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FLAT BED KNITTING MACHINE.

APPLICATION FILED MAR. 23, 1910.

1,015,668.

Patented Jan. 23, 1912.

10 SHEETS—SHEET 1.

Fig. 1

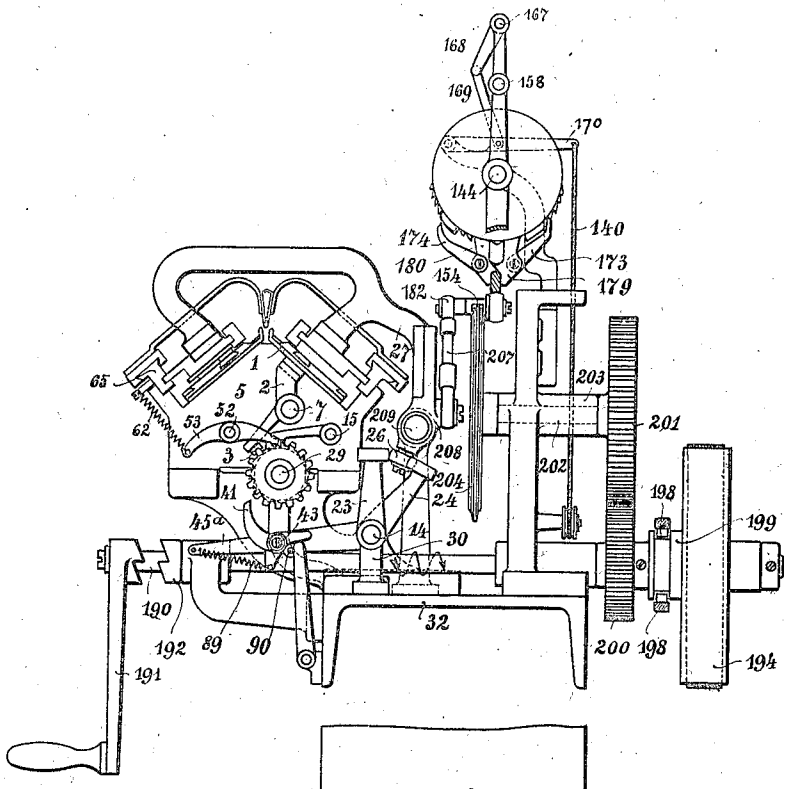
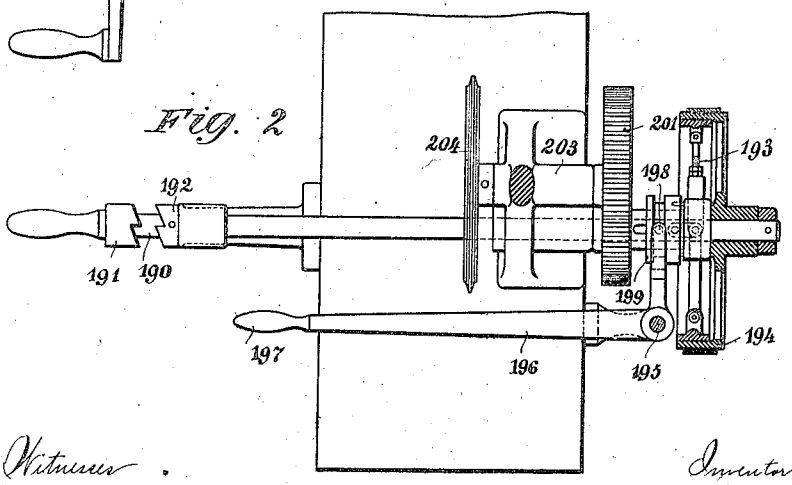


Fig. 2



Witnesses.

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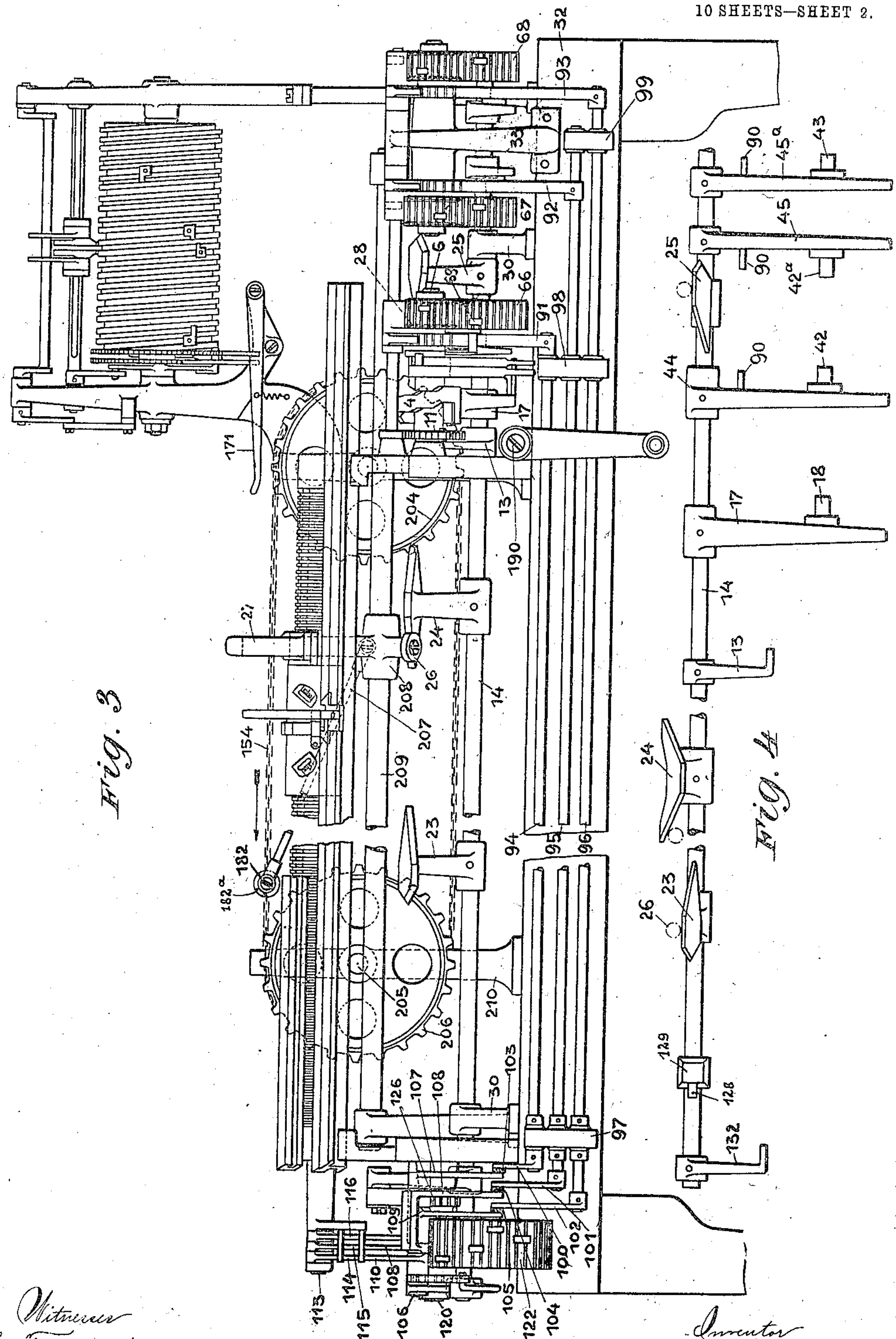

Fig. 3

Fig. 4

Witnesses
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10 SHEETS—SHEET 3.

