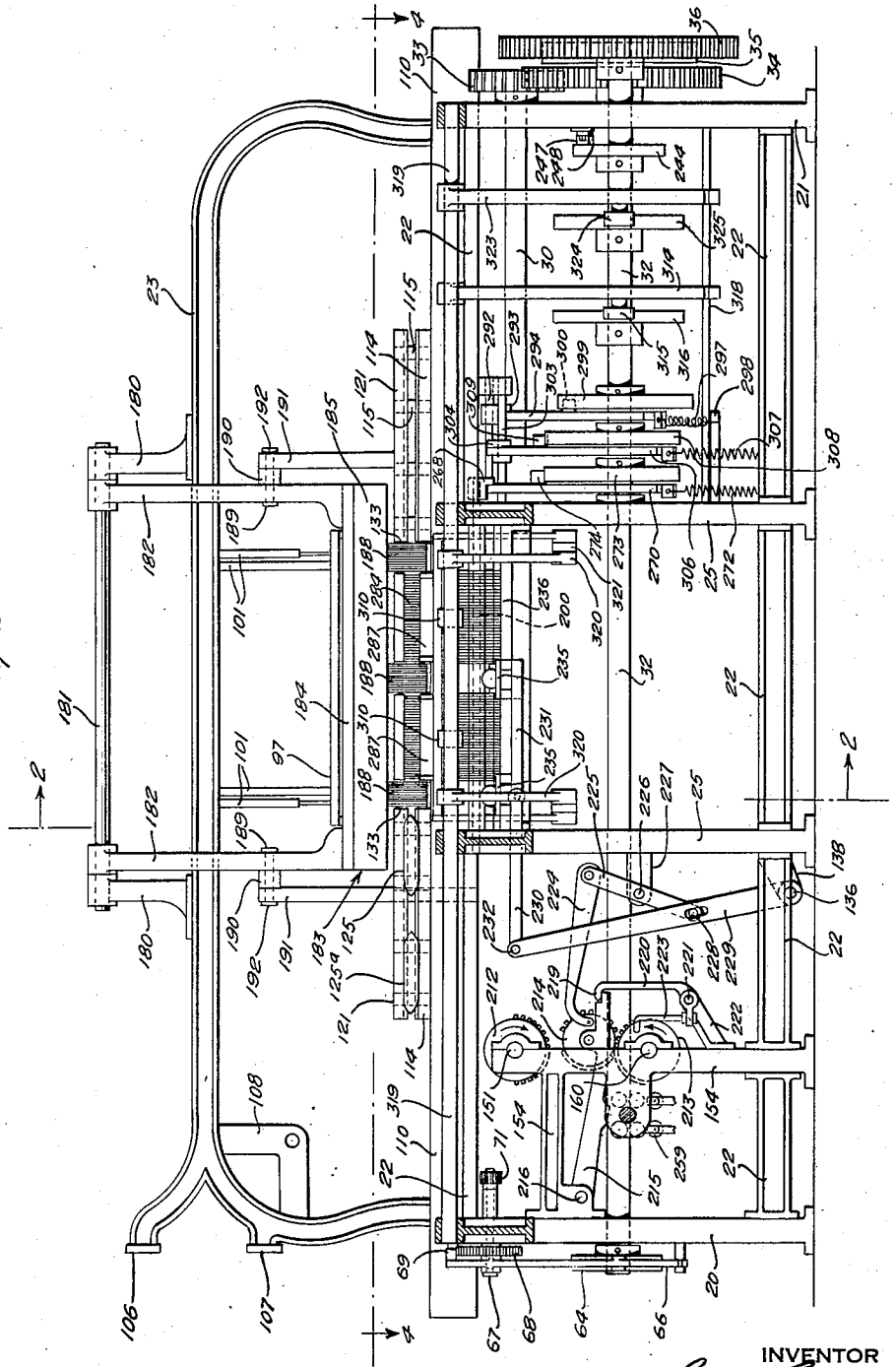
Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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Fig. 1.



