Aug. 31, 1937. A. A. BOHMANN ET AL 2,091,727

MULTIPLE HEAD EMBROIDERY MACHINE

Filed Feb. 16, 1932 2 Sheets-Sheet 1

Fig. 1

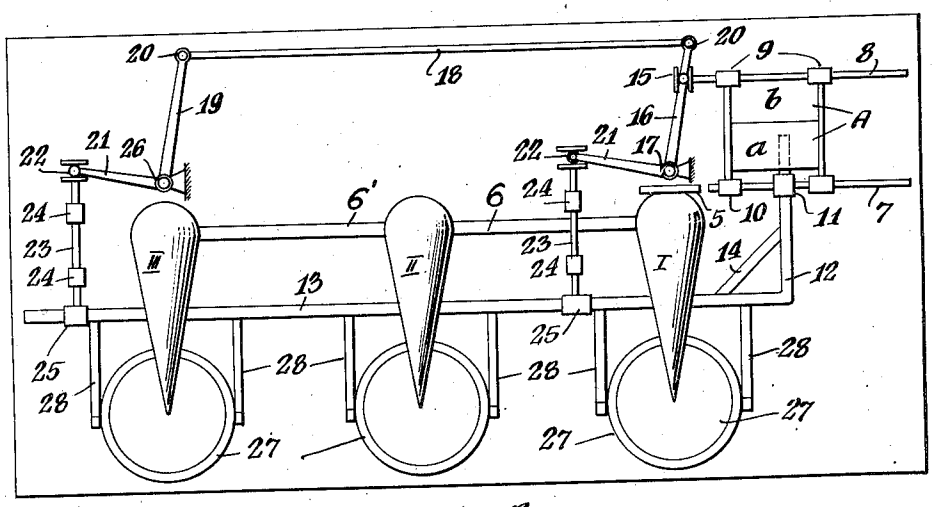


Fig. 2

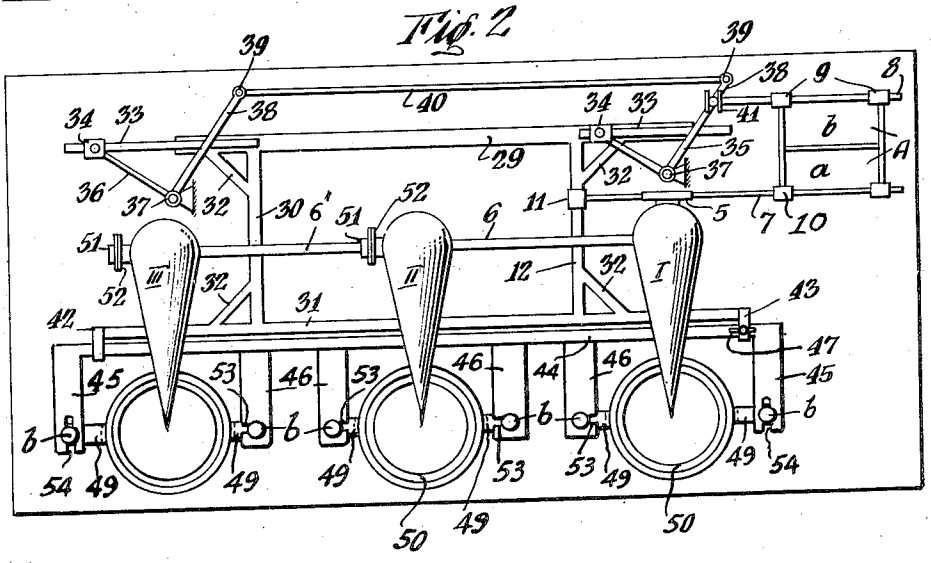
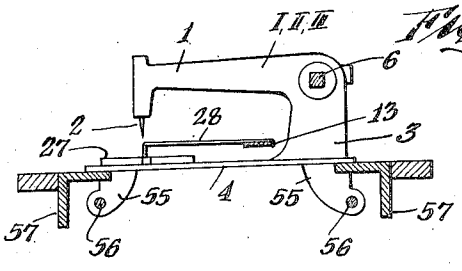


