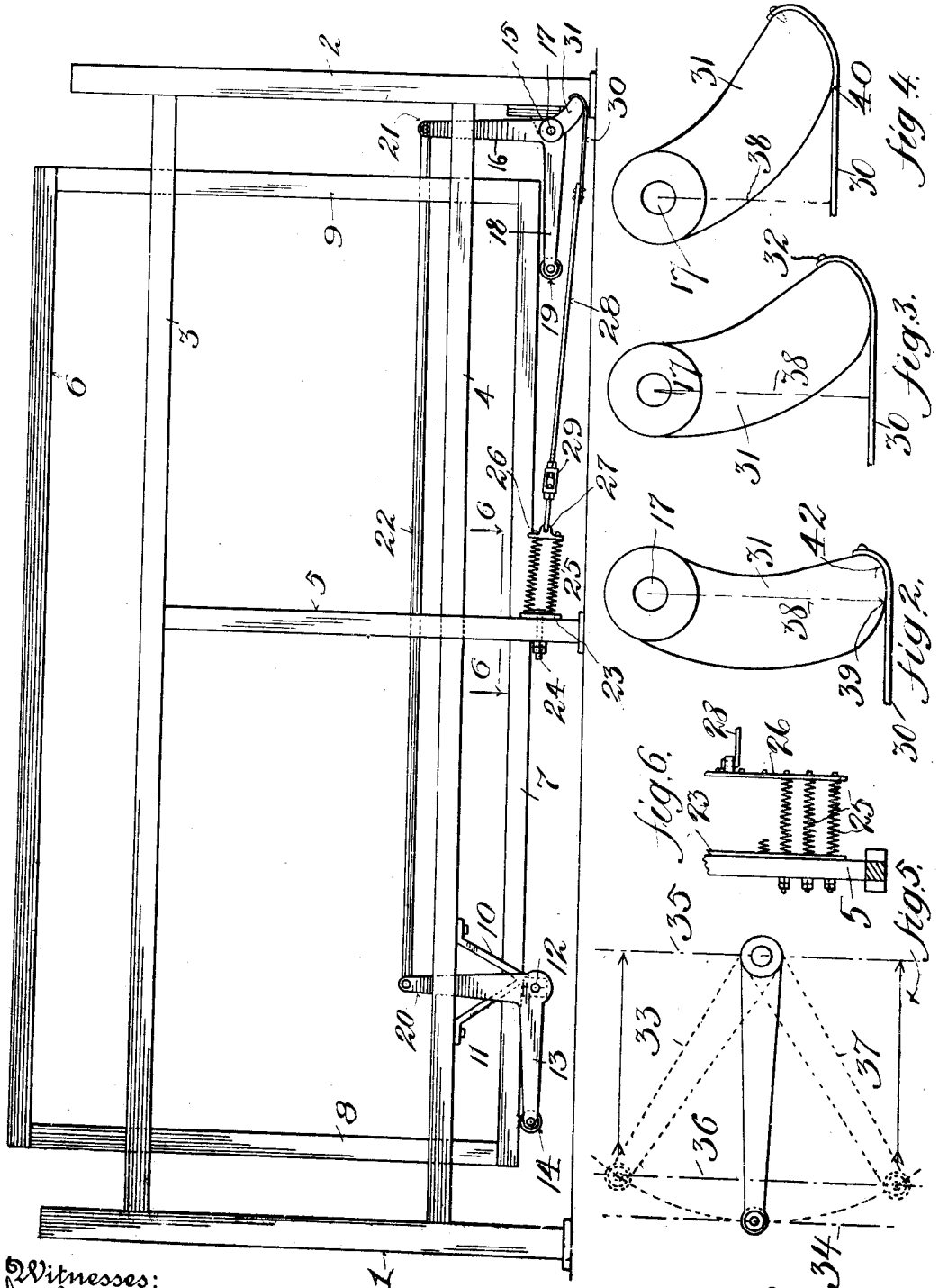
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COUNTERBALANCING MECHANISM FOR EMBROIDERING MACHINES.

