

J. KELLNER & S. WORMS.
 FLAT KNITTING MACHINE.
 APPLICATION FILED APR. 1, 1912.

1,063,453.

Patented June 3, 1913.

5 SHEETS-SHEET 1.

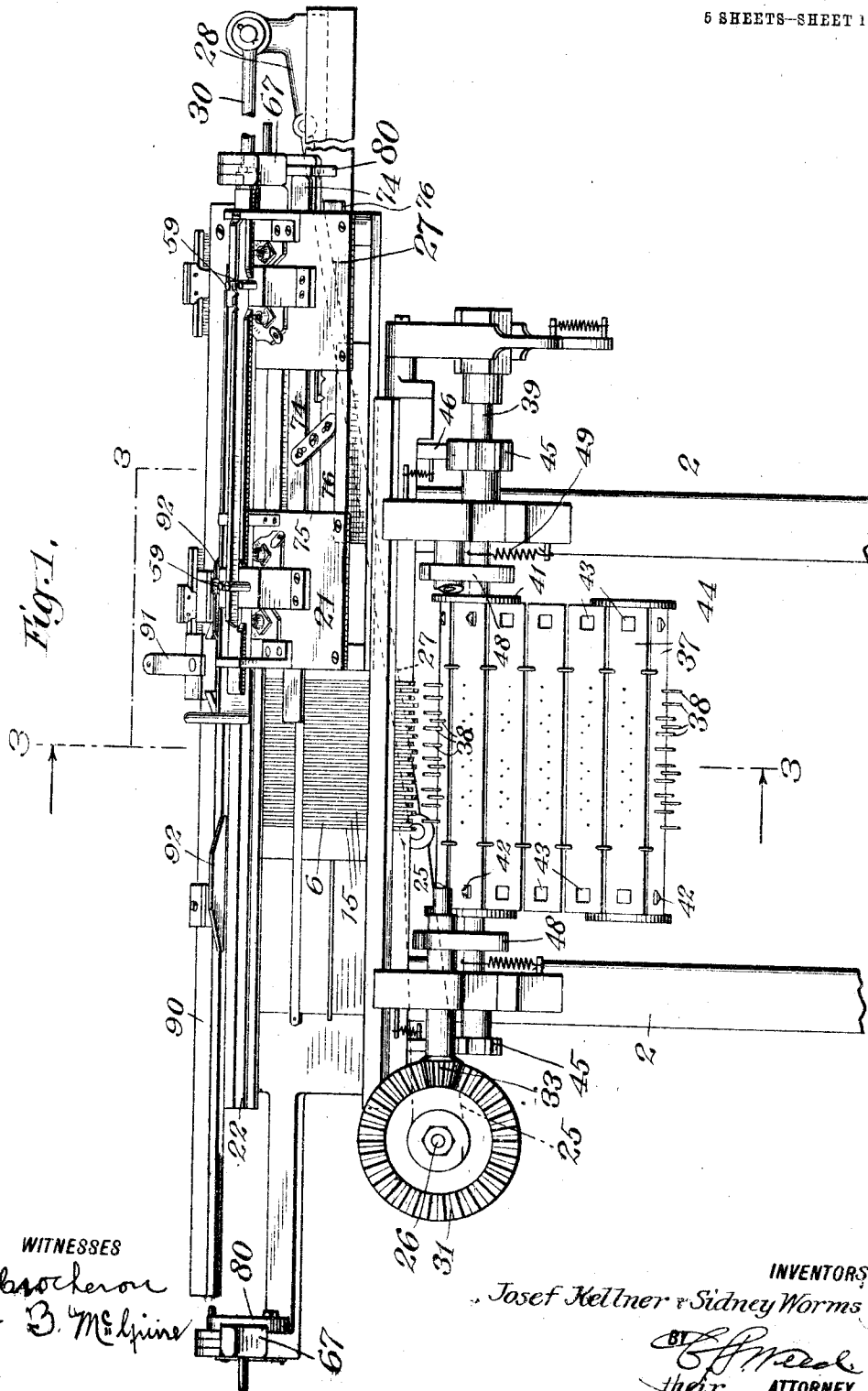


Fig. 1.

WITNESSES
H. Brocheron
J. B. McElpine

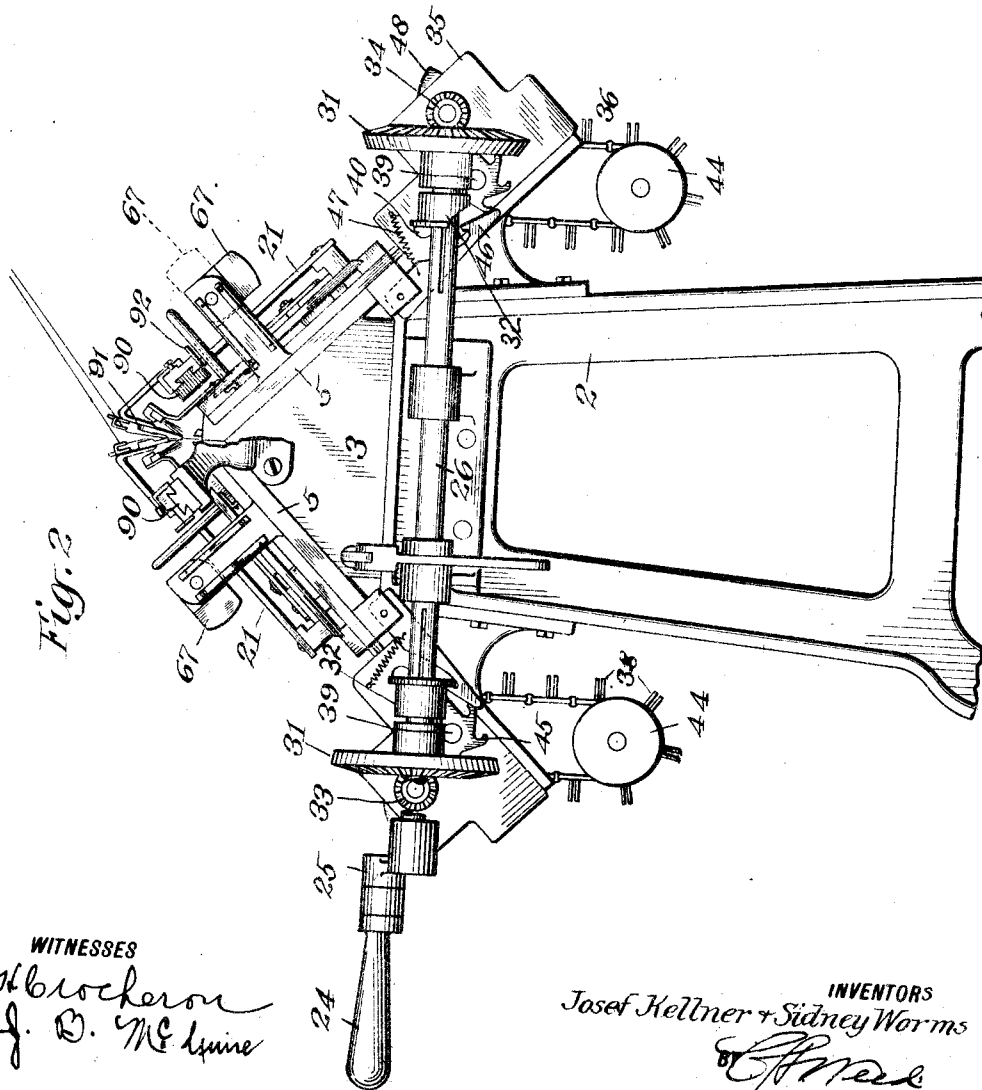
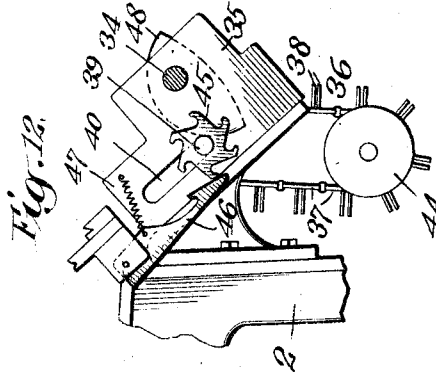
INVENTORS
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 their ATTORNEY

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5 SHEETS—SHEET 2.