INVENTOR
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ATTORNEYS

Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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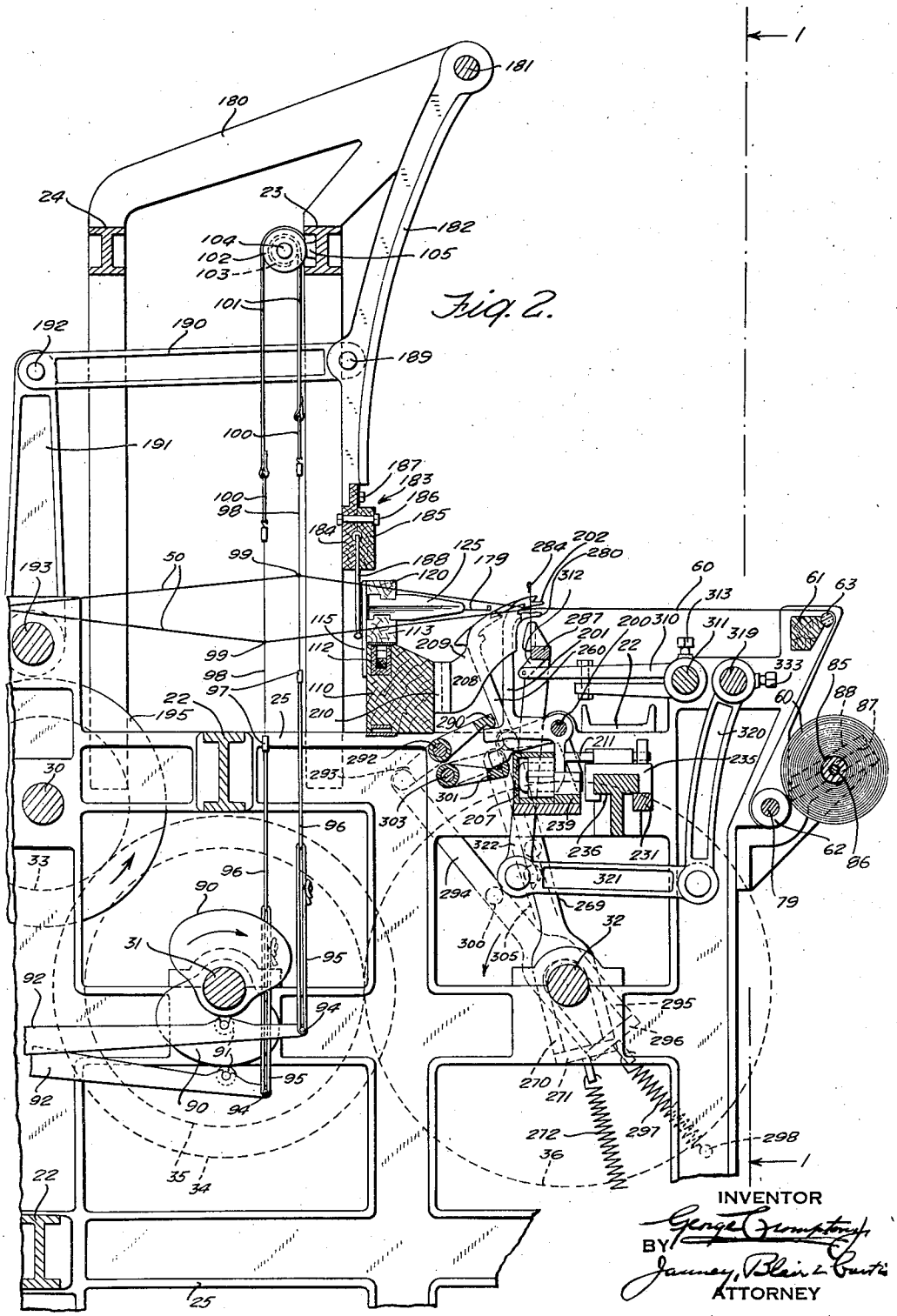


Fig. 2.