APPLICATION FILED FEB. 1, 1912.

1,066,491.

Patented July 8, 1913.



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COUNTERBALANCING MECHANISM FOR EMBROIDERING-MACHINES.

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Application filed February 1, 1912. Serial No. 674,717.

To all whom it may concern:

Be it known that I, JOSEPH A. GROEBLI, a citizen of the United States, and a resident of the city, county, and State of New York, have invented certain new and useful Counterbalancing Mechanism for Embroidering-Machines, of which the following is a specification.

My invention relates to a mechanism for counterbalancing the weight of the tambour frame of an embroidering machine.

It is well known that in large embroidering machines the tambour frame which supports the large sheets of fabric and which is moved at each stitching operation, must be counterbalanced in order that it may be moved easily and accurately. Various devices have been employed for such purpose which have been more or less successful but which have inherent disadvantages. In some cases the tambour frame has been counterbalanced by a weight, but it requires considerable force to quickly overcome the inertia of the combined weight of both the tambour frame and the counterbalancing weight and it is difficult to bring the frame to stop accurately. In other cases springs have been employed to counterbalance the tambour frame, but this introduced other difficulties, because, as the tambour frame was moved in the progress of the formation of the design upon the fabric by the needles, the springs were either contracted or expanded. When the movement of the tambour frame contracted the counterbalancing springs a point was soon reached where they failed to exert sufficient force to fully counterbalance the weight of the tambour frame as the latter was moved in a direction which expanded the springs their tension increased until they overbalanced the weight of the tambour frame and the force necessary to move the latter therefore increased. In the short movement necessary for a given stitch this was hardly important, but as the tambour frame was moved during the progress of the embroidering of the design upon the fabric it threw serious burdens upon the operating source. To overcome this difficulty I provided a compensating system for compensating for the over tension or under tension of the springs, to preserve the equilibrium during the operation of the machine, which device is shown in U. S. Letters Patent to me dated November 9, 1897, and numbered 593206. This system required an operating force to operate the compensating mechanism which force was automatically thrown into and out of action by the movements of the tambour frame. While this system has been in practical operation nevertheless I have found that while the force necessary to cause the movement of the tambour frame has been more regular, nevertheless the burden caused by the unequal tension of the springs has been transferred to the device which operates the compensating mechanism and to the latter itself. In one direction (when the springs are contracting) the compensating mechanism has little work to perform, acting more as a regulator: whereas when the springs are expanded the work performed by the compensating mechanism is considerable and it increases at a considerable ratio as the frame is moved.

The object of my present invention is to overcome the difficulties of both of the above systems. In doing so I avoid the great weight of the counterbalancing weight and therefore make it easier to overcome the inertia of the movable parts: and I also avoid the unequal burden on the compensating mechanism. I provide for the uneven action of the springs in expanding and contracting by providing a compensating device which will be self acting and which does not require the application of an operating force to operate it. That is, the compensating device executes its functions automatically as the tambour frame is moved and without any operating force other than the movement of the tambour frame. The compensating device is very simple and very accurate in its effect.

In my copending application filed October 14, 1911, and serially numbered 654602, I showed and described a counterbalancing mechanism for accomplishing the above purposes: and while the present device is of a similar generic character nevertheless I am herein able to obtain more accurate results. In the present device every element tending to affect the equilibrium during the various movements of the tambour frame is accurately and successfully dealt with and the device is simple and automatic in its operation.

In the drawings forming a part of this application, Figure 1, is an elevation of an embroidering machine showing one application of my invention, but wherein various

stitching mechanisms not immediately concerned with the present invention are omitted. Figs. 2, 3, and 4, are enlarged detail views of the device for automatically preserving equilibrium between the tambour frame and supporting springs. Fig. 5, is a view diagrammatically illustrating the movement of a tambour frame supporting lever, and Fig. 6, is a sectional view taken on the line 6—6 of Fig. 1.