WITNESSES

Strocheron
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INVENTORS

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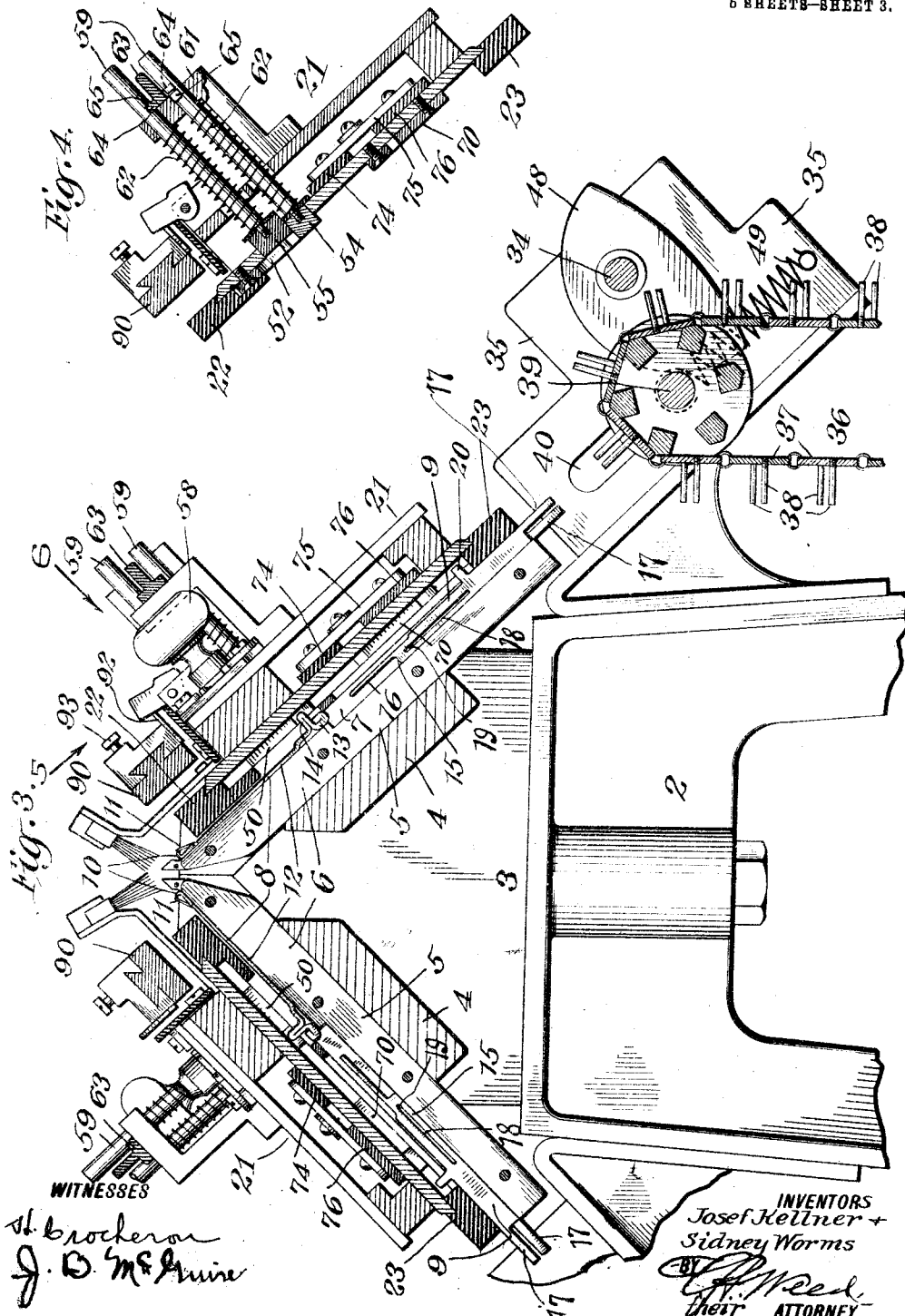
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5 SHEETS—SHEET 3.