Fig. 5

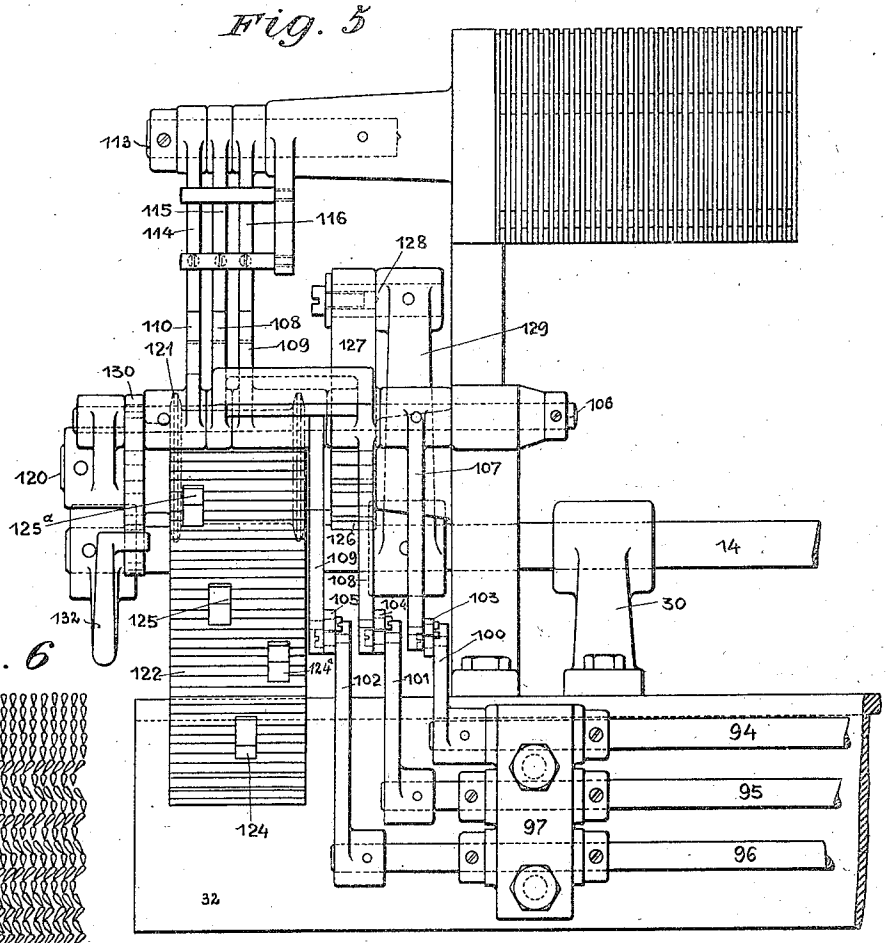
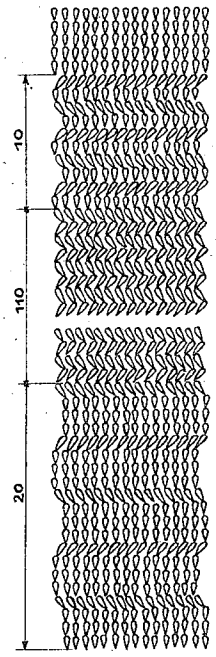


Fig. 6



Witnesses

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Fig. 7

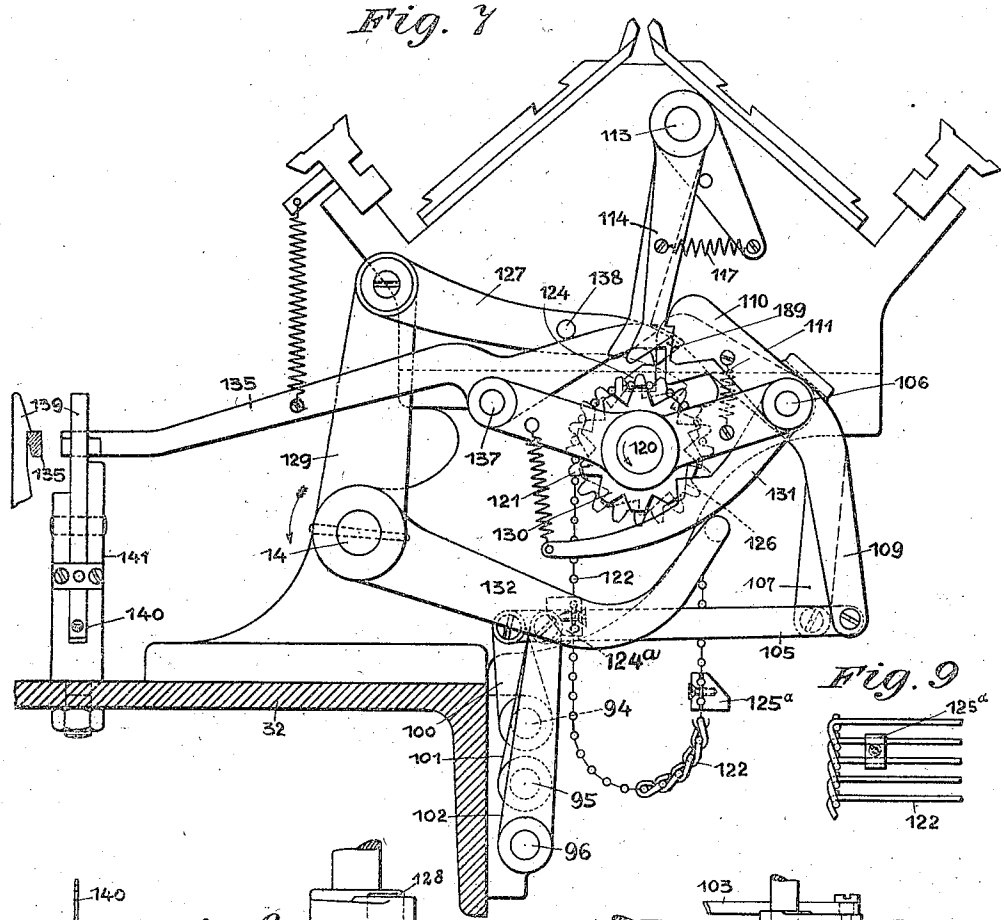
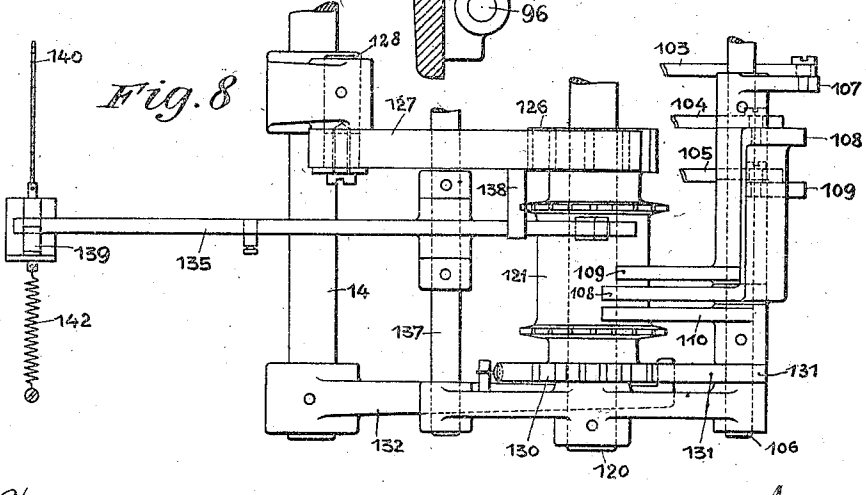


Fig. 9

Fig. 8



Witnesses

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Fig. 10

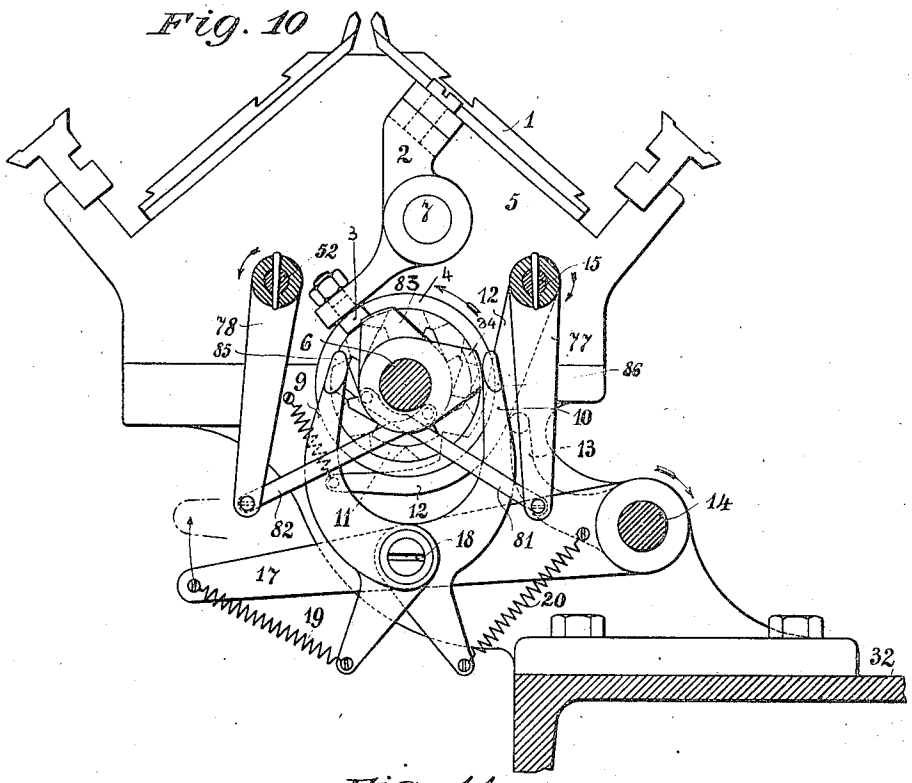
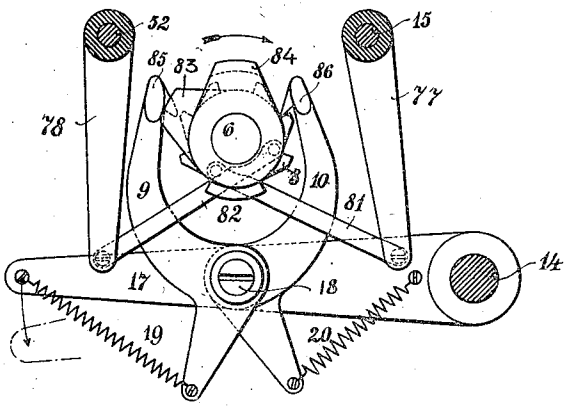