In the subsequent description I will refer to angles of movement and to measurements, in order to teach the practical application of my invention but I do not intend thereby to limit my invention either to a device of any particular dimension or to the exact construction herein shown, but to include all structures coming within the scope of the appended claims.

In the drawings I have shown the ordinary frame of an embroidering machine, consisting of end standards 1 and 2, connected by means of upper and lower longitudinal beams 3 and 4. I have also shown the ordinary intermediate strut or standard 5, for bracing the beams 3, 4, intermediate their ends. The movable frame employed to support and move the fabric is here shown as a rectangular frame consisting of upper and lower longitudinal bars 6, 7, connected at their ends by vertical bars 8, 9. This is the ordinary tambour frame in common use but as the shape and construction of the tambour frame are not altered by the application of my invention the same may be varied according to practice.

My invention relates to the support and counterbalancing of this frame during its various movements from one position to another within its vertical plane of movement.

The object of my invention is to so counterbalance the tambour frame by means of springs that it will require the same amount of force to move it from any given position to any other position within its limit of movement: and to automatically compensate, without the use of separate operating mechanism, for the unequal stresses of the supporting springs as they are expanded or contracted during the movements of the tambour frame from one position to another, notwithstanding the tendency of the levers or other mechanical devices usually embodied in the counterbalancing mechanism, to cause inequalities in the action of the counterbalancing springs. My purpose is to employ a spring system wherein the springs are ultimately secured at one end to a fixed object.

The tambour frame is shown as resting on a system of levers. On the beam 4, I have arranged a bracket 10, which supports a lever 11, fulcrumed thereto at the point 12. The horizontally disposed arm 13, of this lever has a roller 14, which engages the under side of the bar 7. Near the opposite end of the tambour frame I have provided a bracket 15, on the standard 2. This bracket supports another lever 16, which is fulcrumed thereto at the point 17. The horizontal arm 18, of this lever has a roller 19 also engaging the under side of bar 7, of the tambour frame. The weight of the tambour frame continually rests upon the arms 13 and 18. The lever 11, has an arm 20, here shown as extending upwardly at right angles to the arm 13. The lever 16, also has an arm 21, extending upwardly at right angles to the arm 18. Both arms 20, and 21, are connected by a suitable connection, such as a rod 22, fulcrumed to the upper ends of the arms 20, 21. This comprises what is generally termed a parallel motion device because the tambour frame is caused thereby to move the same extent at each end and therefore through its length, because both levers are caused to move in unison.

Upon the stationary support, preferably upon the intermediate strut or standard 5, of the stationary frame I secure a plate 23, by means of bolts 24, passing through the standard 5, and plate; and one end of preferably a number of coil springs 25, are connected to the plate 23. To the opposite ends of the springs 25, is connected a yoke 26, having an eye 27, on one side, to which is connected one end of a rod 28. The latter has a turnbuckle 29, by which the rod may be lengthened or shortened; and the free end of the rod connects with a flexible metal band 30. Upon the same shaft 17, on which the lever 16 is fastened I have secured a rocking member preferably in the nature of a cam or rocker 31, which I have shown extending downwardly from the shaft 17. The flexible strap 30, is connected with some part of the rocking member, preferably at the point 32, so that the strap engages over the curved surface of the rocking member. The weight of the tambour frame resting on the arms 13, 18, tends to rock both levers 11, 16, to the left in Fig. 1, which levers move in unison, and this transmits the weight of the tambour frame through levers 11, 16, to the shaft 17, thence through the rocking member 31, to the strap 30; thence through the rod 28, to the springs 25, and finally to the stationary support. The tambour frame is therefore spring supported. If the tambour frame is moved upwardly from the position shown in the drawing, by means of a pantograph or jacquard, during the usual operations of the embroidering machine the arms 13, 18, will follow the tambour frame by reason of the action of the springs upon the rocking member and the levers; and the tambour frame will continue to be supported in