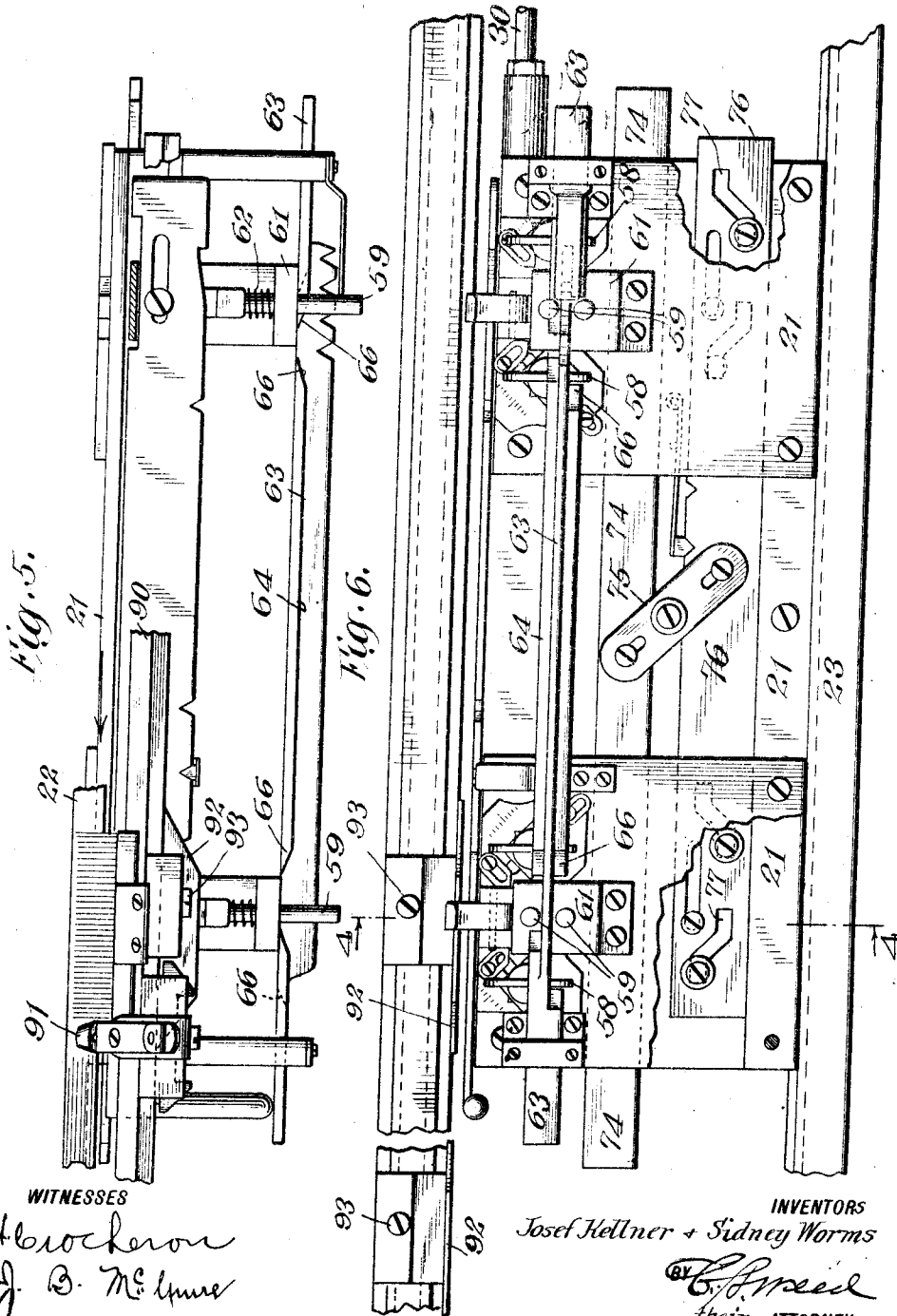


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5 SHEETS—SHEET 4.



WITNESSES
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5 SHEETS-SHEET 5.

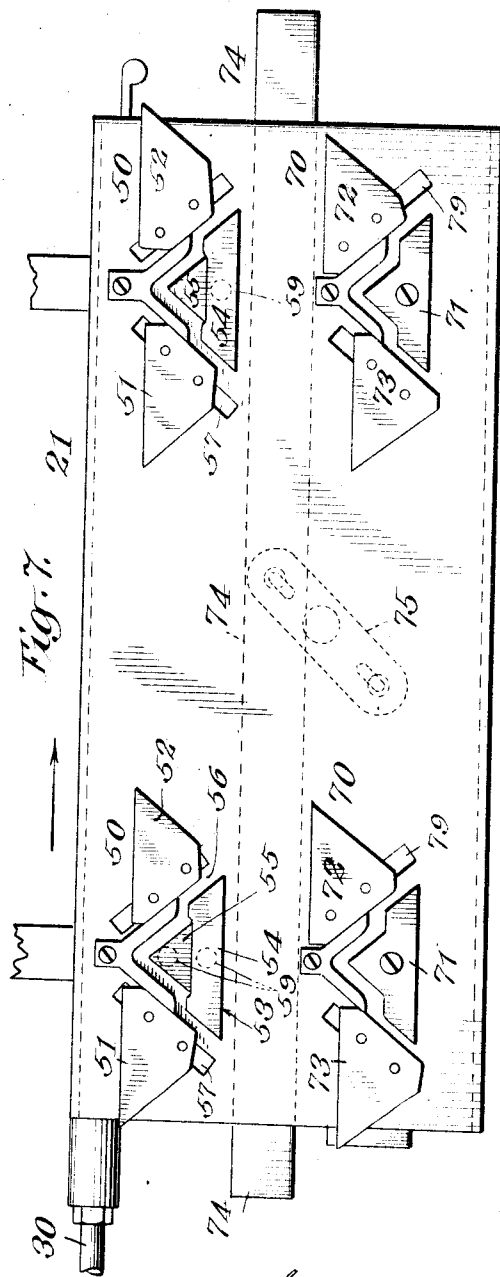


Fig. 7.

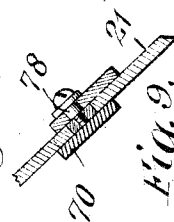


Fig. 11.

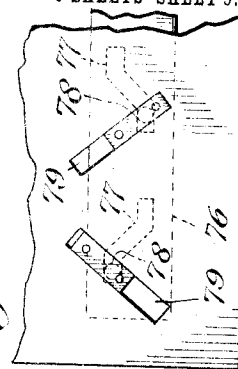


Fig. 9.

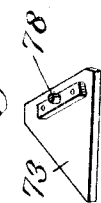
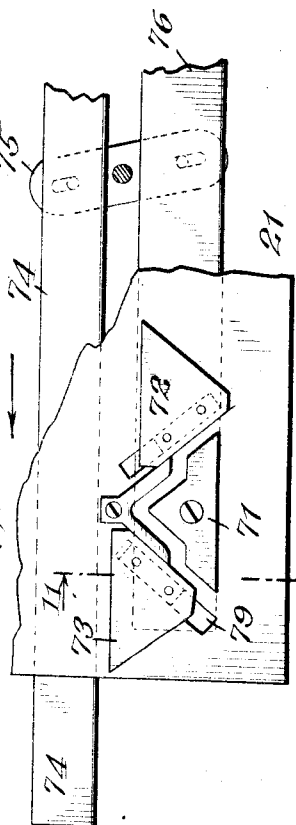


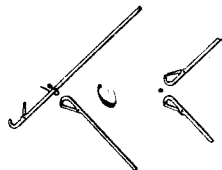
Fig. 10.



WITNESSES
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 J. D. Milne



Fig. 13.



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UNITED STATES PATENT OFFICE.

JOSEF KELLNER, OF BROOKLYN, AND SIDNEY WORMS, OF NEW ROCHELLE, NEW YORK,
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FLAT-KNITTING MACHINE.

1,063,453.

Specification of Letters Patent.

Patented June 3, 1913.

Application filed April 1, 1912. Serial No. 687,564.

To all whom it may concern:

Be it known that we, JOSEF KELLNER, a subject of the Emperor of Germany, and SIDNEY WORMS, a citizen of the United States, residing, respectively, at Brooklyn, in the county of Kings and State of New York, and New Rochelle, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Flat-Knitting Machines, of which the following is a specification.

This invention relates to knitting machines, and more particularly to that class known as flat knitting machines, the object of the invention being to provide an improved machine of this character by means of which the combined knitting needle and helper shown and described in the contemporaneously pending application of Josef Kellner, one of the joint inventors of the present invention, filed February 16, 1912, Serial No. 677,907, may be effectively used, so that by the use of a jacquard mechanism certain of the needles may be pushed or advanced beyond certain companion needles so that in the operation of the machine various designs, according to the setting of the jacquard, may be provided on the article being knit, as for instance a necktie or muffler, or other article adapted to be made on machines of this character.

In the drawings accompanying and forming part of this specification, Figure 1 is a front elevation of this improved machine, showing the carriage at its extreme right hand position and also illustrating the staggered position of the needle helpers; Fig. 2 is a left-hand end view of Fig. 1; Fig. 3 is a cross-sectional view taken on line 3—3 of Fig. 1, assuming the carriage shown in said Fig. 1 to have moved to a central position on the bed of the machine; Fig. 4 is a detail, partly sectional, view of the carriage taken on line 4—4 of Fig. 6, and illustrates more particularly the means for throwing into and out of operation a cam or cam locks, or part thereof, shown at the upper part of Fig. 7; Figs. 5 and 6 are detail views of the carriage viewed respectively in the direction of the arrows 5 and 6 of Fig. 3; Fig. 7 is a bottom plan view of the carriage illustrating the upper and lower set of cams or

cam locks which operate respectively on the needle and needle helpers when the latter are shifted into position by the jacquard mechanism; Fig. 8 is a fragmental view of Fig. 7, showing the lower cam or cam lock in a reverse position from that shown in Fig. 7; Figs. 9, 10 and 11 are detail views of the cam locks and means for operating the same shown in Fig. 8, Fig. 11 being a section taken on line 11—11 of Fig. 8; Fig. 12 is a detail view of a part of the mechanism for actuating the jacquard mechanism; and Fig. 13 is a diagram illustrating four positions of the needle.