Fig. 3



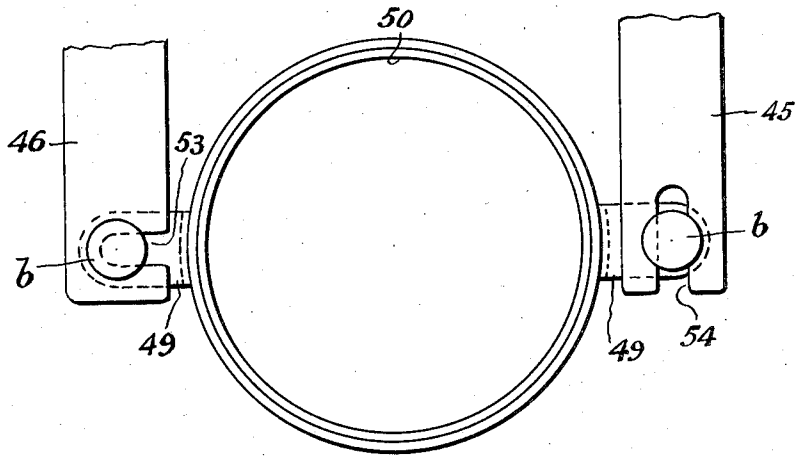
INVENTORS
Arthur Albrecht Bohmann
Kurt Gustav Scheibel
BY Georg C. Heinicke,
ATTORNEY

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Fig.4.



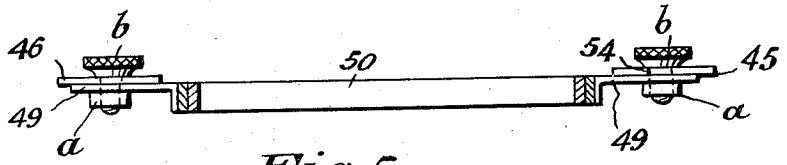


Fig.5.

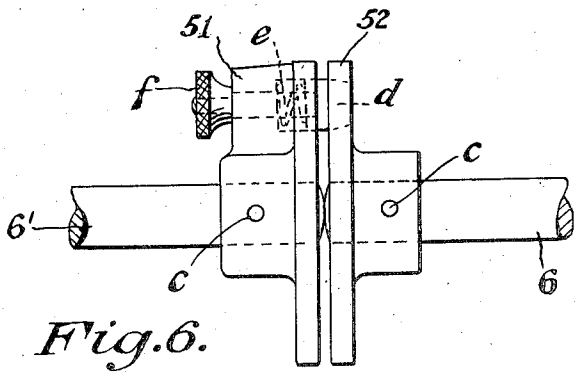


Fig.6.

Inventors.
Arthur A. Bohmann
Kurt Scheibel
by Georg C. Heinicke
Attorney.

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UNITED STATES PATENT OFFICE

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MULTIPLE HEAD EMBROIDERY MACHINE

Arthur Albrecht Bohmann and Kurt Gustav Scheibel, Dresden, Germany, assignors to Wurker, Gesellschaft mit beschrankter Haftung, Dresden, Germany

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In Germany February 17, 1931

1 Claim. (Cl. 112—102)

The present invention relates to improvements in or relating to multiple head automatic embroidery machines.

Multiple head single needle embroidery machines are already known in which the embroidery frames are guided by an embroidery frame displacing device. In these machines the material to be embroidered is guided on a horizontal plane. Consequently the embroidery frame displacing device has considerable friction to overcome in the horizontal plane. Since the weight of the displacing device rests on the needle plate, the oscillating masses must be reduced as far as possible. The whole construction of the multiple head embroidery machine depends therefore in the first place on the embroidery frame displacing device.

Attempts have already been made to employ guiding parallelograms with hinge joints, but these constructions have the disadvantage that with the rapid movement of the frame necessitated by the high rate of revolution of the machine, the hinge points easily wear out and become useless so that accurate guiding of the embroidery frames becomes impossible.