Fig. 11



Witnesses

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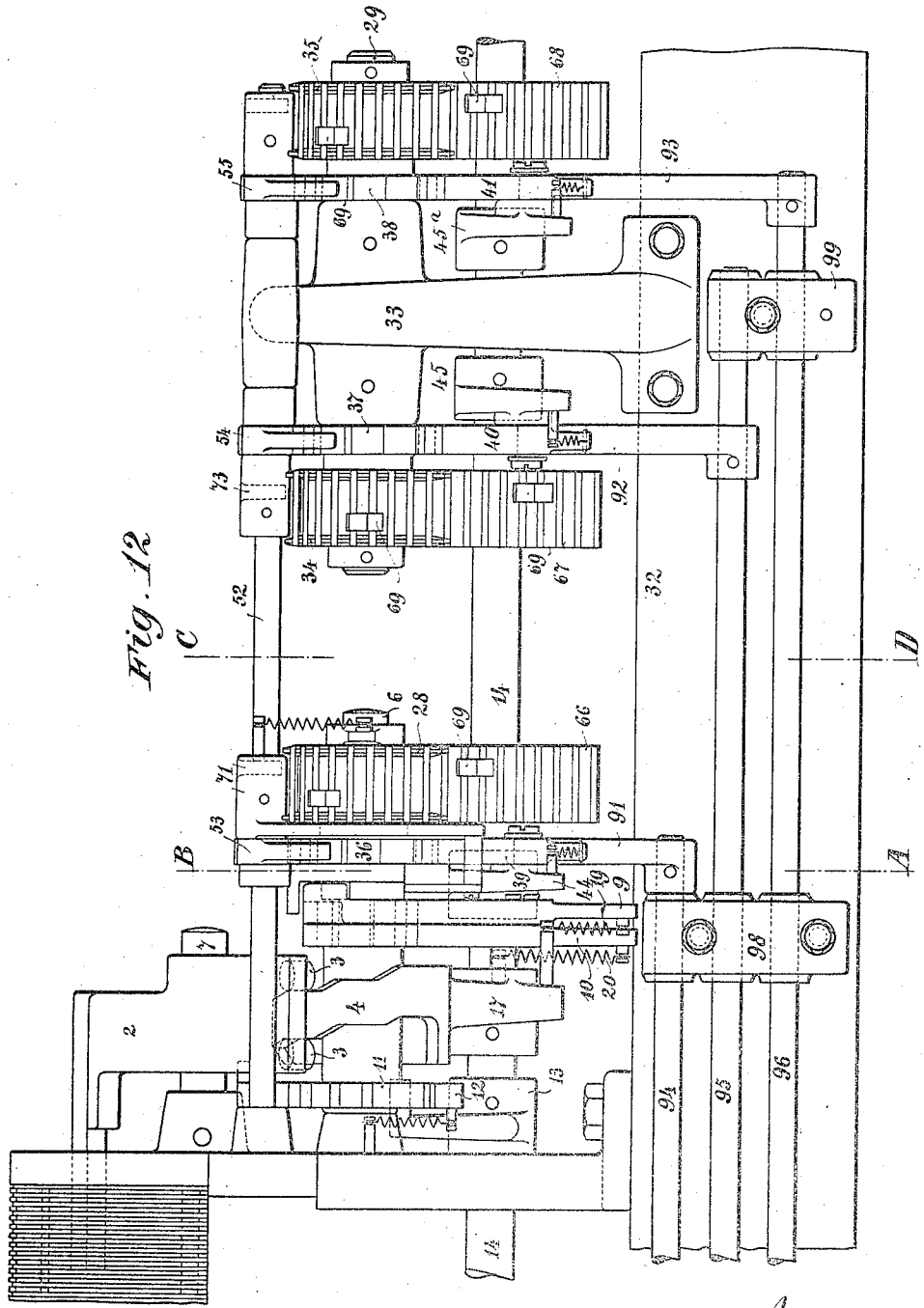
Fig. 12



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10 SHEETS—SHEET 7.

Fig. 13

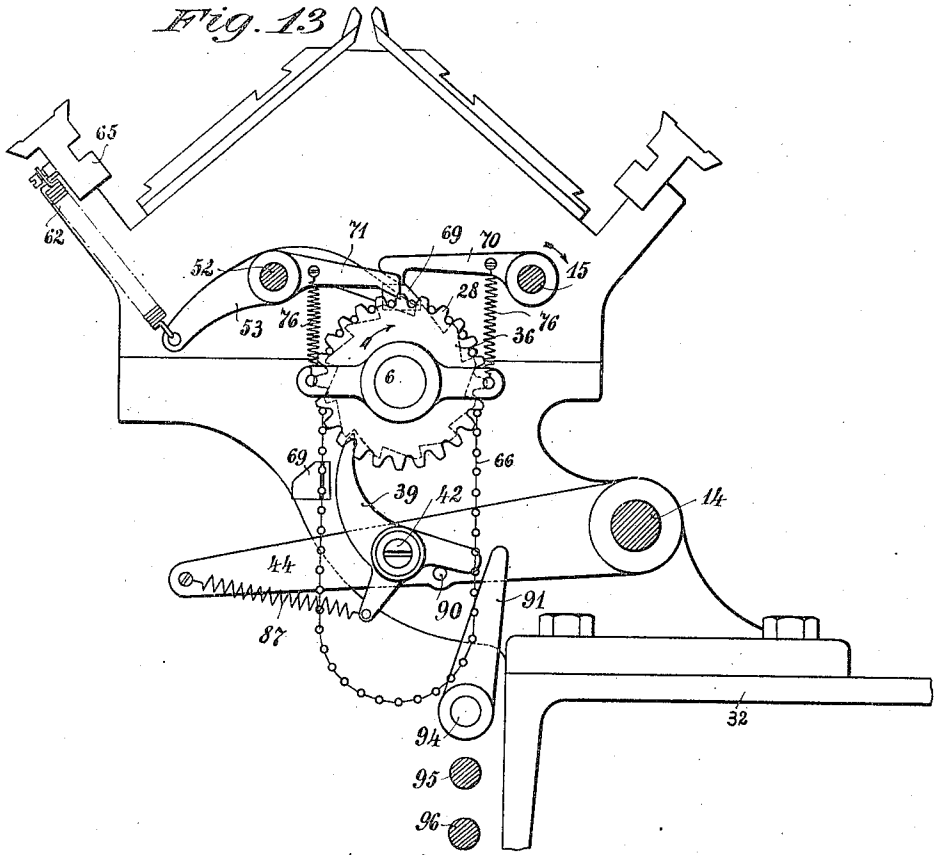
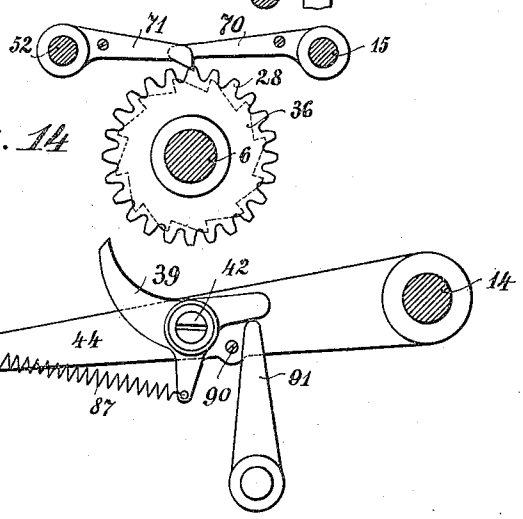


Fig. 14



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10 SHEETS—SHEET 8.