Similar characters of reference indicate corresponding parts throughout the figures of the drawings.

In the present embodiment of the machine it comprises two end frames 2, to each of which is securely bolted a head frame 3, which are connected by suitable bed supporting members 4 disposed at an angle of about 45 degrees with the vertical, (see Fig. 3). These angularly disposed supporting members 4 constitute the means for supporting the needle beds 5. From this it will be observed that one side of the machine is a duplicate of the other, and therefore a description of one side of the machine will serve as a complete description of the other.

Each needle bed consists of a number of sheet metal strips 6 located side by side and set edgewise upon the members 4 and bolted together to form guiding channels or ways 7 for guiding the needles 8 and needle helpers 9. While each needle and its helper may be made as an integral structure as shown in the application hereinbefore referred to, in the present embodiment they are shown as separate members. Each needle is of the usual form, having a hook 10, a spoon latch 11 and a shank 12 provided with a tail 13 having a butt 14. In line with the tail of each of these needles and supported in a way of the bed is the needle helper, comprising a relatively thin bar 15 having a forwardly extending tail-engaging end 16 and a rearwardly extending jacquard-engaging end 17. Each of these needle helper bars is provided with a longitudinally extending slot 18 through which a rod 19 passes and by means of which the helper is

guided and prevented from movement in a vertical plane. Each helper is also provided with a butt or projection 20 in position to be engaged by cams or cam locks for shifting the needle helpers and thereby the needles. Since these needle helpers are extremely thin, corresponding in thickness as a rule with the thickness of the needles, and therefore being not much, if any, over a sixty-fourth of an inch in thickness, it follows that if the needle helpers were located side by side where the needles are placed as closely as twelve to the inch, even though spaced apart by the sheet metal strips 6 of the bed, there would be insufficient distance between the helpers to permit the pins of the jacquard mechanism hereinafter described to engage one helper and advance it without danger of such pins also engaging a companion helper unless the pins of the jacquard mechanism were so small that they would not be durable or sufficiently rigid. Consequently the ends of the needle helpers are so formed that the heel or tail ends of each pair are in opposition, that is to say the tail end of one helper is located to project in a plane above that of the other; in other words, they are in staggered relation, this being obtained by rabbeting the ends of each pair in opposite directions, as shown more clearly in Fig. 3, so that the tail ends of the assembled needle helpers are located in alternation or staggered, as it were, whereby the pins of the jacquard mechanism may be made sufficiently large to give them the proper rigidity and durability and at the same time insure that only those particular helpers which it is desired to advance will be engaged by the jacquard pins.

Directly above each needle bed is located a movable carriage 21, being shiftably mounted in dovetailed ways 22 and 23 secured to the frame of the machine. The carriages may be shifted back and forth by any suitable means. In the present instance they are shifted by a crank 24 carried by an arm 25, (see Figs. 1 and 2), the end of which is secured to a shaft 26 journaled on the bed of the machine. The hub of the crank 24 is connected by a connecting rod 27 to a carriage 28 sliding on ways on the bed of the machine, which carriage is in turn connected by rods 30 with the main carriages of the machine. The transverse shaft 26 has at each end thereof a bevel gear 31 carried by a loosely mounted clutch member, with which a clutch member 22 splined to the shaft is adapted to be engaged and which gear 31 meshes with a bevel pinion 33, which pinion is carried on the end of a cam shaft 34 suitably journaled in upright brackets 35 bolted to the sides of the end frames 2. By shifting the splined clutch members the jacquard mechanism is thrown either into or out of action.

The jacquard mechanism, one at each side of the machine consists of an endless member or belt 36 made up of articulated rigid members 37 each adapted to carry a series of jacquard pins 38, (see more particularly Figs. 1 and 3). A shaft 39 has its ends located in elongated slots or ways 40 of the upright brackets so that this shaft can be shifted up and down by the means hereinafter described. Secured to this shaft is a pair of flanged members 41 carrying projections or teeth 42 adapted to engage similarly formed openings 43 in the rigid members or plates of the jacquard belt, thereby to rotate such belt. Suspended below this shaft 39 is a similarly formed pair of flanged members 44 for suitably holding the jacquard in a perpendicular position during its movements. On each end of the shaft 39 is located a ratchet 45, and in position to engage this ratchet is a pawl 46, (see Fig. 12), so that as the shaft 39 is moved upward in the slots of the upright brackets the teeth of the ratchet will be brought into engagement with the pawl, which is provided with a spring 47 for this purpose, and as the shaft 39 is drawn downward the ratchet will be turned, and thereby the shaft 39, one-sixth of a turn to rotate the jacquard belt.

For raising the shaft 39 of the jacquard mechanism, thereby to bring the pins thereof into position to engage the ends of the needle helpers according as the pins of the jacquard are set, the cam shaft 34 carries a pair of suitable cams 48, (see more particularly Figs. 3 and 12), which, by reason of their engagement with the shaft 39, will at certain times cause the upward movement of the jacquard mechanism, suitable springs 49 secured to the shaft 39 and to the brackets holding the shaft in engagement with the cams and also operating to draw the shaft 39, and thereby the jacquard mechanism, downward in a manner which will be readily understood.

The pins of the jacquard, which are provided with threaded ends, will be located to form the desired pattern, and according to the setting of these pins the needle helpers hereinbefore described will be shifted upward into position to be engaged by the cam locks about to be described. As the cams for operating the needles or needle helpers also temporarily lock the same in their shifted positions they have been herein termed cam locks. Each main carriage hereinbefore described is in the present improvement provided with two sets of cam locks 50 and 70 on its underside, (see more particularly Fig. 7), the upper set coöperating with the butts 14 of the needles while the lower set coöperates with the projections or butts 20 of the needle helpers, provided the jacquard pins have thrown the needle helpers into the path of such cams. Each set of

cams 50 and 70, as a matter of fact, comprises in itself a set of cams, one set located adjacent to each end of the carriage, and each set of the top set of cams consists of two outer cam members 51 and 52 and a central cam member 53, which central cam member is made up in two parts or halves 54 and 55, the cam members 51, 52 and 53 being so formed as to provide a suitable way 5 56, shown of triangular form, whereby the needles will be successively projected upward and returned downward to their normal positions in the channels of the needle bed as the main carriage is shifted back and forth across the bed. The two cam parts 54 and 55 are located in an opening of the carriage so that either or both of them may be drawn upward to be flush with the underside of the carriage or to project below the same to form the raceway hereinbefore described. Obviously, when both parts 54 and 55 are drawn upward to be flush with the bottom of the carriage the needles will not be shifted or projected at all but remain in their normal positions, and obviously also 10 when the cam 55 is drawn upward to be flush with the bottom of the carriage the needles will be projected only by that part 54 of the cam 53 and therefore a less distance than is the case when both cam parts 54 and 55 are projected below the carriage. The cam members 51 and 52 are adjustable relatively to the carriage by adjusting them relatively to the slots 57 and clamping them in such adjusted position by thumb nuts 58, (see 15 Figs. 6 and 7). By this adjustment an increased tension may be placed upon the thread loops as may be desired; that is to say, if the cam members are adjusted downwardly in their slots the needles will be retracted a further distance so that the tension on the thread will be increased.

