

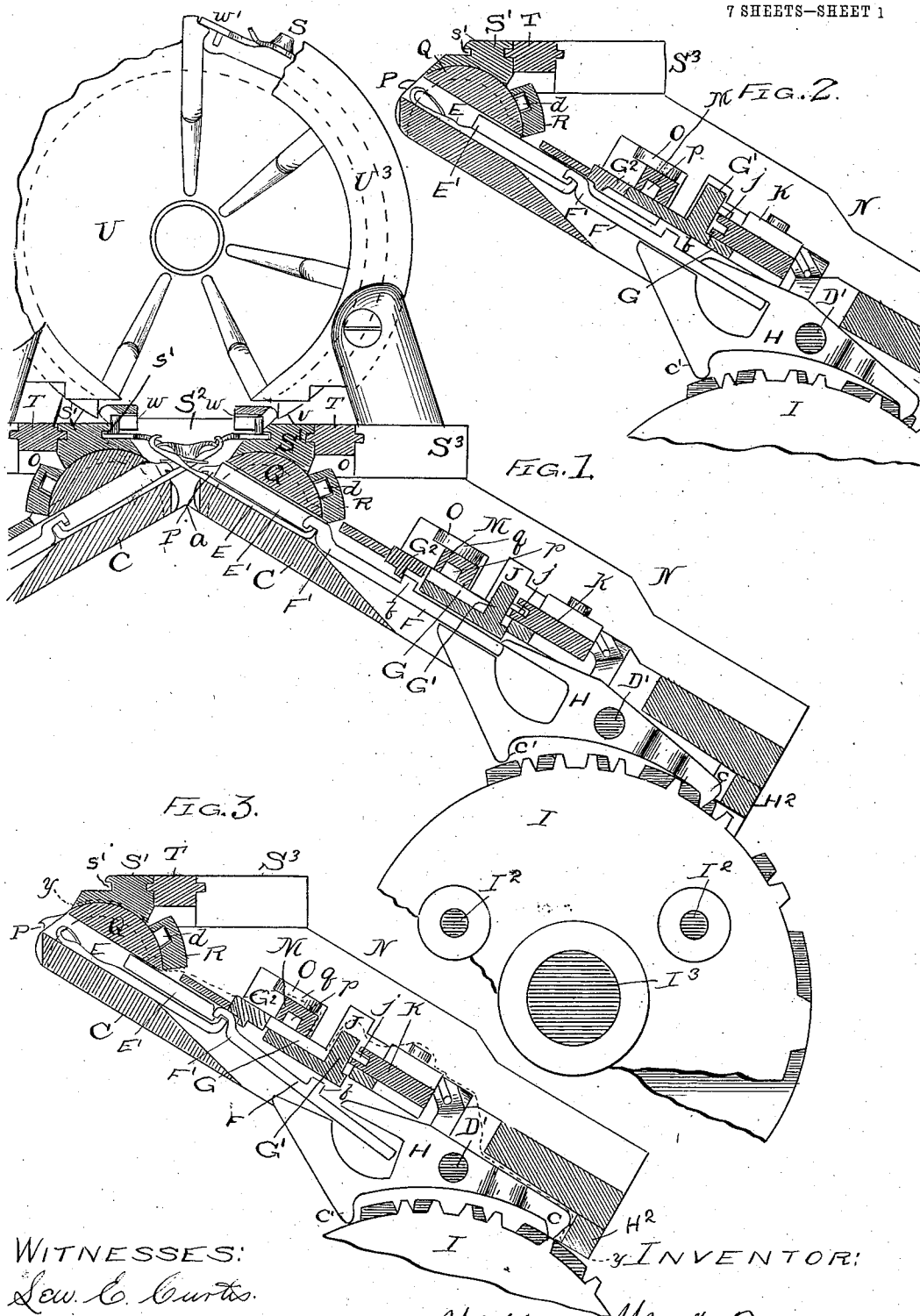
No. 819,407.

PATENTED MAY 1, 1906

W. W. BURSON.
PATTERN KNITTING MACHINE.

APPLICATION FILED DEC. 30, 1895.

7 SHEETS—SHEET 1



WITNESSES:
 Lew. C. Curtis.
 Edw. S. Evans

William Worth Benson.

No. 819,407.

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PATTERN KNITTING MACHINE.

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7 SHEETS—SHEET 2.

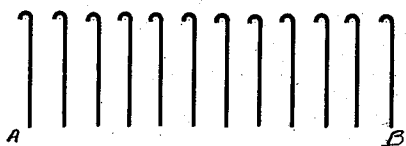
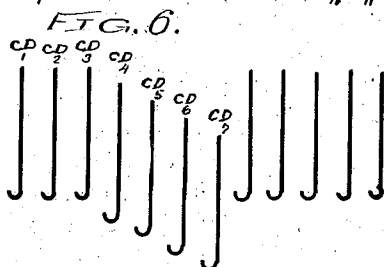
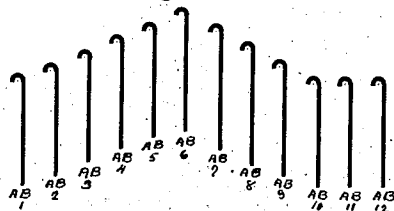
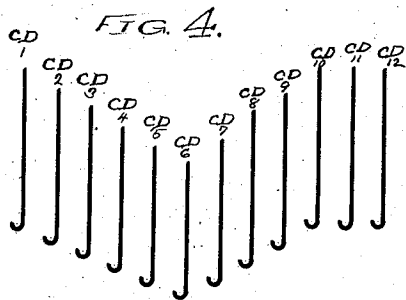
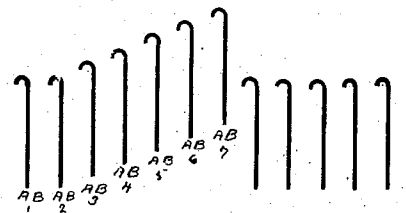


FIG. 8.