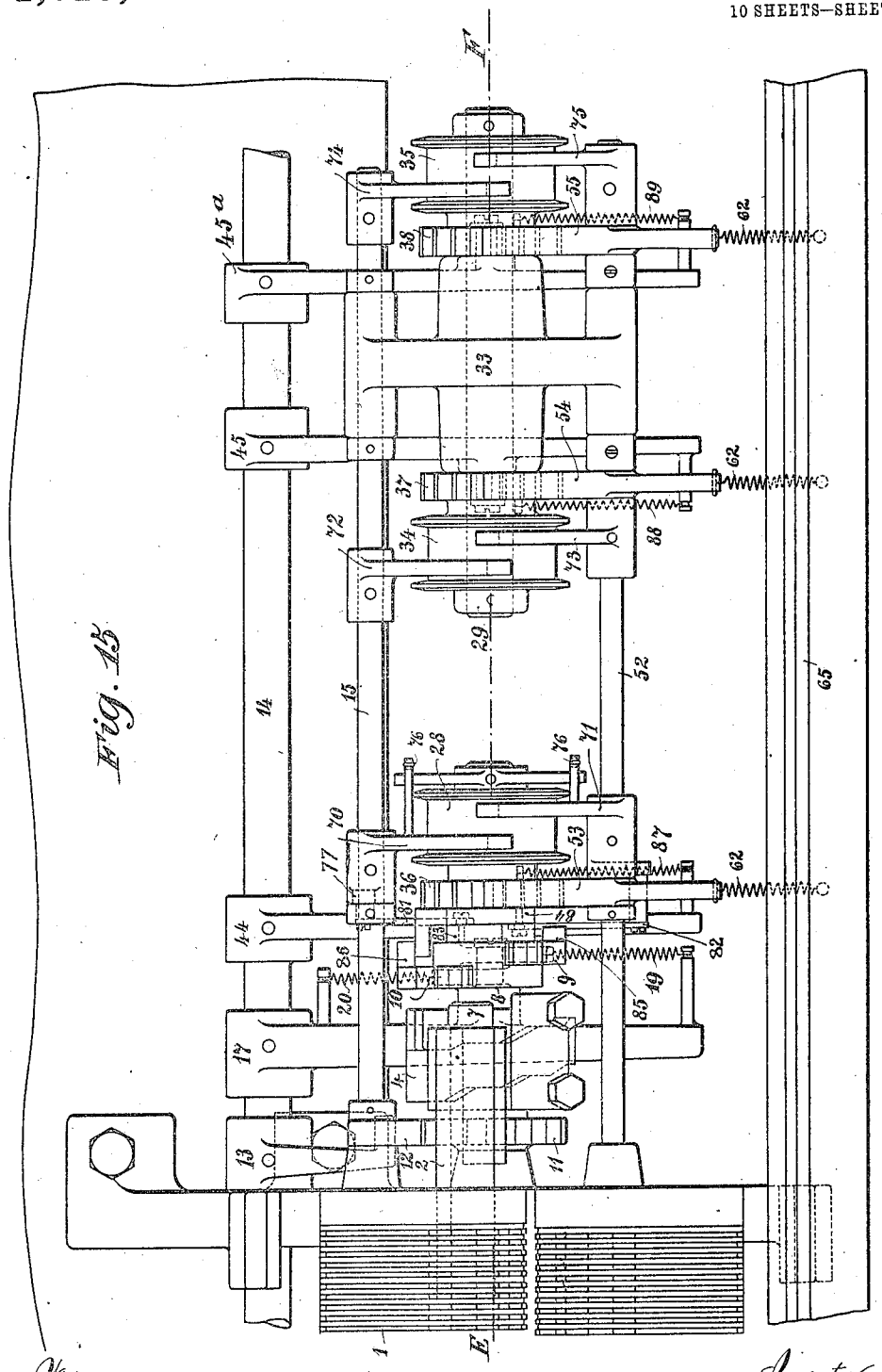

Fig. 15.

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FLAT BED KNITTING MACHINE.

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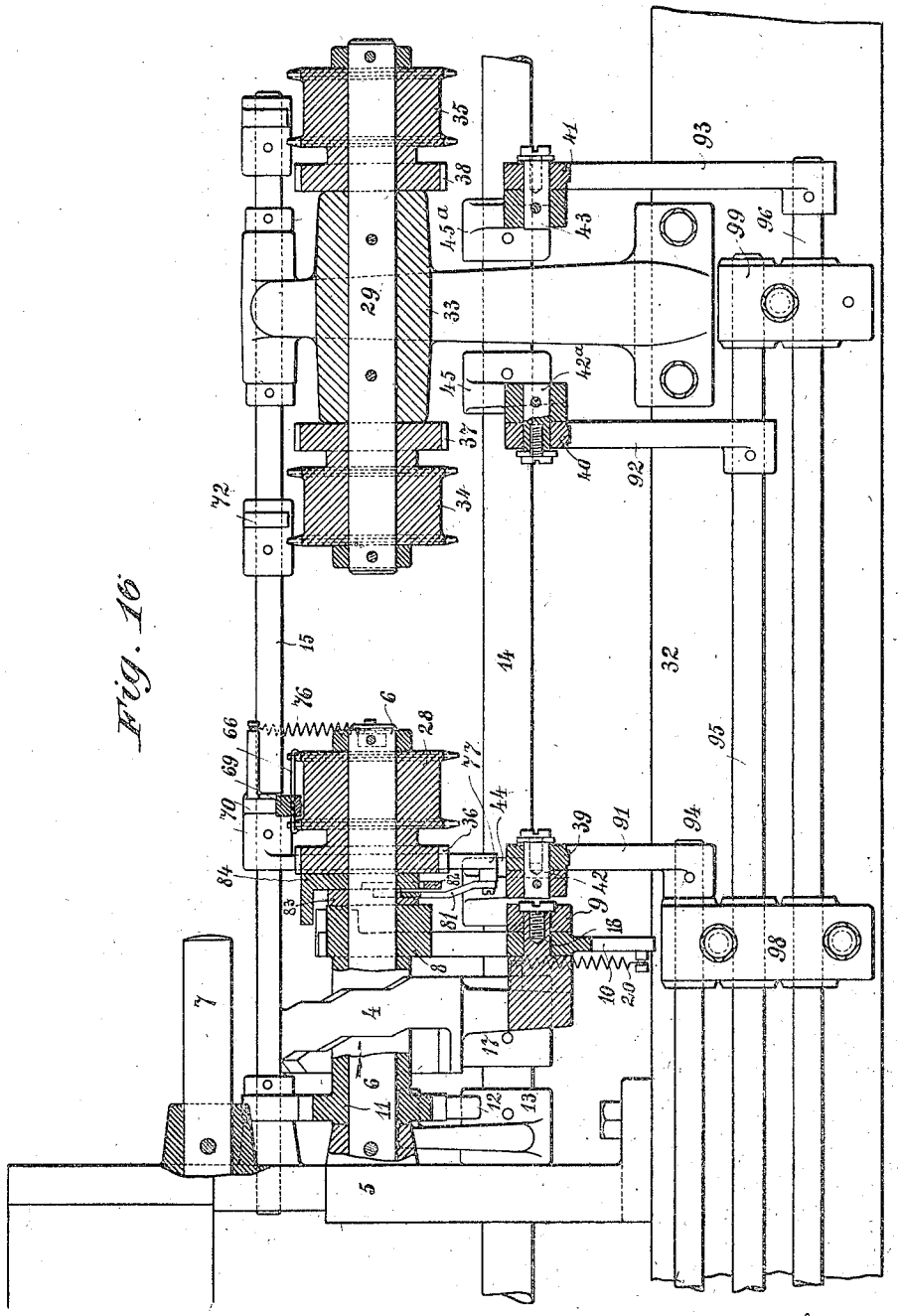
10 SHEETS—SHEET 9.