For raising and lowering the cam members or parts 54 and 55 within the opening thereof provided in the carriage, suitable means is provided, (see more particularly Fig. 4). This means comprises a pin or rod 59 secured to each of the cam part members 54 and 55 and suitably supported 20 for reciprocatory movement in a bracket 61 carried by the carriage. Located on each of the pins is a spring 62 for normally holding the cam members in their lowered position below the bottom of the carriage. To raise the pins and thereby the cams to throw either one or both of them out of action suitable means is provided. This comprises a T-shaped bar 63 carried by and movable with the carriage and located above the brackets supporting the upper ends of the cam pins or rods and also having a sliding movement relatively to the carriage. The flanges 64 of this bar extend into notches 65 of the rods or pins and the flanges are provided with notched cam surfaces 66 which

coöperate with the notched walls of the pins to raise the pins, these cam surfaces being so located as to alternately raise and lower the two cam members 55 of the upper sets of cams during the ordinary knitting operation of the machine, this being accomplished by providing at each end of the bed of the machine a shiftable dog 67, which when shifted downward in the position shown in Fig. 2 for instance,—the dotted line showing its position when shifted upward out of the way,—this bar will be shifted relatively to the carriage as the same reaches the end of its movement on the needle bed in a manner which will be readily understood. When, however, it is desired to use the jacquard mechanism, the shiftable dog 67 will be thrown upward and the T-shaped bar 63 will be manipulated so as to raise both of the cam members 55 of the upper set of cams and throw them entirely out of action. Consequently, as only the cam members 54 are left in position below the bottom of the carriage the needles will be projected by these cam members 54 only a predetermined distance, less than that which they would be projected if the cam members 55 were in action. The lower set of cam locks 70 likewise comprises two sets of such devices located on the bottom of the carriage, and each set comprises a central cam 71 of triangular shape and a pair of triangular shaped side cams 72 and 73. This central cam 71 has substantially the same shape as the two central cams 54 and 55 of the upper set of cam locks, and the side cams 72 and 73 have substantially the same shape as the side cams 51 and 52 of the upper set of cam locks, so that a similar triangular raceway for the butts of the needle helpers is formed. 105

When the jacquard mechanism is inoperative it will be apparent that as the carriage moves from end to end of the needle bed all of the needles will be successively at certain times projected upward by means of the cams 54 and 55. When the jacquard mechanism, however, is used, as the cams 55 are thrown entirely out of operation it follows that while ordinarily the cams 71 would project the needles by means of the needle helpers in precisely the same way as when the two cams 54 and 55 are in operation, yet this cam 71 will project only those needles selected by the jacquard. That is to say, when the jacquard is not in use and the needles are being projected by means of the cam locks 54 and 55 each needle of the bank or gang of needles will be successively projected by the coöperation of the two cams 54 and 55 a certain distance, and while the cam 71 will project the needles, through the medium of the needle helpers, the same distance as do both cams 54 and 55, yet the cam 71 will project only those needles which

are selected by the jacquard instead of all of them successively as when the jacquard is not used.

Each cam 71 is a fixed cam secured to the underside of the needle carriage, while the cams 72 and 73 are automatically shiftable cams. These cams are shiftable by means of a lever or bar 74 linked by links 75 to a lever or bar 76, which bar 76 is provided with slots 77, (see Fig. 9), for the reception of pins 78 carried by the cams 72 and 73, and which pins are carried by blocks mounted in inclined slots 79 in the bottom of the carriage. The two bars 74 and 76 are carried by the carriage and are movable therewith and also have a movement relative to the carriage as the carriage reaches the end of its movement. This movement relative to the carriage is obtained by providing a fixed stop 80 at each end of the machine, which, as the carriage reaches the end of its movement, engages the bar 74 and shifts the same and thereby, through the medium of the links 75, shifts the bar 76 and so moves one side cam down and the other up. In Fig. 7 the two side cams 73 are shown down while the two side cams 72 are shown up, while in Fig. 8 the side cam 72 is shown down while the side cam 73 is shown up, the two side cams being thus alternately shifted according to the direction of movement of the carriage, and in the present machine when the carriage reaches the right-hand end of the machine the cam 73, Fig. 7, will be shifted upwardly and when the carriage reaches the left-hand end of the machine the side cams 72 will be shifted upwardly. This alternating movement of the side cams 72 and 73 is for the purpose of insuring the proper operation of the needle helpers; for instance, viewing Fig. 7, if the two side cams 72 were down instead of in the position shown, when the carriage is moving in the direction of the arrow, said Fig. 7, the tendency of the cams would be to repel the helpers instead of raising them to shift the needles, but by having the side cams in their upward position when the jacquard has shifted the needle helpers to bring the butts thereof into position to be engaged and received in the raceway at the right hand of each set of cams they will properly enter the raceway, so that the helpers will be projected still farther and so project the needles the proper distance. Furthermore, by having the side cams 73 lowered, as at the left in Fig. 7, when the projections or butts of the needle helpers have run through the raceway they will be shifted sufficiently far downward or below the cam locks so as to be out of the way during the movement of the carriage.

It will be understood, of course, that only those needle helpers that are selected by the jacquard mechanism and shifted thereby to

bring the butts thereof into position to be engaged and operated by the needle helper cam locks will be shifted by such cam locks, the remaining needle helpers being left inoperative. In other words, the jacquard mechanism selects certain needle helpers and shifts them upward to bring their butts into the path of the cam locks, which thereupon, by reason of the formation thereof, further project the needle helpers upward so as to engage the tails of the needles and project them the required distance.

At the top of the carriage, (see Figs. 2 and 3), is located a dovetailed bar 90, on which is slidably mounted a thread guide 91, the movement thereof being limited by a pair of cams 92, one at each end, held in their set positions by suitable screws 93. The thread guide slides back and forth with the carriage and is thrown out of action at the end of each stroke by means of the cam stoppers just described.

In the operation of the machine, the needles shown in Fig. 13 are operated in the following manner: As the carriage moves across the bed or bank of needles, if the machine is operating in the ordinary manner with the jacquard inoperative, each needle will be successively projected upwardly by the cam 54 of the cam locks to engage a thread, as at *b*, Fig. 13, and on its return by the same cam 54 form a loop, as at *a*, Fig. 13. As the carriage is again shifted the cams 55 are alternately thrown into position, which thus throws the needles which have previously caught a thread and formed a loop somewhat higher, as shown at *c*, Fig. 13. This causes the first loop to pass down the shank of the needle to a point below the latch, so that as the needle is returned to its normal position, forming a second loop, the first loop will be cast off. This is also the operation of the lower set of cam locks when the jacquard is in operation, except that only those needles which are selected by the jacquard will be operated in the manner described to the position shown at *c*, Fig. 13, the other needles being operated to the position *b*, Fig. 12, by the cams 54, since the other cams 55 of the upper set are at this time entirely out of operation. When the jacquard is thrown into operation the upper triangular cams 55 are, as just stated, thrown entirely out of operation, in consequence of which a certain selected few of the needles will, by means of their helpers, be pushed up to the position shown at *c*, Fig. 13, while the other needles of the bank or series of needles will be only operated to the height to which they ordinarily would be operated by the cams 54 of the upper set of cam locks. By thus projecting the needles selected by the jacquard mechanism, and by setting the jacquard according to certain designs or patterns, it

will be obvious that a similar design or pattern will be formed on the article being knit. For instance, if the pins of the jacquard are set to form a triangular shaped figure then the knitted article will have at certain points therein a triangular shaped figure.