In order to avoid oscillating, the individual embroidery frames themselves have been controlled by a displacing device. Each embroidery frame carries an angle member which is moved by guiding spindles of two component devices of an automatic machine or the like. This arrangement however is only practicable if the guiding spindles are mounted under the needle plate and the intermediate members which engage the two arms of the angle project through slits in the needle plate. In embroidering the material however the disadvantage is presented that the material very easily enters the slits and gets caught there.

The present invention has for its object to remove all these disadvantages of multiple head automatic embroidery machines by a new and stable embroidery frame guiding means the mass of which can be reduced to a minimum and which necessitates a special arrangement of the embroidery machine heads.

According to the present invention we provide a multiple head automatic embroidery machine having an embroidery frame carrier which is moved by a component mechanism working in two directions at right angles characterized in that the means for connections of the component mechanism on the embroidery frame carrier are formed as sliding or roller guides.

In order that the invention may be well understood preferred embodiments thereof will be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic plan view of an embroidery machine having an embroidery frame guiding means comprising a rigid angle, showing the embroidery machine heads.

Figure 2 is a diagrammatic plan view of an embroidery machine having a frame like closed guiding means and showing the embroidery machine heads.

Figure 3 is a sectional elevation showing the arrangement for adjusting the embroidery machine heads.

Fig. 4 is a detail view of the embroidery frame holders and their co-operating parts on an enlarged scale.

Fig. 5 is a sectional elevation thereof.

Fig. 6 is a detail view of a coupling.

Referring to Figure 1 of the drawings embroidery machine heads I, II and III each preferably formed like that of a sewing machine, are arranged at equal distances apart. The heads are each provided with an arm 1 which carries at its forward end a vertically reciprocating needle 2 as shown in Figure 3. The foot 3 of the head is secured to a base plate 4 over which the material is moved. The drive of the multiple head embroidery machine is effected by means of the belt wheel 5 which drives the first embroidery machine head I and the other two heads II and III by means of a coupling shaft 6, 6' and bevel gears. Apart from this the belt wheel 5 drives by the intermediary of suitable mechanism the automatic mechanism A which is provided with two known component mechanisms *a* for producing horizontal direction and *b* for the vertical direction (i. e. vertical referring to Figure 1 of the drawings but actually horizontal). Racks 7 and 8 are driven by the mechanisms *a* and *b* and are guided in bearings 9 and 10. The rack 7 has a sliding or rolling guide 11 in which a short rod like arm 12 engages and which forms a rigid angle with a long arm 13 and a connecting strut 14. The other rack 8 for the vertical direction engages forwardly by means of its head 15 with a bell crank lever 16 which oscillates about a fixed pivot 17. The extended arm is connected through the hinges 20 and a link 18 with a second bell crank lever 19 of equal size, which likewise oscillates about a fixed pivot 26. Both pivots 17 and 26 must therefore be the same distance apart as the length of the link 18 between the hinges 20. The two short arms 21 of the bell crank levers engage in the guides 22 of two slides 23

which are guided parallel to each other in bearings 24. Each slide carries at its forward end a sliding or roller guide 25 which embraces the long arm 13 of the rigid angle member 12, 13. According to the motion of the two racks 7 and 8 by the component mechanisms *a* and *b* the angle member 12, 13 is moved horizontally by the action on the short arm 12 and vertically by the action on the long arm 13. If for example the rigid angle member is moved in the horizontal direction by the rack 7, the two slides 23 which engage the long arm 13 merely serve to guide the angle member in a straight line. If the rack 8 is moved by the component mechanism *b* of the automatic mechanism the movement is transmitted to the parallel slides 23 by the bell crank levers 16 and 19.

For the sake of convenience of operation the embroidery frames 27 are disposed forwardly on the needle plate of the machine. Each embroidery frame is carried by two embroidery frame holders 28. All of the embroidery frame holders 28 are fixedly connected with the arm 13 of the embroidery frame guiding means. The arm 13 which is adapted to be slidably guided is therefore the carrier arm for the frames and preferably lies between the foot 3 and the needle 2 of each embroidery machine head (Figure 3). If for example more than three embroidery machine heads are arranged adjacent one another then the arm 13 of the embroidery frame guiding means must be extremely long. In order that the arm may possess sufficient strength and will not bend or oscillate when in use it must be made correspondingly wide. Consequently the space for the embroidery frame between the foot 3 of the embroidery machine head and the needle 2 becomes too small or narrow and the arm 1 of the embroidery machine head must be considerably increased in length. In order to avoid this it is advantageous to adopt a different arrangement of the embroidery frame guiding means as shown in Figure 2.