WITNESSES:

Edd. S. Evans
Lew. E. Curtis

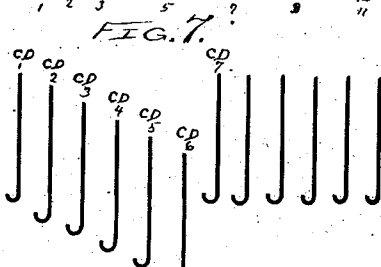
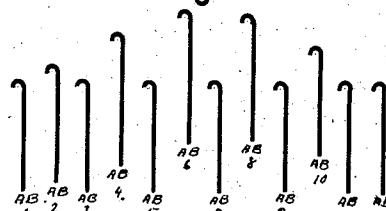
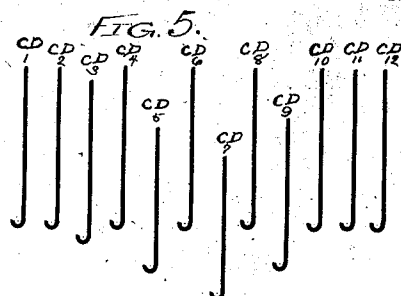
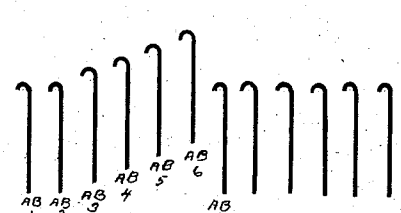
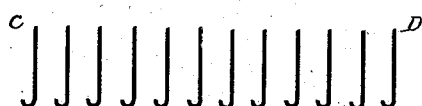


FIG. 9.



INVENTOR:

William W. Burson

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7 SHEETS—SHEET 3.

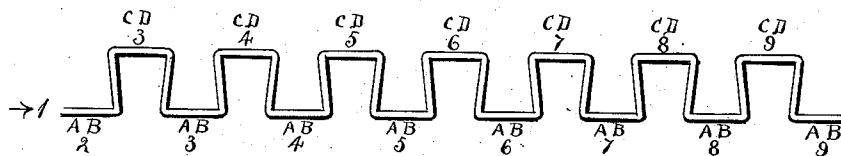


Fig. 4^a

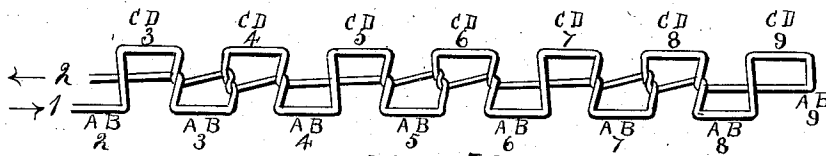


Fig. 5^a

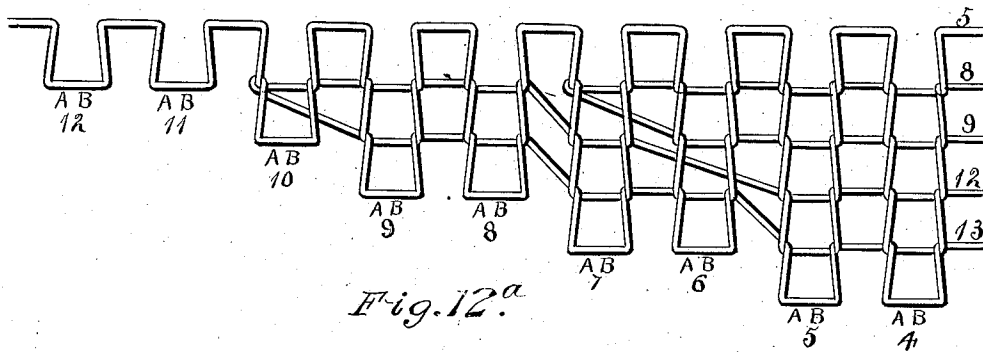


Fig. 12^a

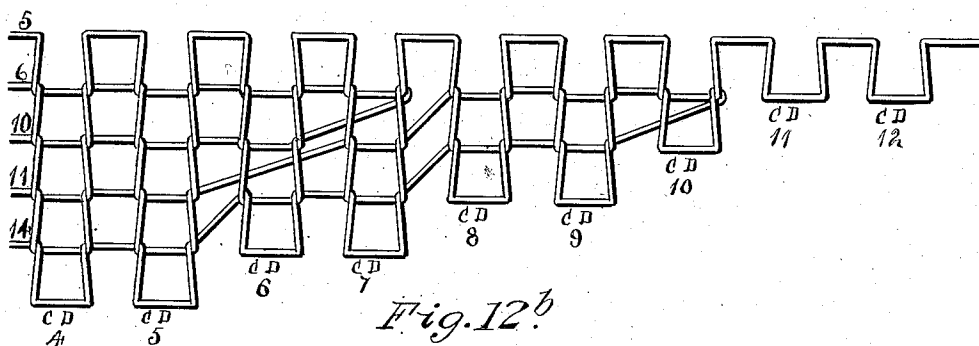


Fig. 12^b

Witnesses:

W. E. Hinchliff
E. W. Parker

Inventor:

William North Burson.