From the foregoing it will be observed that by staggering the needle helpers we are able to dispose at least eighteen or more needles and needle helpers to the inch arranged in the manner shown herein, whereas heretofore in jacquard machines it has only been possible to dispose twelve needles to the inch, and also by making the bed of the machine somewhat deeper and the needle helpers somewhat wider the space between the tails of the needle helpers will be increased, thus permitting the pins, or holes as the case may be, of the jacquard cards to be spaced farther apart. By staggering the needle helpers in the manner shown and described a much finer stitch is obtained, and therefore a much finer and better piece of work results. So that, by arranging the needle helpers in the manner described, not only is this advantage obtained, but the further advantage is obtained that the pins of the jacquard cards or members may be made sufficiently large and rigid to do their proper work without danger of each jacquard pin striking any but the proper helper. From the foregoing it will also be observed that in the present improvement, when one of the jacquard cards has been shifted to position certain of the needle helpers according to the pattern, and the carriage, (see Fig. 7), is moving to the right as indicated by the arrow, the cam locks at the right hand side will shift upwardly those particular needle helpers which have been selected by the jacquard card and will retract such helpers in the manner hereinbefore described as the cam locks pass over the butts of the selected needle helpers. As the cam lock at the right of the needle carriage passes over the butts of the selected needle helpers it leaves them in their retracted or inoperative position as hereinbefore described, whereupon the jacquard mechanism is moved so that a succeeding card will operate either the same or a different set of needle helpers into position, in other words will select the particular needle helpers according to the pattern of the jacquard, and these succeeding set of needle helpers will then be operated by the cam lock at the left of the carriage in precisely the same manner. Thus the present improvement furnishes a double lock jacquard machine by means of which various patterns, according to the pattern for which the jacquard is set, may be obtained.

We claim as our invention:

1. In a knitting machine of the class described, the combination of a needle bed, a

bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and duplicate and spaced means carried thereby for shifting the needle helpers selected by the jacquard mechanism thereby to project the needles.

2. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and means carried thereby for shifting the needle helpers selected by the jacquard mechanism thereby to project the needles, said helpers having their jacquard engaging ends located in staggered relation.

3. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and a double set of spaced cam locks carried thereby for shifting the needle helpers selected by the jacquard mechanism thereby to project the needles.

4. A knitting machine constructed to knit a fabric having a fancy design therein and comprising a bank of needles, means for successively projecting all of said needles during the knitting of a portion of said fabric, means for selecting certain of said needles at a predetermined time and effective to select any of the needles of the bank of needles according to the design to be knit, and means for successively projecting the so selected needles a predetermined distance beyond the normal path of projection of the unselected needles.

5. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and a plurality of spaced means each comprising a fixed cam and a pair of movable side cams carried by said carriage for shifting the needle helpers selected by the jacquard mechanism thereby to project the needles.

6. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, a plurality of spaced means each comprising a fixed cam and a pair of movable side cams carried by said carriage for shifting the needle helpers selected by the jacquard mechanism thereby to project the needles, and means for automatically shifting the side cams alternately into different positions.

7. A knitting machine constructed to knit an iridescent fabric having a fancy design

therein and comprising a bank of needles, means for successively projecting all of said needles a plurality of times during the knitting of a portion of said fabric, means for selecting certain of said needles at a predetermined time and effective to select any of the needles of the bank of needles according to the design to be knit, and means for successively projecting the so selected needles a plurality of times a predetermined distance beyond the normal path of projection of the unselected needles.

8. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, means comprising a fixed cam and a pair of movable side cams carried by said carriage for shifting the needle helpers selected by the jacquard mechanism thereby to project the needles, and means for automatically shifting the side cams alternately into different positions and comprising shiftable means movable with the carriage and also independently thereof and consisting of a pair of linked bars one having cam slots cooperating with the side cams and dogs in position to engage the other of said bars.

9. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and a plurality of automatically shiftable spaced means carried by the carriage and movable relatively thereto for successively shifting the needle helpers selected by the jacquard mechanism thereby to project the needles.

10. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and a double set of upper and a double set of lower cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers.

11. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and an upper and a lower set of cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, said helpers having their jacquard engaging ends located in staggered relation.

12. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and a double set of upper and

able carriage, and a double set of upper and a double set of lower cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, the upper set of cam locks comprising a pair of side cams and a central cam.

13. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and a double set of upper and a double set of lower cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, the upper set of cam locks comprising a pair of adjustable side cams and a central cam.

14. A knitting machine constructed to knit an iridescent fabric having a fancy design therein and comprising a bank of needles all of the same length and a bank of needle helpers cooperating with said needles, means for successively projecting a plurality of times all of said needles during the knitting of a portion of said fabric, means for selecting through the medium of said helpers certain of said needles at a predetermined time and effective to select any of the needles of said bank of needles according to the design to be knit, and means for projecting a plurality of times the selected needles a predetermined distance beyond the normal path of projection of the companion needles.

15. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, an upper and a lower set of cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, both sets of cam locks comprising a pair of shiftable side cams and a central cam, and means for automatically shifting the side cams of the lower set.

16. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, an upper and a lower set of cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, the upper set of cam locks comprising two sets of cam members, each set comprising a pair of side cams and a central cam one shiftable relatively to the other, and means for automatically and alternately shifting said shiftable central cams.

17. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and a double set of upper and

able carriage, an upper and a lower set of cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, the upper set of cam locks comprising two sets of cam members, each set comprising a pair of side cams and a central cam one shiftable relatively to the other, means for automatically and alternately shifting said shiftable central cams, and means for throwing both of said shiftable central cams out of operation.

18. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and a double set of upper and a double set of lower cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, said upper and lower sets of cam locks each comprising a pair of side cams and a central cam.

19. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, a double set of upper and a double set of lower cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, said upper and lower sets of cam locks each comprising a pair of side cams and a central cam, and means for adjusting the side cams of the upper set.

20. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, a double set of upper and a double set of lower cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, said upper and lower sets of cam locks each comprising a pair of side cams and a central cam, and means for automatically shifting the side cams of the lower set.

21. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, a double set of upper and a double set of lower cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, said upper and lower sets of cam locks each comprising a pair of side cams and a central cam, means for adjusting the side cams of the upper set, and means for automatically shifting the side cams of the lower set.

22. In a knitting machine of the class described, the combination of a needle bed,

a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, a double set of upper and a double set of lower cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, each set of cam locks comprising a pair of side cams and a central cam, and means for automatically shifting the central cam of the upper set into and out of its working position.

23. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, a double set of upper and a double set of lower cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, each set of cam locks comprising a pair of side cams and a central cam, means for automatically shifting the central cam of the upper set into and out of its working position, and means for automatically shifting the side cams of the lower set.

24. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, a double set of upper and a double set of lower cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, each set of cam locks comprising a central cam and a pair of side cams, the central cam of the upper set comprising a pair of shiftable members, and means for shifting them.

25. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, a double set of upper and a double set of lower cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, each set of cam locks comprising a central cam and a pair of side cams, the central cam of the upper set comprising a pair of shiftable members and means for shifting them, the side cams of the lower set supported for shiftable movement relatively to the central cam, and means for automatically shifting them into alternate positions.

26. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, a double set of upper and a double set of lower cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers,

each set of cam locks comprising two sets of cams, each set comprising a central cam and a pair of side cams, the central cams of each upper set consisting of a pair of shiftable cams, means for automatically shifting one 5 cam of each central cam of the upper set alternately into their working positions, and means for automatically shifting the side cams of each lower set.

10 27. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selectively engaging and positioning the needle help- 15 ers, means for rotating the jacquard mechanism and for raising and lowering it thereby to engage the needle helpers, a shiftable carriage, and means carried thereby for shifting the needle helpers selected by the 20 jacquard mechanism thereby to project the needles.

28. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried 25 thereby, jacquard mechanism for selecting and positioning the needle helpers, means for rotating the jacquard mechanism and for raising and lowering it thereby to engage the needle helpers, a shiftable carriage, 30 and means carried thereby for shifting the needle helpers selected by the jacquard mechanism thereby to project the needles, said helpers having their jacquard engaging ends located in staggered relation.

35 29. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a 40 shiftable carriage, means carried thereby for shifting the needle helpers selected by the jacquard mechanism thereby to project the needles, said helpers having their jacquard engaging ends located in staggered relation, and means for guiding the needle 45 helpers.

30. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried 50 thereby, jacquard mechanism for selecting and positioning the needle helpers, means for rotating the jacquard mechanism and for raising and lowering it, a shiftable carriage, and an upper and lower set of cam 55 locks carried by the carriage for respectively engaging and shifting the needles and needle helpers.

31. In a knitting machine of the class described, the combination of a needle bed, a 60 bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, means for rotating the jacquard mechanism and for raising and lowering it, a shiftable car-

riage, and an upper and lower set of cam 65 locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, said needle helpers having their jacquard engaging ends located in staggered relation. 70

32. In a knitting machine of the class described, the combination of a needle bed, a bank of needle helpers carried thereby, a jacquard for directly and selectively engag- 75 ing the ends of and positioning the needle helpers, a shiftable carriage, and means carried by the carriage for engaging and shifting the needle helpers selected by the jacquard mechanism.

33. In a knitting machine of the class de- 80 scribed, the combination of a needle bed, a bank of needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and a double set of cam locks carried by the 85 carriage for engaging and shifting the needle helpers selected by the jacquard mechanism.

34. A knitting machine constructed to knit an iridescent fabric having a fancy de- 90 sign therein and comprising a bank of needles all of the same length and a bank of needle helpers cooperating with said needles, means for successively projecting a plu- 95 rality of times all of said needles during the knitting of a portion of said fabric, means for selecting through the medium of said helpers certain of said needles at a prede- 100 termined time and effective to select any of the needles of said bank of needles according to the design to be knit, and means for projecting a plurality of times the selected needles a predetermined distance beyond the normal path of projection of the companion 105 needles, said needle helpers having staggered ends for cooperation with said selecting means.

35. In a knitting machine of the class described, the combination of a needle bed, a bank of needle helpers carried thereby, jac- 110 quard mechanism for selecting and positioning the needle helpers, a shiftable carriage, cam locks carried by the carriage for engaging and shifting the needle helpers selected by the jacquard mechanism, said cam locks 115 comprising a central cam and a pair of shiftable side cams, and means for automatically shifting them.

36. In a knitting machine of the class described, the combination of a needle bed, 120 a bank of needle helpers carried thereby each having a butt and a projecting tail, the tails of said helpers being located in staggered relation, jacquard mechanism for selecting and positioning the needle helpers, 125 a shiftable carriage, and means carried thereby for engaging the helper butts to shift the helpers.

37. In a knitting machine of the class described, the combination of a needle bed, a bank of needle helpers carried thereby each having a butt and a projecting tail, the tails of said helpers being located in staggered relation, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, means carried thereby for engaging the helper butts to shift the helpers, said means comprising a set of cam locks comprising a centrally located cam and a pair of shiftable side cams, and means for automatically shifting said side cams into alternately different positions.

38. In a knitting machine of the class described, the combination of a bank of needle helpers, jacquard mechanism for selectively engaging and positioning the needle helpers and supported for rotary and reciprocatory movement, means for reciprocating said jacquard mechanism and means for rotating it on the reciprocation thereof, a shiftable carriage, and means carried thereby for shifting the needle helpers selected by the jacquard mechanism.

39. In a knitting machine of the class described, the combination of a bank of sliding needle helpers, jacquard mechanism for selecting and positioning the needle helpers and supported for rotary and reciprocatory movement, means for reciprocating said jacquard mechanism and means for rotating it on the reciprocation thereof, a shiftable carriage, means carried thereby for shifting the needle helpers selected by the jacquard mechanism, and means for shifting the carriage and simultaneously operating the jacquard mechanism.

40. In a knitting machine of the class described, the combination of a bank of needle helpers, jacquard mechanism for selecting and positioning the needle helpers and supported for rotary and reciprocatory movement, means for reciprocating said jacquard mechanism and means for rotating it on the reciprocation thereof, a shiftable carriage, means carried thereby for shifting the needle helpers selected by the jacquard mechanism, and means for shifting the carriage and simultaneously operating the jacquard mechanism, said means including a shaft and gearing connecting said shaft to the jacquard mechanism.

41. In a knitting machine of the class described, the combination of a bank of needle helpers, jacquard mechanism for selecting and positioning the needle helpers and supported for rotary and reciprocatory movement, means for reciprocating said jacquard mechanism and means for rotating it on the reciprocation thereof, a shiftable carriage, means carried thereby for shifting the needle helpers selected by the jacquard mechanism, and means for shifting the carriage

and simultaneously operating the jacquard mechanism, said means including a shaft, gearing connecting said shaft to the jacquard mechanism, a cam shaft and a cam.

42. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, an upper and lower set of cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, and means for throwing certain of the cam locks out of operation.

43. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, an upper and lower set of cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, each upper set of cam locks including a pair of shiftable cams, and means for throwing one cam of each pair out of operation during the operation of the jacquard mechanism.

44. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, an upper and lower set of cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, each upper set of cam locks including a pair of shiftable cams, means for throwing one cam of each pair out of operation during the operation of the jacquard mechanism, and means for automatically shifting some of the lower set of cam locks during the shifting movement of the carriage.

45. A knitting machine constructed to knit an iridescent fabric having a fancy design therein and comprising a bank of needles all of the same length and a bank of needle helpers cooperating with said needles, means for successively projecting a plurality of times all of said needles during the knitting of a portion of said fabric, means for selecting through the medium of said helpers certain of said needles at a predetermined time and effective to select any of the needles of said bank of needles according to the design to be knit, and means for projecting a plurality of times the selected needles a predetermined distance beyond the normal path of projection of the companion needles, said needle helpers having guiding slots and means located therein for guiding said helpers.

46. In a knitting machine of the class described, the combination of a needle bed, a

bank of needles carried thereby, a shiftable carriage, means carried thereby for shifting the needles thereby to project them and comprising a set of cam locks comprising a centrally located cam and a pair of side cams, said centrally located cam comprising a pair of shiftable cams and means for raising and lowering both of said central cams or one of them independently of the other and comprising a pair of reciprocatory pins connected with said cams and a sliding member having cam surfaces cooperating with said pins.