Fig. 16.



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FLAT BED KNITTING MACHINE.

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Patented Jan. 23, 1912.

10 SHEETS—SHEET 10.

Fig. 21

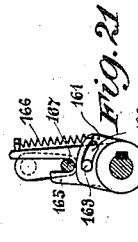


Fig. 19

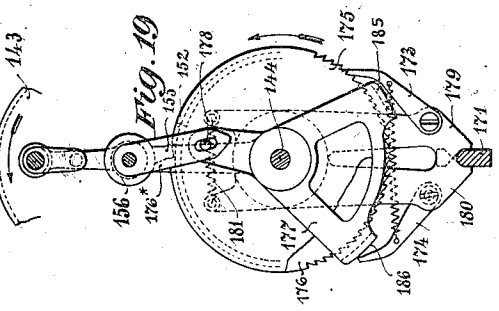


Fig. 20

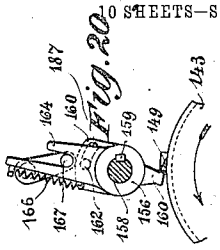


Fig. 18

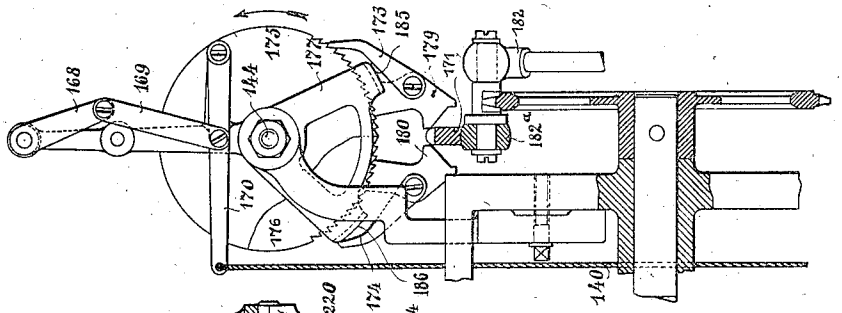
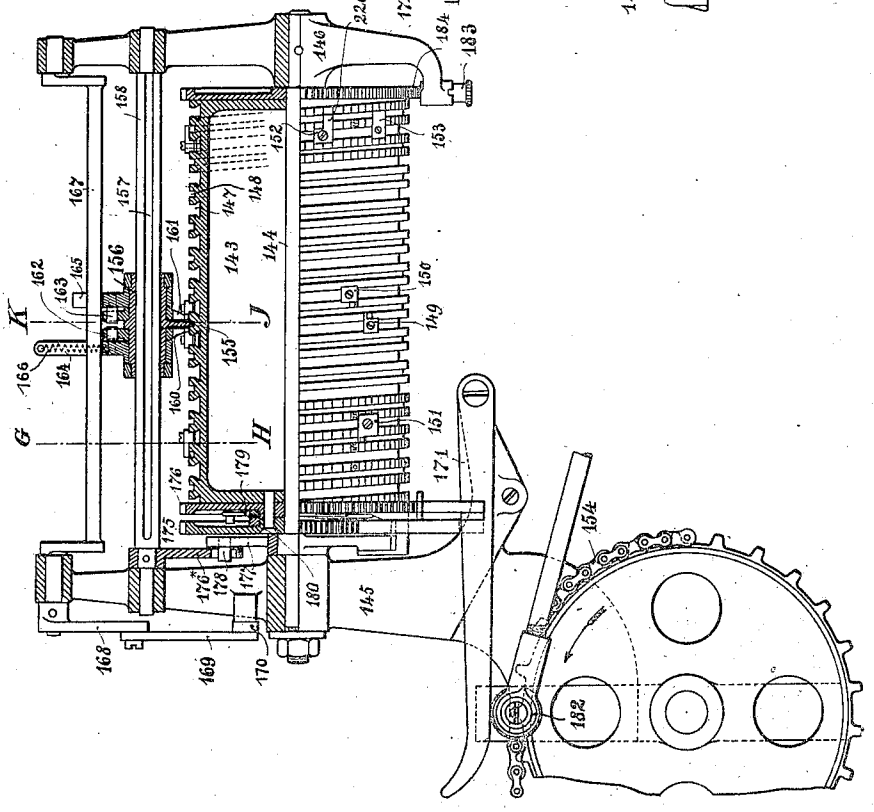


Fig. 17



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UNITED STATES PATENT OFFICE.

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FLAT-BED KNITTING-MACHINE.

1,015,668. Specification of Letters Patent. Patented Jan. 23, 1912.

Application filed March 23, 1910. Serial No. 551,048.

To all whom it may concern:

Be it known that I, EDOUARD DUBIED, a citizen of the Republic of Switzerland, residing at Couvet, in the Canton of Neuchatel, Republic of Switzerland, (whose post-office address is Couvet,) have invented certain new and useful Improvements in Flat-Bed Knitting-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

Knitting-machines in which the needle-bed is automatically racked or shogged as required to suit the fabric by means of a pattern mechanism are already known. In those cases, however, where different racked patterns had to be produced in the same article, a very long pattern chain was required, as the chain had to remain in operation during the whole process of knitting the article. Such long chain, besides being expensive, had the disadvantage that it had to be changed or altered over its entire length, when it was necessary to alter one of the racked patterns even if it was only to the extent of one row of loops, which took up much time and involved considerable expense.

In the automatic racking or shogging device forming the subject of the present invention a separate pattern mechanism is provided for each pattern such mechanisms being separately and independently of each other brought into and out of action through one common main chain, each of the said mechanisms causing a shogging of the needle-bed. By this arrangement the aforesaid defects are reduced to a minimum.

The accompanying drawings illustrate the invention by way of example in one form of construction of a needle-bed shogging device for knitting machines for producing fabrics with three different patterns.

Figure 1 is an end view of the machine looking from what is the right hand end in Fig. 3. Fig. 2 is a part sectional plan of Fig. 1. Fig. 3 is an elevation of the machine looking from what is the left hand side in Fig. 1. Fig. 4 is a plan of the actuating mechanism for the main and pattern chains. Fig. 5 is a front elevation of the left end portion of the machine. Fig. 6 is a diagram of the fabric produced by the machine. Fig. 7 is a part end elevation looking from what is the left hand side in Fig. 5. Fig. 8 is a plan of Fig. 7. Fig. 9 is a detail of Fig. 7. Fig. 10 is a section on the line A—B of Fig. 12. Fig. 11 is a detail of Fig. 10. Fig. 12 is a front elevation of the right end portion of the machine on a larger scale. Fig. 13 is a section on the line C—D of Fig. 12. Fig. 14 shows a detail taken from Fig. 12. Fig. 15 is a plan corresponding to Fig. 12. Fig. 16 is a section on the line E—F of Fig. 15. Fig. 17 is a front elevation of the controlling mechanism partly in section. Fig. 18 is an end view looking from what is the left hand end in Fig. 17. Fig. 19 shows a portion of the controlling mechanism. Fig. 20 is a section on the line G—H of Fig. 17, shown from the left side. Fig. 21 is a section on the line J—K of Fig. 17 shown from the left side.

1 denotes the rear needle bed slidably arranged within the frame 5 of the knitting machine; said needle bed carries a guide piece 2 loosely embracing a rod 7 secured in the frame 5 (Figs. 1, 10, 12). Two studs 3 fixed on the guide piece engage both sides of a stepped shogging cam 4 which is rotatably mounted on a shaft 6 in the frame 5 and is connected with a ratchet wheel 8 (Figs. 1, 10, 11, 12, 15, 16). The latter has two rows of oppositely directed teeth, the pitch of the teeth corresponding to the pitch of the stepped cam 4, while the height of the steps of the latter is equal to the pitch of the needles in the bed 1. Both rows of teeth of the ratchet wheel 8 are engaged by pawls 9 and 10 respectively so that when the ratchet wheel 8 is racked by either of the pawls to the extent of one or more teeth the needle-bed 1 is shogged a corresponding number of needle pitches in one direction or the other. Secured to the stepped cam 4 is a notched wheel 11, the notches of which are engaged by a detent 12 (Figs. 3, 10, 12, 15) which is pressed against the notched wheel by means of a lever 13 fixed on the rock shaft 14, thus preventing accidental rotation of the cam wheel 4. The shaft 14 is carried in bearings 30 fixed on base plate 32 (Figs. 1, 3 and 5).