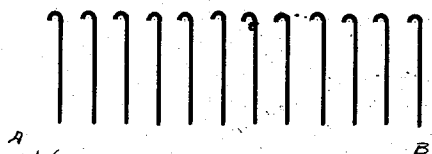
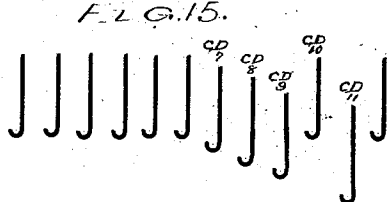
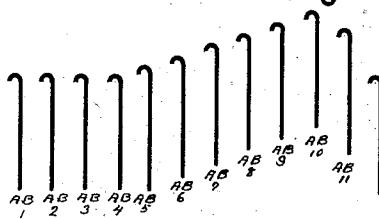
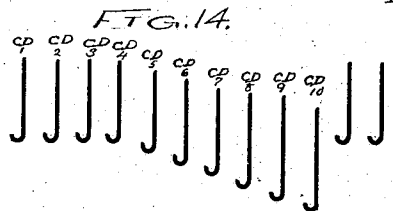
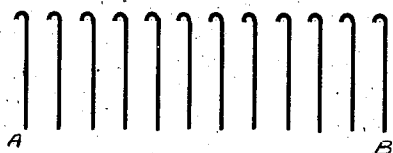
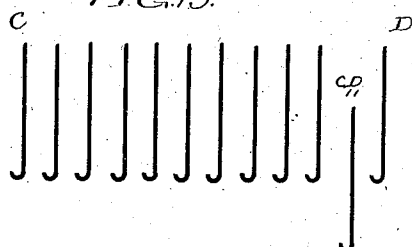
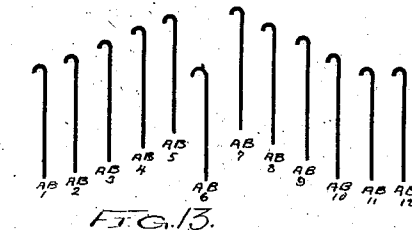
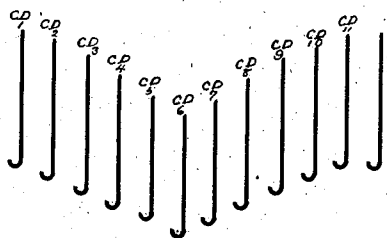
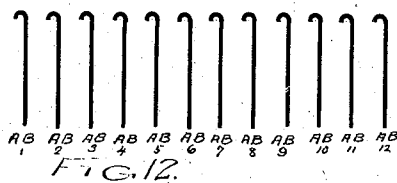
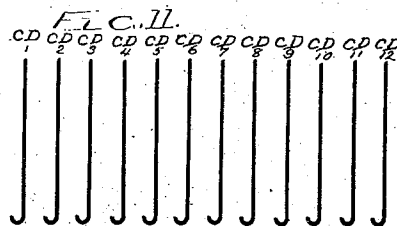
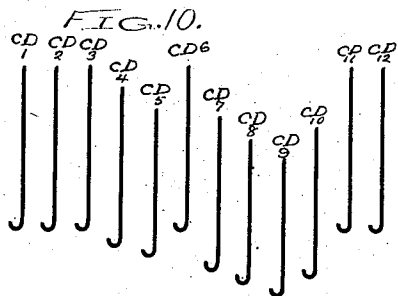
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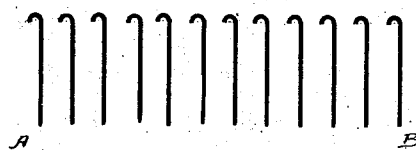
W. W. BURSON.
PATTERN KNITTING MACHINE.

APPLICATION FILED DEC. 30, 1895.

7 SHEETS—SHEET 4.



WITNESSES
Geo. E. Curtis
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INVENTOR:
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No. 819,407.

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W. W. BURSON.
PATTERN KNITTING MACHINE.

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7 SHEETS—SHEET 5.