For the sake of simplicity the arrangement is likewise shown as having three embroidery machine heads. As in the first example the embroidery machine heads are driven by means of the belt wheel 5 through bevel gears and the coupling shaft 6, 6'. In addition to this the automatic mechanism A is driven by means of the belt wheel 5 and comprises two component mechanisms *a* for the horizontal direction and *b* for the vertical direction (referring of course to the horizontal and vertical directions of Figure 2 of the drawings). Racks 7 and 8 are driven from the component mechanisms, the two racks being guided in bearings 9 and 10. The rack 7 for providing the horizontal motion engages with its slide or roller guideway 11 which in this case is disposed at the forward end of the rack 7 with a small rod-like arm 12 which forms a rigid angle with the long arm 29 which is utilized as a straight line guiding means. The angle member so formed is closed by means of a connecting strut 30 and a carrier bar 31 for the embroidery frames to form a rigid quadrilateral frame. Struts 32 serve for stiffening the angles of the quadrilateral frame. The foot 3 of one or more of the embroidery machine heads project through this quadrilateral frame, but as shown in Figure 2 this only applies to the machine head II. If the machine includes more embroidery machine heads the quadrilateral frame is elongated and is strengthened by means of a plurality of connecting struts 30 so that the frame forms a rigid carrier in the form of a grating. The long arm 13 of Figure 1 is therefore considerably strengthened and of considerably increased effective width by being thus formed as a frame or grating. Since the embroidery machine heads project through the rigid frame the space behind the heads is effectively utilized whilst the carrier bar 31 for the embroidery frames passes between the foot 3 and the needle 2 of each embroidery machine head instead of the arm 13 as in the former case corresponding to Figure 3.

The method of reducing the weight indicated in connection with the former example is also utilized in this case and for this purpose the arm 29 of the embroidery frame guiding means is constructed of light metal. This carries at each end guide rails 33 made of steel on which guide blocks 34 of bell crank levers 35 and 36 slide. The two bell crank levers oscillate about fixed pivots 37 and carry pivots 39 at the end of their longer arms to which pivots the connecting link 40 is hinged. The rack 8 engages with its head 41 which is formed as a sliding or roller guide member with the bell crank lever 35 and thereby moves the guiding frame in a vertical direction. The guiding in a straight line of the embroidery frame guiding means in this case is effected directly by the two bell crank levers. Also in this case the linear guiding is dependent upon the distance of the bell crank levers. In order to save weight the carrier bar 31 for the first and last embroidery machine heads I and III is extended at both sides of the forward corners of the quadrilateral frame so that the embroidery frames for the corresponding machine heads can be fixed to the free ends of the carrier bar 31. By this arrangement it is possible to avoid the use of further connecting struts 30 at the ends because the carrier bar 31 is in itself of such strength that the free ends possess sufficient rigidity. In this way considerable weight is saved.

The carrier bar 31 need not be directly the carrier for the embroidery frame holders. In the example described with reference to Figure 2 two guide bearings 42 and 43 are arranged on the ends of the carrier bar 31 in which a round embroidery frame rod 44 is guided on which the embroidery frame holders 45 and 46 are fixed. Whilst the bearing 42 merely serves as a guide the bearing 43 is provided with a clamping screw 47 by means of which the embroidery frame rod 44 can be held fixed. This whole arrangement has the advantage that the embroidery frame rod 44 with the frame holders and the frames can be shifted in the guides 42 and 43. This is particularly important if greater areas of material are to be embroidered than the normal areas for which the machine is normally employed. In this case the method of displacement as described in German Patent specification No. 469,261 can be adopted. Apart from this this arrangement has the advantage that the embroidery frame rod together with the frame holders and the frames can be swung upwardly. Thus without removing the frames the lower side of the embroidery can be inspected. It is also possible so to fix the embroidery frame rod by means of the clamping screw 47 that the frames rest very lightly on their under surfaces. The embroidery frame holders 45 and 46 can therefore be constructed of resilient material and the points of attachment for the frames can lie in the medial axis of the frames. As shown in Figures 4 and 5, each of the frames 50 has at both of its sides a fastening strip 49, each in the form of an angular metal member and car-