The detent 12 sits loosely on the shaft 15,

but is prevented from axial movement thereon. On the shaft 14 (Figs. 4, 10, 12, 15 and 16) is fixed a lever 17 which carries on a pivot 18 the two pawls 9, 10 which are pressed against the teeth of the ratchet-wheel 8 by means of the springs 19, 20. On the shaft 14 (Figs. 1, 3 and 4) are mounted arms 23, 24, 25 with cam-blocks having oblique working surfaces, against which a roller 26 strikes at each str ke of the carriage 27. The middle arm 24 carries a block having two oppositely disposed working surfaces, one of which is parallel to the working surface of the arm 23, and the other parallel to the working surface of the arm 25. Accordingly, at each stroke of the carriage, the shaft 14 is rocked once forward and once backward through the co-action of the roller 26 with the said surfaces, whereby the arm 17 fixed on the rock shaft 14 and carrying the pawls 9 and 10 moves up and down while the lever 13 moves backward and forward.

On the shaft 6 is mounted a chain drum 28 adapted to carry the pattern chain (Figs. 1, 3, 12, 13, 15 and 16), and the shaft 29, which is fixed in a bracket 33 on the base plate 32, carries two chain drums 34 and 35, each of which is rotatable on the said shaft 29. Each of the said chain drums has a ratchet wheel 36, 37, 38, (Figs. 12, 15 and 16), actuated by pawls 39, 40 and 41 respectively (Figs. 1, 3, 12, 13, 14, 16) which pawls are pivoted on pins 42, 42ª, 43 (Figs. 1, 4, 14, 13 and 16) carried on the levers 44, 45 and 45ª fixed on the rock shaft 14. The pawls 39, 40, 41 are normally pressed by means of springs 87, 88, 89, against pins 90 on the levers 44, 45, 45ª. An oscillating movement is imparted to the levers 17, 44, 45 and 45ª as they are rigidly fixed to the shaft 14.

The shaft 52 (Figs. 1, 12, 13, 14, 15) carries pawls 53, 54, 55, which are kept in engagement with the ratchet wheels 36, 37, 38 by means of springs 62 attached to the carriage guide 65 so that backward rotation of the chain drums 28, 34, 35, is prevented. The chain drums 28, 34, 35, carry pattern chains 66, 67, 68 (Figs. 12, 13, 15) to each of which may be screwed two rows of studs 69, in any desired position according to the requirements of the pattern of the fabric which studs act upon feeler levers 70, 71, 72, 73, 74, 75, upon rotation of the chain drums 28, 34 and 35, and advance of the pattern chains 66, 67, 68. The levers 70, 72, 74 are secured on the shaft 15, and the levers 71, 73, 75, are fixed on the shaft 52. The levers 70, 71, 72, 73, 74, 75 are pressed against the pattern chains 66, 67, 68 by means of springs 76 (Fig. 13) engaging the levers 70 and 71.

The levers 70, 71 (Figs. 10, 11, 12 and 15) have downwardly extending arms 77, 78 the lower ends of which are connected by means of rods 81, 82 with cams 83, 84 loosely mounted on the shaft 6 between the stepped cam wheel 4 and the chain drum 28 (Fig. 16). The pawls 9 and 10 have side projections 85, 86 in engagement with the cams 83, 84 (Figs. 11 and 15).

Under the pawls 39, 40, 41 (Figs. 3, 12, 13, 16) are arranged knock-off fingers 91, 92, 93 which are secured to shafts 94, 95, 96 which latter are carried in bearings 97, 98, 99 fixed on the base plate 32. At the left hand ends of the shafts 94, 95, 96 are secured levers 100, 101, 102, (Figs. 3 and 5) which are connected by means of rods 103, 104, 105 with levers 107, 108, 109, on the shaft 106 (Figs. 3, 5, 7 and 8). The levers 108, 109, 110 are subjected to the downward tension of the springs 111. The shaft 106 is rotatably mounted in the left hand end of the machine frame 5; the lever 107 being secured to said shaft while the levers 108, 109 are loosely mounted thereon. The lever 107 is positively connected with a feeler lever 110 through the shaft 106. Upon a pin 113 fixed to the machine frame are loosely mounted hooked catches 114, 115, 116 each of which is pressed by means of a spring 117 against one of the levers 108, 109, 110. Below these levers is a chain drum 121 rotatably mounted on a shaft 120 fixed to the machine frame which chain drum carries the main pattern controlling chain 122 having the same number of rows of pattern studs 124, 124ª, 125ª of various height, as there are pattern-chains (in the present case therefore three) which pattern studs engage with the levers 108, 109, 110, upon rotation of the chain drum 121, *i. e.* upon feeding of the chain 122. The main chain drum 121 has on its right hand side a ratchet wheel 126 the teeth of which are engaged by a pawl 127 pivoted on a pin 128 carried by a lever 129 fixed on the shaft 14 (Figs. 7 and 8). The main chain wheel 121 has secured to it at the left hand side a notched wheel 130 the notches of which are engaged by a catch 131 which, when the main chain drum 121 is at rest, is pressed against the notched wheel by a lever 132 secured to the shaft 14 (Figs. 5, 7 and 8), accidental movement or sudden advance of the main-chain drum 121 being thus prevented. The catch 131 is pivotally mounted on the shaft 106.

The main pattern controlling chain 122 is brought into and out of action by a special controlling mechanism hereafter described. See Figs. 5, 7 and 8.

A double armed lever 135 which is pivotally mounted on a shaft 137 fixed in the machine frame 5, bears with its forward end (right hand) upon the main pattern chain 122; the pawl 127 has a pin 138 with which it rests on the lever 135, said pawl being thus prevented from engaging the ratchet wheel 126 when the lever 135 is

raised by a stud 124ª on the chain. In this position of the lever 135 its rear end is arrested by a catch 139, the further racking or feeding of the main chain 122 being thereby prevented. The lever 135 remains in the position shown until the catch 139 is withdrawn from the lever 135 by means of the wire 140 through the action of the controlling mechanism whereupon the lever drops and the pawl 127 engages the teeth of the ratchet wheel 126 whereby the feeding of the main chain is continued. The catch 139 is pivotally mounted within its support 141 which is fixed to the base plate 132 immediately behind the lever 135. A spring 142 tends to return the catch into its normal position.

The periodical throwing into and out of action of the pattern chains 66, 67, 68 and the stepped cam 4 is effected by the main chain 122 (Fig. 3). The chain drum 121, carrying the main chain 122 is operated from the rock shaft 14 (Figs. 7 and 8) to which an oscillating movement is imparted upon reciprocation of the carriage 27 (Figs. 3 and 4) by the coöperation of the roller 26 with the arms 23, 24, 25. Each backward oscillation of the rock shaft 14, *i. e.* in the direction of the arrow indicated in Figs. 7 and 10, effects an advance of the ratchet wheel 126 and thereby also an advance of the main chain 122 through the intermediary of the lever 129 and the pawl 127 when the double lever 135 is lowered.

When one of the low studs 124 (Figs. 3, 5, 7) on the main chain 122 strikes one of the levers 108, 109, 110 for instance the lever 110, the latter is raised and engaged by a corresponding catch 114 until one of the high studs 125ª in the same row strikes the toe of the catch 114 throwing the latter out of engagement with the lever 110 which is then returned to its normal position through the action of the spring 111. In raising the lever 110 the shaft 94 is turned through the intermediary of the shaft 106 the lever 107 the rod 103 and the lever 100 thereby moving the knock-off finger 91 out of engagement with the pawl 39 (Fig. 13).