Fig. 13^a

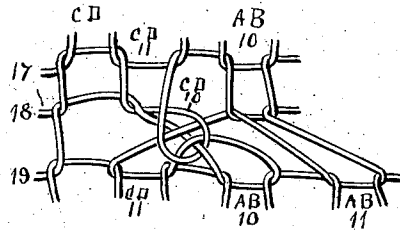


Fig. 15^a

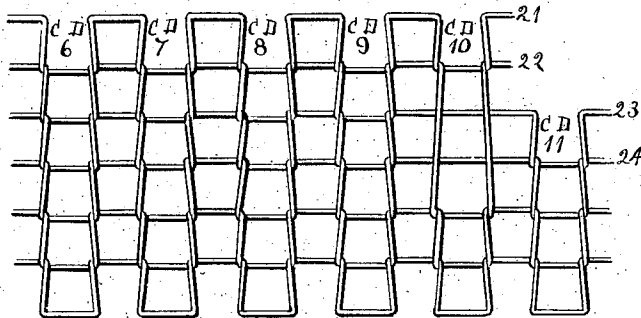


Fig. 19^a

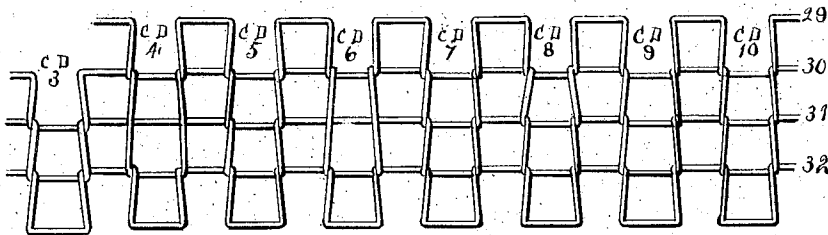
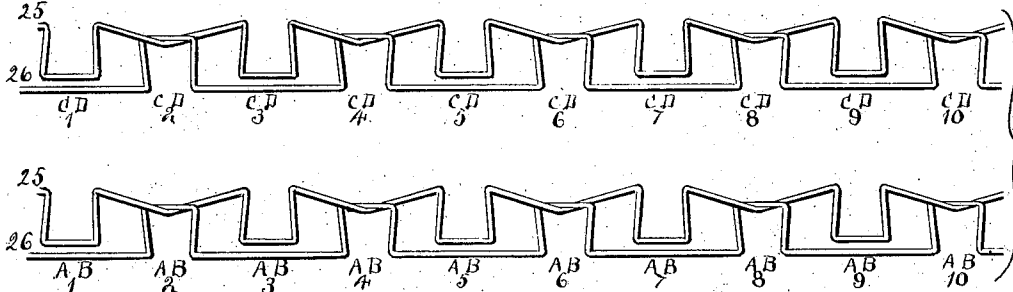


Fig. 21^a

Witnesses:
W. H. Hinds
E. W. Parker

Inventor:
William North Burson

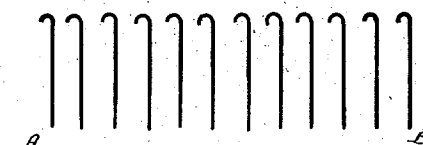
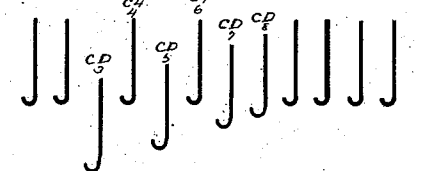
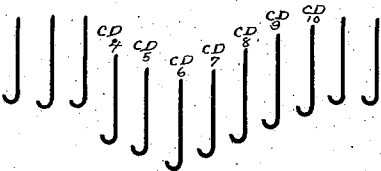
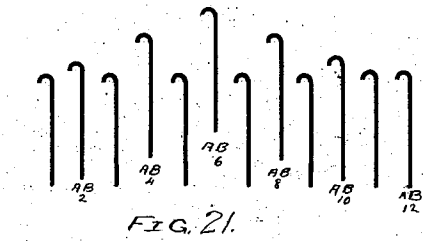
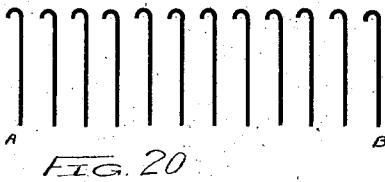
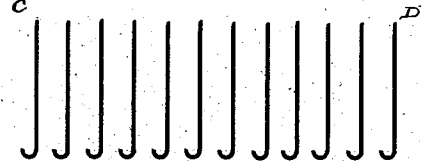
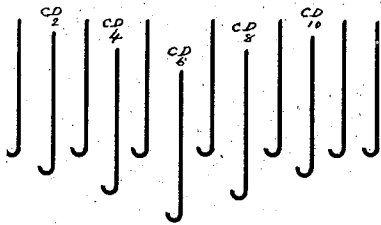
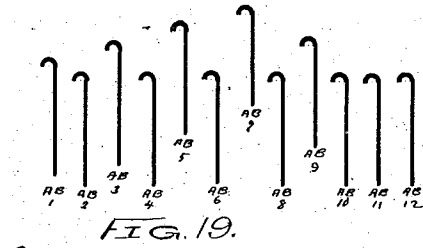
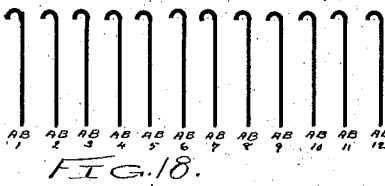
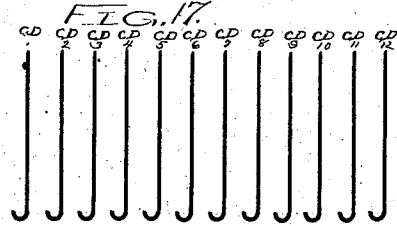
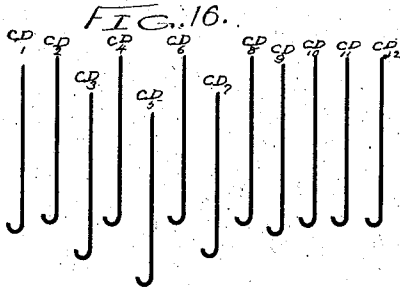
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APPLICATION FILED DEC. 30, 1895.

7 SHEETS—SHEET 6.



WITNESSES:
Edw. S. Erast
Sew. C. Curtis

INVENTOR:
William North Burson

No. 819,407.

PATENTED MAY 1, 1906.

W. W. BURSON.
PATTERN KNITTING MACHINE.

APPLICATION FILED DEC. 30, 1895.