its new position by means of the springs. This assumed upward movement causes the rocking member 31, to move to the left in the drawing, thus permitting the springs 25, to contract because they are connected ultimately with a fixed support. The natural tendency of the springs in this action would be to contract and thus exert less force upon the levers which support the tambour frame and thus fail to properly counterbalance the weight of the tambour frame. This would necessitate a greater force than is desirable to move the tambour upwardly and hold it there and the higher such frame were moved the more the force necessary to move it and retain it if it were not for the compensating device to be presently described. Conversely, if the tambour frame were moved downwardly from the position shown the levers 11, 16, would be rocked to the left in the drawings. This would move the rocking member 31, to the right and expand the springs 25, and if the springs were adjusted to exactly counterbalance the tambour frame in the position shown in Fig. 1, then if no compensation were made, the force necessary to move the tambour frame downwardly would increase as the frame is moved below the position shown, because the springs, being expanded, would ordinarily exert a greater force upon the levers 11, 16. In ordinary practice the tambour frame movement is such as to cause the arms 13, 18 to move upwardly about 22 degrees above the horizontal and the same distance below the horizontal, as is graphically illustrated in Fig. 5. When the tambour frame is moved upwardly beyond the position shown in Fig. 1, the arms will move toward the position 33, shown in Fig. 5; and as the arms move above the horizontal, the leverage of the arms decreases. For instance, in the horizontal position the leverage will be according to the distance from dotted line 34, to dotted line 35. When the arms reach the higher position 33, the leverage will be according to the distance between dotted line 36, and dotted line 35, which will be less than when in the horizontal position. Likewise when the arms move below the horizontal the leverage will decrease until they reach the position 37, when the leverage will be according to the distance between dotted lines 36, and 35, the same as in the position 33. Between either of these assumed extreme movements the leverage will continually change as the tambour frame is moved. As the arms 20, 21, are usually arranged at right angles to the arms 13, 18, the result will be to change the rocking stress upon the shaft 17, as the tambour frame is moved above or below the position shown. If, therefore, the tension of springs 25, were adjusted for the weight of the tambour frame while the arms 13, 18, were horizontal, and no compensation were provided for, the equilibrium between the springs and the tambour frame would be upset upon the movement of the tambour frame above or below the position shown. Allowance therefore must be made in the compensating action for this difference in applied power caused by the rocking of levers 11, 16.

I prefer to so position the rocking member 31 on its shaft 17, that the point at which the band 30 meets (or leaves contact with) the periphery of the rocking member 31, will change between say the point 39, on the periphery and the point 40. The action is illustrated in Figs. 2, to 4. The end of the band 30, is fixed say at the point 32, to the rocking member, so that as the latter moves, the band will have a rocking contact with the rocking member; or it may be said that the point of contact changes.

It is to be remembered that the weight of the tambour frame is transmitted to the springs through the rocking member 31, which of course moves whenever the tambour frame moves. Let it be assumed that the tambour frame is moved upwardly from the position shown in Fig. 1. In that case the rocking member 31, will move from the position shown in Fig. 3, to the left, and in the amplitude of movement of the tambour frame assumed, the rocking member may be moved as far as the position shown in Fig. 2. Or, if the tambour be moved downwardly in Fig. 1, then the rocking member 31, will rock to the right and may move to the position shown in Fig. 4. When in the position shown in Fig. 2, the leverage of the rocking member is greatest but as it is moved toward the position shown in Fig. 4, it decreases. In a device arranged as shown herein there are, therefore, three elements to be considered in the compensating device in order to retain the springs and tambour frame in proper equilibrium during the various movements of the frame. First there is the difference in the leverage caused by the change in the angle of applied power of the weight of the frame as the levers 11, 16, move one way or the other from the position shown: secondly the change of the angle of applied power as the rocking member 31, moves in unison with the levers 11, 16: thirdly, the differences in the action of the springs as they are contracted or expanded during the movements of the tambour frame. By means of the changing contact or rolling action of the band 30, on the member 31, I am able to compensate for any, and in fact all, of the above changes in condition, so that the springs and the tambour frame will always be in proper equilibrium in whatsoever position the tambour frame may be; and

the power necessary to move the latter from any position to any new position will always be the same.