At each stroke of the carriage the pattern chain drum 28 is turned to the extent of one tooth by means of the shaft 14 through the intermediary of the pawl 39 on the lever 44. This turning continues until the lever 110 is again released. If one of the chain studs 69 fixed to the pattern chain 66 which is thus fed strikes one of the feeler levers 70, 71 for instance the lever 70, the shaft 15 as also the cam 83 are partially rotated in the direction indicated by the arrow in Fig. 10; the cam 83 is moved through the intermediary of the rod 81 and the lever 77. The projection 85 of the pawl 9 slips off the cam 83 and the pawl 9 engages one of the teeth of the ratchet wheel 8 and rotates at the next downward movement of the lever 17 the stepped cam wheel 4 to the extent of one step to the front, inasmuch as both pawls 9, 10, have an up and down motion in consequence of being pivoted on the lever 17. The said racking or turning of the stepped cam 4 effects a shogging of the needle-bed 1 to the extent of as many needle pitches to the left as teeth of the ratchet wheel, and thereby of the cam, have been successively racked. If a stud 69 of the pattern chain 66 strikes the lever 71 the shaft 52 will be partially rotated and thereby by means of the rod 82 and the lever 78 also the cam 84 (Fig. 11). The projection 86 of the pawl 10 slips off the cam 84, the pawl 10 engages with the other row of teeth of the ratchet wheel 8 and turns, at the next downward movement of the lever 17 the stepped cam 4 to the extent of one step to the rear whereby the needle bed 1 is shogged from left to right. The springs 76 effect the return of the levers 70, 71, 72, 73, 74, 75 into normal position after the chain studs 69 have passed them. The throwing into action of the other pattern chains 67 and 68 is effected by the other rows of studs 124, 125 on the main chain 122, striking the corresponding levers 108, 109.

Figs. 17 to 20 show an extremely suitable controlling mechanism for the main chains 122. The controlling apparatus has a counter drum 143, Fig. 17, which is loosely mounted on the shaft 144 held in brackets 145, 146 and is provided externally with double helical grooves 147, 148 along which run index marks numbered for instance from 1 to 1000. Within the grooves 147 of the drum 143 are slidable contact blocks 149, 150, 151, 152, 153 which may be fixed in position. In the helical grooves 148 (Figs. 17, 19) on the drum 143 slides the lower portion 155 of a reversing sleeve 156 which is slidably mounted on a shaft 158 with a key way 157 engaged by a key block 159 (Fig. 20) of the sleeve 156 which is thus prevented from rotation on the shaft. The shaft 158 is carried in the brackets 145, 146. The reversing sleeve 156 carries loosely two feeler levers 160 and 161 (Figs. 17, 20 and 21) which are in operative connection with the rocking levers 164, 165 through the intermediary of pins 162, 163. The rocking levers 164, 165 engage with their upper forked portions a cranked shaft 167 which is carried by the brackets 145, 146 (Fig. 17) and has secured to it the lever 168 (Figs. 17, 18) which is connected by means of the rod 169 with the lever 170.

For the rocking or rotation of the drum 143, at each stroke of the carriage there are arranged a lever 171 (Figs. 17, 18, 19) two push-pawls 173, 174, (Figs. 18, 19) as also two ratchet wheels 175, 176 (Figs. 17, 18, 19) which are rigidly secured to the drum

143, the teeth of the ratchet wheels being shaped in opposite directions. The shaft 158 (Fig. 17) has secured to it a lever 176* which is in connection through the intermediary of a pin 178 with the reversing cam 177 (Figs. 17, 18, 19) which is loosely mounted on the shaft 144 between the bracket 145 (Fig. 17) and the ratchet wheel 175. Between the two ratchet wheels 175, 176 (Figs. 17 and 18, 19) are arranged the two pawl carriers 179, 180, which form with each other a kind of tongs, a spring 181 (Fig. 19) tending to keep the tongs constantly closed when they are not forced open by the lever 171 which receives its upward movement from the connecting-rod head 182 with the roller 182a (Figs. 3, 17 and 18). The drum 143 has further fixed to it the retaining wheel 184 the teeth of which are engaged by a spring actuated pin 183 any undue rotation of the drum 143 being thereby prevented.

The connecting-rod head 182 with the roller 182a (Figs. 3, 17, 18) which are fixed to the driving chain 154 of the knitting machine, move the lever 171 upward whereby the pawl carriers 179, 180 are forced apart owing to the beveled faces of their lower ends, the pawl 173, being in action, when the cam 177 is in the corresponding position shown in Figs. 18 and 19, moves the ratchet wheel 175 to the extent of one tooth and the drum 143 to the extent of one index pitch in the direction of the arrow indicated in Figs. 18 and 19. This action is repeated every time the connecting-rod head 182 (Fig. 17) is brought under the lever 171 through the movement of the driving chain. The pawl 173 remains operative until the projecting toe 220 of the contact block 152 (Fig. 17) strikes the downwardly extending projection 155 of the reversing sleeve 156 thus partially rotating the latter and the shaft 158. By this rotation of the shaft 158 the lever 176* is also rotated which latter moves the reversing cam 177 by means of the pin 178 which is fixed on the latter. In consequence of the rotation of the cam 177 the pawl 173 is brought to bear on the face 185 of the cam 177 thus preventing its engagement with the ratchet wheel 175. The pawl 174 slips off the face 186 of the cam 177 and drops into engagement with teeth of the ratchet wheel 176, which teeth are arranged in an opposite direction to the teeth of the ratchet wheel 175. The drum 143 is now rotated by the pawl 174 that is in the opposite direction to that imparted by the pawl 173, until a contact block 151 (Fig. 17) strikes the projection 155 of the reversing sleeve 156. Thereby the reversing cam 177 is again brought into the former position shown in Fig. 19, the pawl 173 being brought into operation while the pawl 174 is put out of action and the drum 143 (Fig. 17) is again rocked in the first mentioned direction.

The contact blocks 149, 150 are secured in the broad groove 147 but the reversing sleeve 156 with its lower end 155 is freely movable since the projecting toes 220 are kept short and do not cover the narrow groove 148. The contact blocks 149, 150 thus act only on both feeler levers 160 or 161 (Figs. 17, 20, 21).

The feeler levers 160 and 161 (Figs. 17, 20, 21) are provided with slots 187, 188 (Figs. 20, 21) so that the forked rocking levers 164, 165 can only be actuated, each in one direction through the feeler levers by the forward and backward motion of the drum.

In the direction indicated by the arrows in the Figs. 18 and 19, *i. e.* when the drum is rotated by the pawl 173, a contact block 149 striking the feeler lever 160 will move the latter and also rock the forked lever 164, the slot 187 being correspondingly arranged relatively to the pin 162 as shown in Fig. 20. If however in the direction indicated, a contact block 150 (Figs. 17, 21) engages the feeler lever 161 the pin 163 slides within the slot 188 so that the forked lever 165 is not rocked as the block 150 slides past under the feeler lever 161 as shown in Fig. 21, without the latter actuating the forked lever 165. If on rotation of the drum by means of the pawl 174, *i. e.* in the direction opposite to that indicated in Figs. 18 and 19 a contact block 149 comes into engagement (Figs. 17 and 20) with a feeler lever 160 the latter will move away from the pin 162 in consequence of its slot 187 (Fig. 20) and will not actuate the forked rocking lever 164. However in the same direction of rotation the block 150 will engage the feeler lever 161 in such manner that the forked lever 165 is rocked thereby. In order to return the feeler levers 160, 161, again into their original positions, when the contact blocks 149, 150 have passed beneath them without actuating the forked rocking levers 164, 165, respectively, each of the feeler levers 160, 161 is provided with a spring 166 (Figs. 17, 20, 21) which tends to keep the said feeler levers 160, 161, against the pins 162 and 163 respectively.

The main chain 122 of the knitting machine is brought automatically into and out of action in the following manner. The controlling lever 170 is connected by means of a steel wire 140 with the catch 139 (Figs. 1, 7, 8, 17 and 18) for the purpose of bringing the main chain 122 into and out of operation. While the lever 170 is in the position shown in Fig. 18, the pawl 127 pivoted on the lever 129 serving for the rocking of the ratchet wheel 126 of the main chain (Figs. 7 and 8) rests upon the double lever 135 through the intermediary of the pin

138 and is thus prevented from engagement with the ratchet wheel 126. The left hand end of the double lever 135 is held down by the catch 139; at its right hand end the lever 135 has a hooked portion 189. If on rotation of the drum 143 by means of the pawl 173, *i. e.* in the direction of the arrow Figs. 18 and 19 a contact block 149 strikes the feeler lever 160 Fig. 20 it then effects rotation of the latter and moves the forked lever 164 by means of the pin 162. The lever 164 with its upper forked portion imparts movement to the cranked shaft 167 and the lever 168, whereby the lever 170 is raised through the intermediary of the rod 169; the catch 139 is thus withdrawn by means of the steel wire 140 from engagement with the double lever 135. This lever 135 is now free and drops with its hooked portion 189 on the chain 122. When the contact block 149 has passed through under the feeler lever 160 on rotation of the drum 143 by means of the pawl 173 the catch 139 is returned to its former position by the spring 142 (Fig. 8) feeler lever 160 is returned into its former position by spring 166 (Figs. 17, 20). When the hooked portion 189 of the lever 135 drops down, the pawl 127 falls into engagement with the teeth of the ratchet wheel 126 and feeds the main chain forward through the oscillation of the shaft 14, the said chain in its turn controls the automatic operations in the manner described. The pawl 127 remains in operation until a stud 124^a on the main chain passes under the double lever 135 which causes the left hand end of the said lever to pass beneath the catch 139 and is arrested in that position whereby the pawl 127 and the main chain 122 are thrown out of action. If on rotation of the drum 143 by means of the pawl 174 *i. e.* in the opposite direction to the arrow in Figs. 18 and 19 a contact block 150 strikes the feeler lever 161 the latter will be rotated and the main chain 122, brought into action in the same manner as already described. The main chain 122 is thus thrown into and out of action upon the forward or backward rotation of the drum 143, as many times as there are contact blocks 149 and 150 respectively fixed into the groove 147 and as these blocks may be adjusted in any desired position on the drum 143 the main chain 122 may be brought into action after any desired number of rows of loops according to the position of the blocks.