7 SHEETS—SHEET 7.

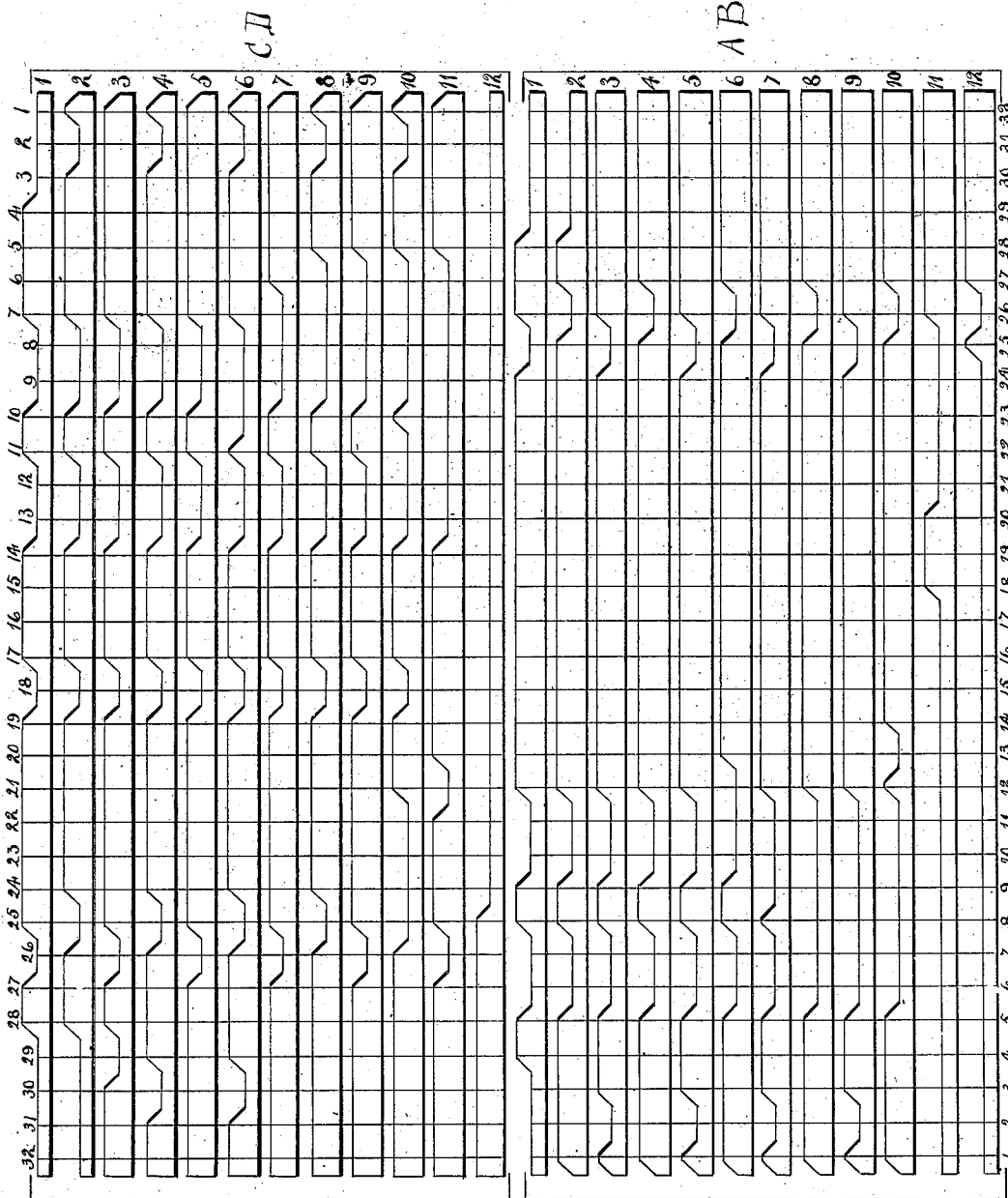


Fig. 23.

Fig. 22.

Witnesses:
H. H. Hinchliff
E. W. Parker

Inventor:
William Worth Burson.

UNITED STATES PATENT OFFICE.

WILLIAM WORTH BURSON, OF CHICAGO, ILLINOIS.

PATTERN KNITTING-MACHINE.

No. 819,407.

Specification of Letters Patent.

Patented May 1, 1906.

Application filed December 30, 1895. Serial No. 573,769.

To all whom it may concern:

Be it known that I, WILLIAM WORTH BURSON, of Chicago, in the county of Cook and State of Illinois, have invented a new and Improved Pattern Knitting-Machine, of which the following is a specification.

My invention is an improvement in that class of knitting-machines called "straight-row" machines, in which two rows of needles are arranged to point toward each other at an obtuse angle and are arranged to knit across a slotted opening, down which the knitted article passes as the work progresses, the needles of each row being alternated with a set of presser-hooks for holding the work down and both rows of needles being operated by cams connected with slide-bars that are arranged to reciprocate at right angles to the length of said needles so as to move the latter and cause them to cooperate with the yarn-carrier as it reciprocates across the hooked inner ends of the needles.

In the drawings I have shown the invention embodied in a machine which is essentially identical in its general construction with that of United States Letters Patent No. 616,600, granted to me December 27, 1898.