INVENTOR
George Crompton, Jr.
BY
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ATTORNEY

Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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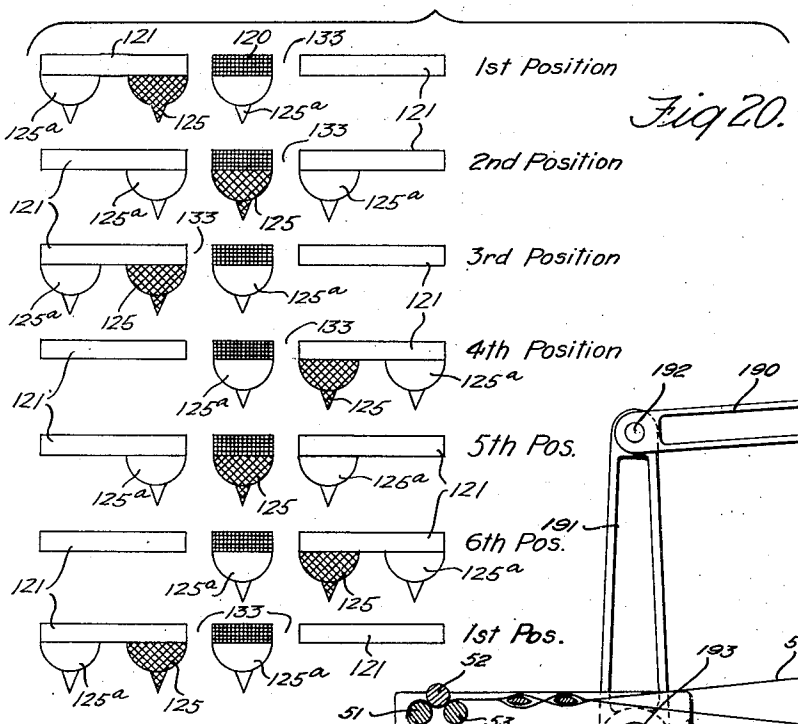


Fig 2a.

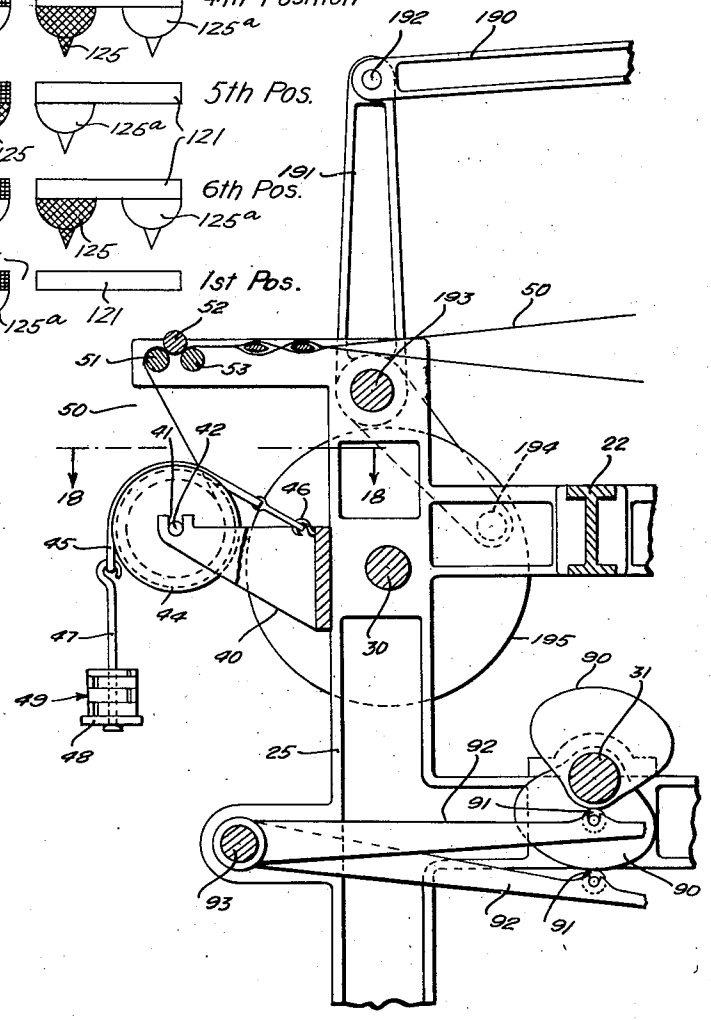


Fig. 3.

INVENTOR
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Janney, Blair & Crosby
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Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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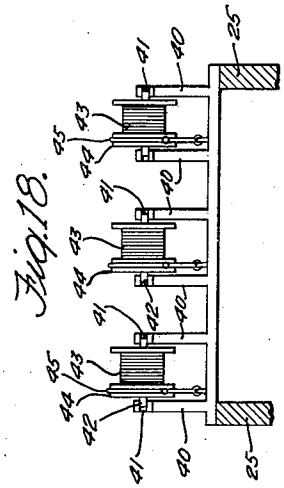


Fig. 18.