The curvature of the surface 42, of the rocking member 31, is designed to compensate for each of the above elements. In laying out this curve I proceed as follows: I lay out a number of radii from the point 17, representing the movements of the arms 13, 18 and on these radii I lay out a curve representing the differences in applied power as the arms 13, 18 move above or below the horizontal. On each radius I add from the point representing the above curve a certain increment corresponding to the loss of power by the relaxation of the springs and from these last points I draw lines at right angles to the particular radius and these lines are tangents to the curve and determine its form. Of course the proper curvature may be developed in the empirical way. When the tambour frame is moved the leverage of the member 31, will change automatically by reason of the rocking or moving contact of the strap and member 31. When the latter is curved as here shown and described the length of the radius drawn from the point 17 and at right angle to the line of force represented by the band 30 will change as the tambour frame is moved, thus changing the relationship of leverage and spring tension. This change will always compensate for changes in the condition of the several elements of the device, so that the tambour frame will always be properly counterbalanced by the springs in whatever position the tambour frame may be, and very slight force will be required to move the tambour frame. The compensating action is entirely automatic and the device for compensating requires no external or separate operating force.

Having described my invention, what I claim is:—

1. An embroidering machine having a movable tambour frame and a counterbalancing device therefor, embodying a spring arranged to counterbalance the tambour frame, a fixed support to which one end of said spring is ultimately connected and means for preserving equilibrium between the spring and tambour frame, embodying a rocking member, having a curved surface and a flexible member having a rolling contact with said curved surface, arranged whereby the leverage between the tambour frame and spring will automatically change during the movements of the tambour frame to compensate for inequalities in the said spring as the latter expands and contracts.

2. An embroidering machine having a movable tambour frame, and a counterbalancing device therefor, comprising a spring arranged to counterbalance the tambour frame, a fixed support to which one end of said spring is ultimately connected, and means for automatically preserving equilibrium between the spring and tambour frame, embodying a rocking member having a curved surface, and a flexible member having a rolling contact with said curved surface, arranged whereby the leverage of said rocking member will automatically change during the movements of the tambour frame to compensate for inequalities in the stress of said spring as the latter expands and contracts.

3. An embroidering machine having a movable tambour frame, and means for counterbalancing the same, comprising a spring arranged to counterbalance the same, a fixed support to which one end of said spring is connected, and means for preserving equilibrium between said spring and tambour frame, comprising a rocking member connected with the tambour frame, having a curved surface, and a flexible member having one end connected with said rocking member, engaging over said curved surface, and connected with one end of said spring, said curved surface being arranged whereby the leverage of said rocking member will automatically change during the movements of the tambour frame to compensate for the inequalities in the stress of said spring as the latter expands and contracts.

4. An embroidering machine having a movable tambour frame, and means for counterbalancing the same, comprising a lever through which said frame is supported, and a rocking member having a curved surface, a spring, a fixed support to which one end of said spring is connected, a flexible member connected with the other end of said spring and having a rolling contact with the curved surface of said rocking member, said members being arranged so that, as the rocking member moves, the distance between said flexible member and the fulcrum of said rocking member will be automatically increased and decreased by reason of the said curved surface, whereby the leverage between the tambour frame and spring will compensate for the inequalities in the stress of said spring as the latter expands and contracts.

5. An embroidering machine embodying a tambour frame, levers having arms at right angles to each other and arranged to support the tambour frame at different portions of its length, means connecting said levers to cause them to move in unison, a rocking member moved in unison with said levers and having a curved surface, a fixed support, a counterbalancing spring connected at one end with a fixed support, a flexible member connected with said rocking member and said spring and arranged to have a rocking contact with the curved surface thereof, the curvature of said sur-

face being so shaped as to change the leverage of the said elements to compensate for differences in the relative stress of said spring and the weight of said tambour frame, during the movements of the latter, to preserve equilibrium between said spring and frame.

Signed in the city, county and State of New York this 31st day of January, 1912.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."