Figure 1, Sheet 1, is a sectional view through the machine aforesaid, showing the relations of a pattern-cylinder, rocking lever, needle-jack, and needle-actuating cam, the latter being down in position to operate against the needle-jack lug, and the needles being projected to their utmost throw in position to be operated upon by the latch-openers on the yarn-carrier. In this view I have shown a portion of the pattern-cylinder at one side of the machine, together with the adjacent parts and a small portion of the parts at the other side of the machine. Fig. 2, Sheet 1, is a similar section of the same parts taken in the same plane as Fig. 1 and showing the needle-actuating cam raised out of range of contact with the needle-jack lug. Fig. 3, Sheet 1, is also a similar view in the same plane, but showing the needle-jack depressed by the rocking lever and pattern-cylinder, so that the needle is thrown out of work for both reciprocations of the cam-slide. Fig. 4, Sheet 2, is a diagram showing the needle movement in setting up the toe of a stocking or the like. Fig. 4^a, Sheet 3, illustrates the position which the first course of yarn fed

to the needles is caused to assume by the needle movement of Fig. 4. Fig. 5, Sheet 2, is a diagram showing the return needle movement succeeding the needle movement of Fig. 4—in other words, Fig. 5 shows the latter half of the first round in setting up the toe. Fig. 5^a, Sheet 3, shows the first and second courses of set-up stitches as produced by the needle movements which are represented by Figs. 4 and 5, Sheet 2. Fig. 6, Sheet 2, is a diagram showing the needle movement in beginning the heel of a stocking or the like. Fig. 7, Sheet 2, is a diagram showing the return heel-needle movement next succeeding that of Fig. 6 on the same row of needles as in Fig. 6. Fig. 8, Sheet 2, is a diagram showing a heel-needle movement similar to that in Fig. 6, but on the opposite row of needles. Fig. 9, Sheet 2, is a diagram showing a heel-needle movement like that in Fig. 7, but on the opposite row of needles, as in Fig. 8. Fig. 10, Sheet 4, is a diagram showing a heel-needle movement of which the reversing-needle is dropped out of action on one row of the needles. Fig. 11, Sheet 4, is a diagram showing a heel-needle movement in which the reversing-needle is dropped out of action on the row opposite to that in which the dropping out occurs in Fig. 10. Fig. 12, Sheet 4, is a diagram representing as having been brought into operation the needle which in Fig. 10 is dropped. Figs. 12^a and 12^b, Sheet 3, are diagrams of portions of widened knit fabric, showing the results produced in the fabric by the needle movements which are represented in Figs. 6, 7, 8, 9, 10, and 11. Fig. 13, Sheet 4, is a diagram showing the edge needle of the row opposite that in which the widening occurs brought into operation simultaneously with the new widening-needle. Figs. 13^a, Sheet 5, is a diagram of a portion of widened knit fabric in the production of which the needle movement illustrated in Fig. 13 is utilized. Figs. 14 and 15, Sheet 4, are diagrams showing other movements of the needles for widening. Figs. 15^a, Sheet 5, is a diagram showing portion of a widened fabric in the production of which the needle-movements of Figs. 14 and 15 are utilized. Figs. 16 to 19, Sheet 6, are diagrams showing needle movements for setting up. Fig. 19^a, Sheet 5, is a diagram showing the position of the threads in the opposite portions of a tubular fabric resulting from the needle move-

ments of Figs. 16 to 19. Figs. 20 and 21, Sheet 6, are diagrams showing another needle movement used in widening. Fig. 21^a, Sheet 5, is a diagram of a portion of widened fabric produced by the needle movements of Figs. 20 and 21. Figs. 22 and 23, Sheet 7, are diagrams on the order of developments on a plane of the main pattern elements of the two pattern-cylinders, Fig. 22 showing the said pattern elements of one cylinder, and Fig. 23 showing those of the other cylinder.

Having reference to the drawings, in Figs. 1, 2, and 3, Sheet 1, C C are the two needle-beds of the machine, and *a* is the narrow slot between the inner edges of the said needle-beds, across which slot the needles work and down through which the article being produced passes as it is knit. E represents the needles, and F the needle-actuating jacks, both arranged in the slots of the needle-beds and the needles being loosely connected to the jacks, which latter have lugs *b* normally projecting above the general level of the needle-bed into position to be engaged and operated by the needle-actuating cams G' G² upon the lower sides of the cam-bars G G, which reciprocate endwise in a direction at right angles to the jacks and impart the necessary reciprocating motion to the jacks and through the latter to the needles. Fig. 5 shows only the jacks, needle-actuating cams, and cam-bars at one side of the machine. The lower ends of the needle-jacks rest in slotted seats in the rocking levers H, which correspond in number to the number of needles. The jacks at each side of the machine are pivotally mounted upon a rod D', so as to be capable of a rocking or tilting movement. Such movement of the said levers H gives a vertical movement to the needle-jacks, and according to the direction in which the levers H are swung either raises their lugs *b* above the needle-beds into the range of action of the needle-cams, as shown in Fig. 1, or depresses them below the upper surfaces of the needle-beds and out of such range of action, as shown in Fig. 3. This capacity for rocking movement possessed by the levers H provides for enabling any number of needles to be thrown into or out of action individually. The adjustment or shift of the levers H is caused automatically by two pattern-cylinders I, one on each side of the machine, (only one of which is shown,) the periphery of each pattern-cylinder being wrought into elevations and depressions that operate upon the two feet *c c'* of each rocking lever H to give to the respective rocking levers the necessary movement. The levers H, respectively, are bent or offset laterally, so that the feet *c c'* of each of the said levers rest in different vertical parallel planes upon two adjoining different peripheral sections of the corresponding pattern-cylinder. Thus each of the said levers

H is moved positively in one direction through the interaction of one set of projections on the pattern-cylinder with one foot, and is moved positively in the other direction through the interaction of the adjoining set of projections on the pattern-cylinder with the other foot. As in my Letters Patent aforesaid, each pattern-cylinder is made of a series of rings or disks, which are cut upon their peripheries with notches and elevations corresponding to the desired pattern, these rings or disks being made in pairs, one ring or disk of each pair being the complement of the other, and each pair of rings constituting the pattern for one rocking lever H and its corresponding needle. In the diagrams of the two pattern-cylinders which are given in Figs. 22 and 23, Sheet 7, I have represented only the acting portions of the main cylinder or disk of each pair of pattern rings or disks, the supplemental ring or disk of each pair which forms the complement of that one which is shown being omitted in order to simplify the drawings. The cams attached to the under side of each cam-bar G are double cams, which are adapted to project and return the needles at each single stroke of the needle-cam bars.