If instead of a contact block 152 a contact block 153 is placed within the groove 147 which block is so formed and arranged that it contacts simultaneously with the feeler lever 160 and the reversing member 156, the main chain 122 will be brought into action simultaneously with the reversal of the drum 143 from forward to backward rotation.

If the contact block 151 is so formed and arranged that it contacts at the same time with the reversing member 155 and feeler 161 the main chain 122 will be brought into action simultaneously with the reversal from backward to forward rotation. If, for instance, the article to be produced has 780 rows of loops that number of rows will be counted forward and for the next article backward, that is, a contact block 151 will be fixed on the index mark 0 and another contact block 153 will be fixed at the mark 780, therefore the controlling mechanism, will return into its initial position after every two articles made. If, however the article has for instance 1300 rows, one contact block 152 is fixed at 650, this will represent 650 rows, on the forward rotation of the drum and again 650 rows on the backward rotation, which is equal to 1300 rows. This is on the assumption that the drum has 1000 index divisions.

The movement of the carriage 27 may be effected by hand or motor. Figs. 1, 2 and 3 show an actuating arrangement which is suitable for manual or power operation. In the frame of the machine is carried a shaft 190 on the forward end of which is loosely mounted a crank handle, 191, the boss of which is provided with teeth at the rear. A collar 192 also provided with teeth is secured to the shaft 190. It is clear from the drawing that manual rotation of the shaft 190 is only possible when the crank handle is pushed back into engagement with the collar 192 and rotated in a clockwise direction. The rear end of the shaft 190 carries a clutch 193 and a loose belt pulley 194 so that by means of the said clutch the pulley may be coupled to the shaft. For this purpose a bell crank lever 196 is pivoted to the machine frame at 195, the longer arm of which lever is provided with a handle 197 the shorter arm engaging by means of two pins 198 the groove of a sleeve 199 slidable upon the shaft 190. The said sleeve is so connected with the clutch that upon corresponding movement of the bell-crank lever the arms 193 of the clutch are forced against the inner periphery of the belt pulley thus coupling the latter to the shaft. The motion of the shaft 190 is transmitted by means of toothed wheels 200 and 201 to a shaft 202 which is supported on a bearing 203 in the machine frame and carries a chain wheel 204 at its forward end. On the base plate 32 is fixed a bracket 210 for the shaft 205 of another chain wheel 206. A chain 154 is passed over the chain wheels 204, 206 and the head 182 of a connecting rod 207 is attached to one of the chain links the other end of said rod being connected to an arm 208 of the carriage 27. The arm 208 slides along a guide bar 209 fixed in the machine frame. It is to be understood from the above that motion may

be imparted to the carriage 27 by hand as also by power.

Fig. 6 shows a diagram of a fabric of 140 rows of loops which may be knitted in the machine. In this case the first 20 rows of loops are racked after every fourth stroke of the carriage, the following 110 rows are racked after each stroke of the carriage and finally the last 10 rows on every second stroke. If this pattern had to be produced on an ordinary knitting machine the pattern chain necessarily would be very long.

In the new machine in addition to the main chain there are provided as many smaller chains as the number of different patterns in the fabric (in the present case three). Each of these chains contains as many links as are necessary to produce the particular pattern, for instance the chain for that pattern where the rows of loops are to be racked after every second stroke of the carriage has at least four links the second chain which is to cause the racking of the rows of loops after every stroke has at least two links and the third chain for the racking of the loops on every fourth stroke, at least eight links; this being in all at least fourteen links. In previously known machines a chain of 140 links would be necessary to produce a fabric of this pattern.

What I claim is:—

1. In an automatic racking device for the needle beds of flat bed knitting machines the combination of a primary rotating pattern controlling chain, a plurality of secondary rotating pattern-chains, means for throwing each of the secondary rotating pattern chains into and out of action apart from the others by the primary chain, a rotatable stepped cam, and means for rotating the stepped cam from each of the secondary pattern chains in one or the other direction.

2. In an automatic racking device for the needle beds of flat bed knitting machines the combination of a primary rotating pattern controlling chain, a plurality of secondary rotating pattern chains, the primary rotating main pattern controlling chain having as many rows of studs as there are secondary rotating pattern chains, each of the secondary rotating pattern chains having a group of studs, the studs of the various groups being placed in different successions, means for throwing each of the secondary rotating pattern chains into and out of action apart from the others, a rotatable stepped cam, and means for rotating the stepped cam from each of the secondary pattern chains in one or the other direction.

3. In a flat-bed knitting machine the combination of a slidable needle-bed, a rotatable stepped cam wheel for shogging said needle-bed, a carriage sliding over the needle bed, mechanism actuated from the carriage for counting the number of strokes, a primary pattern controlling chain, means for operating said primary chain through the reciprocation of the carriage, a plurality of secondary pattern chains, means for throwing each of the secondary rotating chains into and out of action apart from the others by the primary rotating chain, and means for rotating the stepped cam wheel, from each of the pattern chains, in one or the other direction.

4. In a flat bed knitting machine, the combination of a slidable needle-bed, a carriage adapted to slide over the needle-bed, said carriage carrying a roller, a shaft, a plurality of arms fixed to the shaft carrying cam blocks adapted to coöperate with said roller, a chain drum, a primary rotating pattern controlling chain carried by the drum, a ratchet wheel connected to the drum, a lever fixed to the shaft, and a pawl pivoted to the lever and engaging the ratchet wheel.

5. In a flat bed knitting machine, the combination of a primary chain, a chain drum carrying said primary chain, several rows of alternating high and low studs on said chain, levers extending into the path of these studs, catches for arresting said levers, extensions on said catches reaching into the path of said studs, knock off fingers, and means for transmitting the movement of said levers to said knock off fingers.

6. In a flat bed knitting machine, the combination of a slidable needle bed, two studs carried thereby, a stepped cam wheel engaged by said studs, a ratchet wheel having two oppositely disposed sets of teeth and rigidly secured to said stepped cam, two cams partly projecting beyond said ratchet teeth, two shafts disposed one on either side of said stepped cam, two arms secured to the said shafts, and two rods, each of which connects one of said arms with one of said cams for imparting rotations to said cams.

7. In a flat bed knitting machine the combination of a stepped cam wheel, a ratchet wheel having two oppositely disposed sets of teeth and rigidly secured to said stepped cam, two rotatable cams, two rods for imparting rotation to said cams, two shafts disposed one on either side of the stepped cam and two arms secured to the said shafts and connected with said rods, a rock shaft, a lever secured to said rock shaft, two pawls pivoted to said lever engaging said ratchet teeth, projections on said pawls extending into the path of the said cams, for preventing the engaging of the one, or the other, or both of said pawls into the corresponding teeth.

8. In a flat bed knitting machine a movable needle bed, studs mounted thereon, a stepped cam engaged by said studs, shafts, chain wheels mounted on said shafts, pattern chains carried thereby, a notched wheel

rigidly connected with said stepped cam wheel, two shafts arranged one at each side of said pattern chain, a detent loosely mounted on one of said shafts and adapted to engage said notched wheel and a lever mounted on said rock shaft and adapted to actuate said detent.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

EDOUARD DUBIED.

Witnesses:

HERMANN HUBER,

CARL GUBLER.