rying a threaded socket *a*. The holder **46** has a laterally extending slot **53**, while holder **45** has a longitudinally extending slot **54**. The frame **50** is slid beneath the holders and is secured by means of screws *b* to its holders. If now for instance the screw *b* of the right hand holder **45** is loosened, the frame **50** can be inwardly moved in the slot **54** so that upon loosening screw *b* at the left hand the frame can be moved at the slot **53** of holder **46** so as to allow a regulation of the material within certain limits. This, of course, pertains only to the opposite end frames, as the holders **46** are all provided with laterally extending slots.

If the frames **50** are all tensioned then these form with the embroidery frame holders **45** and **46** and the embroidery frame rod **44** a rigid framework which permits no oscillation of the frames. The fact that the carrier bar for the frames is arranged as a special embroidery frame rod **44** on the embroidery frame guiding means and is exchangeable by being withdrawn from the guides **42** and **43** has the advantage that other larger frames can be employed for embroidery which are themselves fixed to a separate rod. The driven shaft **6'** can be uncoupled from the driving shaft **6**, carrying the embroidery head II, by the retraction of bolt *d* to uncouple members **51**, **52** of the coupling. Bolt *d* is kept in its retracted position by any well known means employed for this purpose. The distance between the heads can be varied due to the squared shaft sections as illustrated in Figure 3.

With the multiple head automatic embroidery machine according to the embodiment described in the example it is also possible to embroider overlaid work. All three embroidery machine heads then embroider simultaneously in a common frame. By means of the above described enlargement of the embroidering area by displacement the individual designs can be arranged one over the other to an overlaid design. The size of the design must then always be a multiple of the distance apart of the embroidery machine heads. In order not to be bound by the size of the design it is advantageous to be able to adjust the embroidery machine heads II and III. For this purpose the flat base plate **4** carries two brackets **55** for each head (only one pair of such brackets is shown in Figure 3 for head I as an example) which serve as threaded guides in which two adjusting rods **56** engage. Each head can be adjusted by means of the two adjusting rods so that the distance from needle to needle of the individual heads can be diminished or increased. The embroidery machine heads II and III rest with their base plates **4** on two longitudinal angle members **57** which serve as guide rails and at the same time as carriers for the embroidery machine heads. Since the embroidery machine heads must work in time with one another it is necessary that between the individual bevel gears in the heads and also in the individual couplings **51** and **52** and the coupling shaft **66'** there shall be no back lash.

The embodiments of the present invention illustrated and claimed in the appended claim are not merely applicable to automatic embroidery machines but also to multiple head embroidery machines which are operated by hand by means of pantographs. Moreover it is to be understood that various modifications may be made without departing from the scope of this invention.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

In a multiple head embroidery machine including embroidery frames, means for guiding said frames, said means comprising a carrier bar, guide bearings at the ends of said carrier bar, a frame supporting rod supported in said guide bearings for longitudinal adjustment therein, means for retaining said rod in adjusted position relatively to the carrier bar, resilient embroidery frame holders carried by said rod at the ends thereof and intermediate the ends and extending laterally of the rod in longitudinally spaced relation therealong, the intermediate holders being provided with lateral slots adjacent their free ends, and the end holders being provided with longitudinal slots adjacent their free ends, fastening strips secured to the frames, means carried by the free ends of the fastening strips for securing same to the holders with capacity for angular adjustment of the fastening strips of the end frames, means for uncoupling one of the embroidery heads from the rest, and means to vary the distance between the heads.

ARTHUR ALBRECHT BOHMANN.
KURT GUSTAV SCHEIBEL.