In knitting some kinds of work it is necessary that only a single (instead of a double) action of the cam should take place. Thus in knitting tubular goods the needles on one side must be advanced and retracted by the forward movement of the needle cam-slide, and then the needles upon the other side advanced and retracted by the return of the said slide, the first set of needles remaining quiescent during the said return stroke. For this mode of action the cams which advance or project the needles are made movable into and out of operative position, so as to enable them to be lifted out of position for engagement with the lugs of the needle-jacks, as in Fig. 2, at every alternate stroke. The means of controlling the action of the cams and lifting and lowering them is shown and described in my patent aforesaid.

P represents the presser-hooks, which hold the fabric down in the slot *a*. These rise and descend with every movement of the needles and are actuated by the presser-hook-actuating cam-bars R, the latter being operated in manner shown and described in the Letters Patent aforesaid.

The remaining features of construction and the mode of operation of the machine are in general as set forth in my patent aforesaid.

Inasmuch as every needle in the machine is controlled by a pattern, it follows that a great range of combinations of movements may be made for the purpose of knitting different articles. A few of the said combinations embodying features of the present invention will now be described. In this de-

scription I shall refer to the diagrams Figs. 22 and 23, Sheet 7, showing the main pattern elements of the two pattern-cylinders. As I have already stated herein, in Figs. 22 and 23 I have represented only the acting edge portions of the main ring or disk of each pair of rings or disks of the respective pattern-cylinders, the supplemental or complementary ring or disk of each pair being omitted in order to simplify the drawings. In Fig. 22 the order of sequence of the successive lines of elevations and depressions of the pattern is from left to right, in Fig. 23 from right to left. The said lines are numbered consecutively in each figure, and the lines which act in unison bear the same numerals.

To set up the toe of a stocking or the like, corresponding portions of both rows of needles are utilized, the first "step" or row of indicators of each pattern-cylinder, the same being designated 1 1 in Figs. 22 and 23, respectively, acting to cause the needles of both rows to be thrown forward simultaneously to take the yarn, as indicated in Fig. 4, Sheet 2, and the yarn being taken by all of the said needles in the first passage of the yarn-carrier across them, thereby producing what may be termed the "first course." The position of the yarn in the said first course is illustrated diagrammatically by Fig. 4^a, Sheet 3. In the return-passage alternate needles of those which were operated in the first course are left out of action on both rows of needles, the intermediate needles of both rows being knit, as indicated in Fig. 5, Sheet 2, finishing the second course or first round. The steps 2, 2 of the pattern-cylinders control the action of the needles during this movement. The result in the fabric is shown by the diagram Fig. 5^a, Sheet 3. I regard this manner of setting up and closing the toe of the stocking or the like as better than that which usually is adopted in practice. It has been the practice heretofore in starting the knitting by closing the toe to place the yarn in the first course upon all of the needles which are denominated "setting-up" needles and then to knit all the needles on each side on which there are loops before widening. This operation makes a thin set-up line and causes a severe strain upon the yarn which is first placed upon the needles. Both of these drawbacks or disadvantages are relieved by my plan of closing the toe and setting up the knitting. The toe is now ready to be widened by the needle movements, which will be considered later.

To knit the heel of a stocking or the like, I prefer to knit a part of one row of needles, as CD' to CD' of the CD row (see Fig. 6, Sheet 2) during the passage of the yarn-carrier in one direction and in the return movement (see Fig. 7) to drop needle CD' and to knit CD^e, called the "reversing-needle," and all

the other needles to and including CD'. The knitting is then crossed over to the AB row and needles AB' to AB' are knit, as in Fig. 8. On the return movement needle AB' is omitted and needles AB' to AB^e are knit. The knitting is then crossed over to the CD row again, and a series of needles differing from the former one is knit, the last needle knit in the passage from left to right being dropped on the return-passage. Steps 5 to 13 of the respective pattern-cylinders, Figs. 22 and 23, control during these movements. In this procedure no two connected rows of switches or courses are of the same length, the return course being uniformly one needle shorter than the outgoing course, and the third row of stitches on either side should stop, preferably, at least one needle short of the last row knit, the fourth course, like the second, being one needle less than the former course. The result of this procedure is illustrated in Figs. 12^a and 12^b, Sheet 3.

When the knitting course ends in the fabric, as distinguished from the edge of the fabric, or end of a needle-row, the first needle in the return course—for instance, the needle CD^e of Fig. 7, Sheet 2, and AB^e of Fig. 9, same sheet—is called the "reversing-needle." When it is necessary to knit past a reversing-needle in either row of needles, the said needle is dropped, as indicated by Fig. 10, Sheet 4, in the case of needle CD^e, and two or more stitches, preferably, are knit beyond it, after which the same return movement that has already been described is made on that row. The same action is repeated on the AB row of needles when needle AB^e is dropped and knit past, Fig. 11, Sheet 4, and the return movement is made as above stated. A repetition of these movements in the proper order forms a well-shaped heel which is free from eyelet-holes and which may be knit without other appliances than the regular needle movements require.