17. In a knitting machine of the class described, the combination of a needle bed, a bank of needles carried thereby, a shiftable carriage, means carried thereby for shifting the needles thereby to project them and comprising a set of cam locks comprising a centrally located cam and a pair of side cams, said centrally located cam comprising a pair of shiftable cams, means for raising and lowering both of said central cams or one of them independently of the other and comprising a pair of reciprocatory pins connected with said cams and a sliding member having cam surfaces cooperating with said pins, a bank of needle helpers also carried by said bed in position to engage the needles, a set of cam locks carried by said carriage and operative to shift the needle helpers, and means for selecting the needle helpers.

18. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and a bank of needle helpers carried thereby, means for selecting and positioning the needle helpers, a shiftable carriage, and means carried thereby for respectively engaging and shifting the needles and needle helpers.

49. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and a bank of needle helpers carried thereby, means for selecting and positioning the needle helpers, a shiftable carriage, and means carried thereby for respectively engaging and shifting the needles and needle helpers and comprising two sets of double cam locks.

50. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and a bank of needle helpers carried thereby, means for selecting and positioning the needle helpers, a shiftable carriage, and means carried thereby for respectively engaging and shifting the needles and needle helpers and comprising two sets of double cam locks, one set having a part thereof adjustable.

51. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and a bank of needle helpers carried thereby, means for selecting and positioning the needle helpers, a shiftable carriage, and means carried thereby for re-

spectively engaging and shifting the needles and needle helpers and comprising two sets of double cam locks, one set having a part thereof shiftable into and out of their working position.

52. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and a bank of needle helpers carried thereby, means for selecting and positioning the needle helpers, a shiftable carriage, and means carried thereby for respectively engaging and shifting the needles and needle helpers and comprising two sets of double cam locks, one set having a part thereof automatically shiftable.

53. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and a bank of needle helpers carried thereby, means for selecting and positioning the needle helpers, a shiftable carriage, an upper and a lower set of cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, each set comprising duplicate sets of cam locks and each set of cam locks comprising a centrally located cam and a pair of side cams forming a triangular raceway, the side cams of the upper sets of cam locks supported for adjustability and the centrally located cams of the upper sets of cam locks supported for shiftable movement into and out of their working positions, means for shifting either or both of said central cams into and out of their working positions, the side cams of the lower sets of cam locks supported for shiftable movement, and means for automatically shifting said lower side cams to lower one of each set while the other is being raised.

54. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and a bank of needle helpers carried thereby, means for selecting and positioning the needle helpers, a shiftable carriage, an upper and a lower set of cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, each set comprising duplicate sets of cam locks and each set of cam locks comprising a centrally located cam and a pair of side cams forming a triangular raceway, the side cams of the upper sets of cam locks supported for adjustability and the centrally located cams of the upper sets of cam locks supported for shiftable movement into and out of their working positions, means for shifting either or both of said centrally located cams into and out of their working positions, the side cams of the lower sets of cam locks supported for shiftable movement, and means for automatically shifting said lower side cams to lower one of each set while the other is being raised, the said needle helpers having their tail ends located in staggered relation.

55. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and a bank of needle helpers carried thereby, means for selecting and positioning the needle helpers, a shiftable carriage, an upper and a lower set of cam locks carried by the carriage for respectively engaging and shifting the needles and needle helpers, each set comprising duplicate sets of cam locks and each set of cam locks comprising a centrally located cam and a pair of side cams forming a triangular raceway, the side cams of the upper sets of cam locks supported for adjustability and the centrally located cams of the upper sets of cam locks supported for shiftable movement into and out of their working positions, means for shifting either or both of said centrally located cams into and out of their working positions the side cams of the lower sets of cam locks supported for shiftable movement, and means for automatically shifting said lower side cams to lower one of each set while the other is being raised, the said needle helpers having their tail ends located in staggered relation and each of said needles and needle helpers having a projection or butt in position to be engaged by the cam locks.

56. A knitting machine constructed to knit an iridescent fabric having a fancy design therein and comprising a bank of needles all of the same length and a bank of needle helpers cooperating with said needles, means for successively projecting a plurality of times all of said needles during the knitting of a portion of said fabric, means for selecting through the medium of said helpers certain of said needles at a predetermined time and effective to select any of the needles of said bank of needles according to the design to be knit, and means for projecting a plurality of times the selected needles a predetermined distance beyond the normal path of projection of the companion needles, said needle helpers having staggered ends for cooperation with said selecting means and also having guiding slots and means located therein for guiding said helpers.

57. In a knitting machine of the class described, the combination of a needle bed, a bank of needles, jacquard mechanism for positioning the needles, a shiftable carriage, a plurality of sets of cam locks carried by said carriage for shifting the needles selected by the jacquard mechanism, and means for operating the jacquard mechanism thereby to position the needles a plurality of times during each shifting movement of the carriage.

58. In a knitting machine of the class described, the combination of a needle bed, a bank of needles, a bank of needle helpers, jacquard mechanism for positioning the

needle helpers, a shiftable carriage, a plurality of sets of cam locks carried by said carriage for shifting the needle helpers selected by the jacquard mechanism, and means for operating the jacquard mechanism thereby to position the needle helpers a plurality of times during each shifting movement of the carriage.

59. In a knitting machine of the class described, the combination of a needle bed, a bank of needles, a bank of needle helpers provided with tails located in staggered relation, jacquard mechanism comprising a series of cards for selecting and positioning the needle helpers, a shiftable carriage, a plurality of sets of cam locks carried by said carriage for shifting the needle helpers selected by the jacquard mechanism, and means for operating the jacquard mechanism whereby one of said cards will select a series of needle helpers for the operation of one set of said cam locks and a succeeding card will select the same or a different series of needle helpers for another set of said cam locks.

60. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and means carried thereby for shifting the needle helpers selected by the jacquard mechanism thereby to project the needles, said helpers having their jacquard engaging ends located in staggered relation and also having slots and means projecting through said slots for guiding said helpers.

61. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and duplicate and spaced means carried thereby for shifting the needle helpers selected by the jacquard mechanism thereby to project the needles, said helpers having staggered ends.

62. In a knitting machine of the class described, the combination of a needle bed, a bank of needles and needle helpers carried thereby, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, and duplicate and spaced means carried thereby for shifting the needle helpers selected by the jacquard mechanism thereby to project the needles, said helpers having slots and means projecting therethrough for guiding the helpers.

63. In a knitting machine of the class described, the combination of a needle bed, a bank of needles, a bank of needle helpers, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, a plurality of sets of cam locks carried thereby for shifting the needles, a plu-

5 rality of sets of cam locks also carried by said carriage for shifting the needle helpers selected by the jacquard mechanism, said needle helpers having staggered ends co-

10 64. In a knitting machine of the class described, the combination of a needle bed, a bank of needles, a bank of needle helpers, jacquard mechanism for selecting and positioning the needle helpers, a shiftable carriage, a plurality of sets of cam locks carried thereby for shifting the needles, a plu-

15 rality of sets of cam locks also carried by said carriage for shifting the needle helpers selected by the jacquard mechanism, said needle helpers having staggered ends cooperating with said jacquard mechanism and also having slots and means projecting therethrough for guiding said helpers.

20 Signed at 1821 Park Row Building, New York, N. Y., this 30th day of March 1912.

JOSEF KELLNER.
SIDNEY WORMS.

Witnesses:

C. S. WEED,
F. E. BOYCE.