To widen the fabric, as in the toe, heel, and leg of the stocking, when the knitting is begun at the toe, three different combinations of needle movements, available under different circumstances, are capable of being utilized either separately or conjointly, as now will be explained. In Fig. 12 the needles of the CD row are all meant to be operative from needle CD' to needle CD¹¹, and on the AB row the needles from AB' to AB¹⁰. Fig. 13 shows all of the needles of the CD row except CD¹¹ dropped out of action, and needle AB¹¹, which is the needle to be brought into action for the purpose of widening, is actuated in such manner that needle CD¹¹ takes the yarn between needles AB¹⁰ and AB¹¹ and knits a stitch, which operation closes the eyelet-hole which otherwise would be made by the widening-needle. The result in the

fabric is shown by Fig. 13^a, Sheet 5. Steps 17 to 19, Figs. 22 and 23, of the pattern-cylinders control in these movements. The needle which is brought into action from the needle-row opposite to that containing the widening-needle may be called the "closing-needle," because it closes the eyelet-hole that would otherwise be made by the widening-needle. When it is desired to widen a needle on the CD row, then the edge needle on the AB side on which there is fabric is in like manner advanced, so as to engage with the yarn between the needle which already has a loop upon it and the needle of the CD row which is to be added to the operative series to effect the widening, all the other needles of the AB row being inactive. This manner of widening may be used in giving shape to the toe, heel, or leg, or wherever widening at the edge of the fabric is required.

In Fig. 14, Sheet 4, needles CD⁷ to CD¹⁰ are shown as operative, the last one being a widening-needle. In Fig. 15, Sheet 4, in the next round the needle CD¹⁰ is dropped out of action and the needle CD¹¹ is knit. The needle CD¹⁰ is left inactive one or more rounds and then is knit regularly. This movement of the needles operates to close the eyelet-holes which otherwise would be formed. The result in the fabric is illustrated by Fig. 15^a, Sheet 5. Steps 21 to 24, Figs. 22 and 23, of the pattern-cylinders control in these movements. The same process is repeated for the side AB, and alternately one side and then the other is widened, as desired. This manner of widening the fabric may be employed advantageously in some cases and is applicable to all parallel-row-knitting machines where the needles are controllable by a pattern mechanism.

To set up the fabric for either flat web or open tubular knitting, it is desirable for the first round to cause alternate needles in the respective rows to take the yarn as shown by Figs. 16 and 17, Sheet 6, and in the second round to cause the needles which were active during the first course or round to remain inactive, bringing the intermediate needles into action, as shown by Figs. 18 and 19 of Sheet 6. This sets up a fabric that will not ravel from the beginning. The result in the fabric is shown in Fig. 19^a. Steps 25 and 26 of the pattern-cylinders control during these movements.

Another needle movement applicable in widening is shown in Figs. 20 and 21, Sheet 6. In Fig. 20 the needle CD³ is shown inactive, the needle CD⁴ and others to the right of the same being in operation. In Fig. 21 the needle CD³ is brought into action for the purpose of widening, and needle CD⁴ is dropped out of action, needle CD⁵ being knit, while needle CD⁶ is dropped out of action, CD⁷, &c., being knit. It will be seen in Fig. 21 that the first

and third needles, beginning with the widening-needle, are dropped out of action, while the second and fourth needles are knit. The inactive needles CD⁴ and CD⁶ are called "relieving-needles," because by throwing them out of action less strain devolves on the yarn in the process of widening. The result in the fabric of the procedure illustrated by Figs. 20 and 21 is shown in Fig. 21^a, Sheet 5. Steps 29 to 32 of the pattern-cylinders control during these movements.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of two rows of needles and controlling pattern devices to operate a part of both rows of needles in the first passage of the yarn-carrier across them, and to operate only each alternate one of said needles in the return-passage leaving the others inactive, whereby to set up and close the toe of hose, substantially as described.

2. The combination of two rows of needles, and needle-controlling pattern devices to knit a heel portion of hose integrally by operating only a part of the needles in one row in the first passage of the yarn-carrier, dropping uniformly the last needle knit in the return movement of the yarn-carrier, and uniformly leaving the "reversing-needle" inactive when it is knit past, whereby a heel is knit integrally by making successive stitch-rows of unequal length without the "eyelet-holes" otherwise made where reversing is done in the fabric with the needles drawn down, substantially as described.

3. The combination of two rows of needles, and needle-controlling pattern devices to operate each alternate needle of one row in the first passage of the yarn-carrier and in like manner each alternate needle in the other row in the return-passage of the yarn-carrier, the others being inactive, and in the second round to leave the first set of operating-needles inactive and operate the other set, whereby the fabric is set up with a selvage on both rows of needles, substantially as set forth.

4. The combination of rows of needles, and two needle-controlling pattern devices whereby when the fabric is to be widened a new needle is brought into action on one row and the edge needle of the other row is operated at the same time, all the others being inactive, whereby the yarn is engaged by said single needle between the fabric and the new widening-needle and knit into the other row and the "eyelet-hole" otherwise made in widening is closed, substantially as specified.

5. The combination of two rows of needles, and needle-controlling patterns so formed that when the fabric is to be widened a new needle is brought into action at the edge of the fabric and given the yarn once and then dropped out of action remaining inactive during one or more rounds while another needle

outside of said needle is brought into action thereby knitting over or past the first widening-needle, substantially as specified.

5 6. The combination of two rows of needles, and needle-controlling patterns so formed that when a needle is widened the first adjoining needle on which there is already a stitch, as also the third needle from said

widening-needle are dropped out of action, whereby the strain on the yarn in the operation of widening is reduced, substantially as set forth.

WILLIAM WORTH BURSON.

Witnesses:

WM. E. HINCHLIFF,
H. D. EASTMAN.