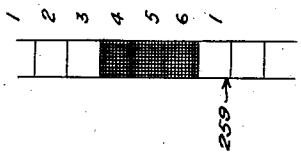


Fig. 23.

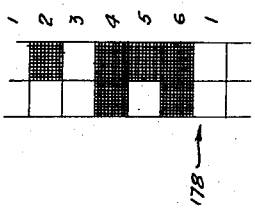


Fig. 22.

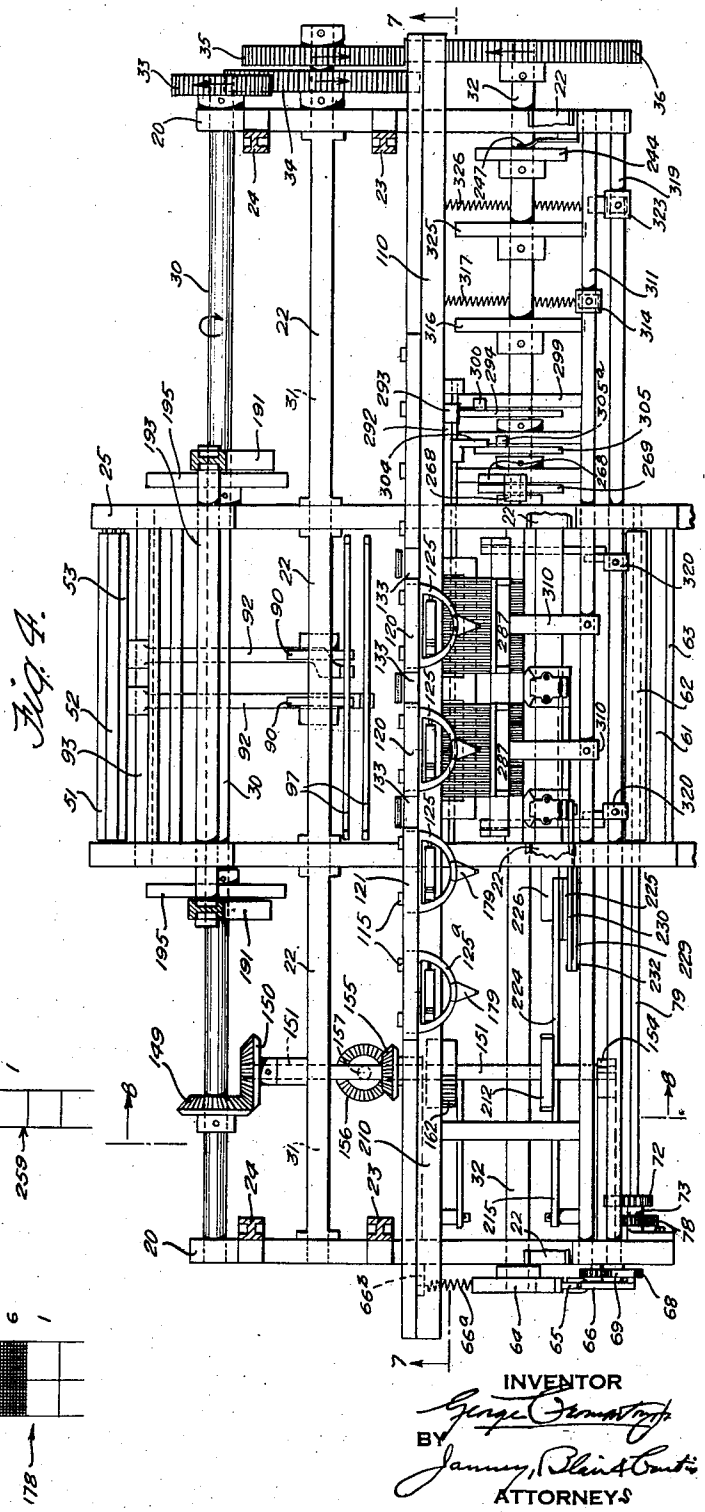


Fig. 4.

INVENTOR

George Crompton

BY

Jenney, Eliot & Curtis

ATTORNEYS

Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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Fig. 5.

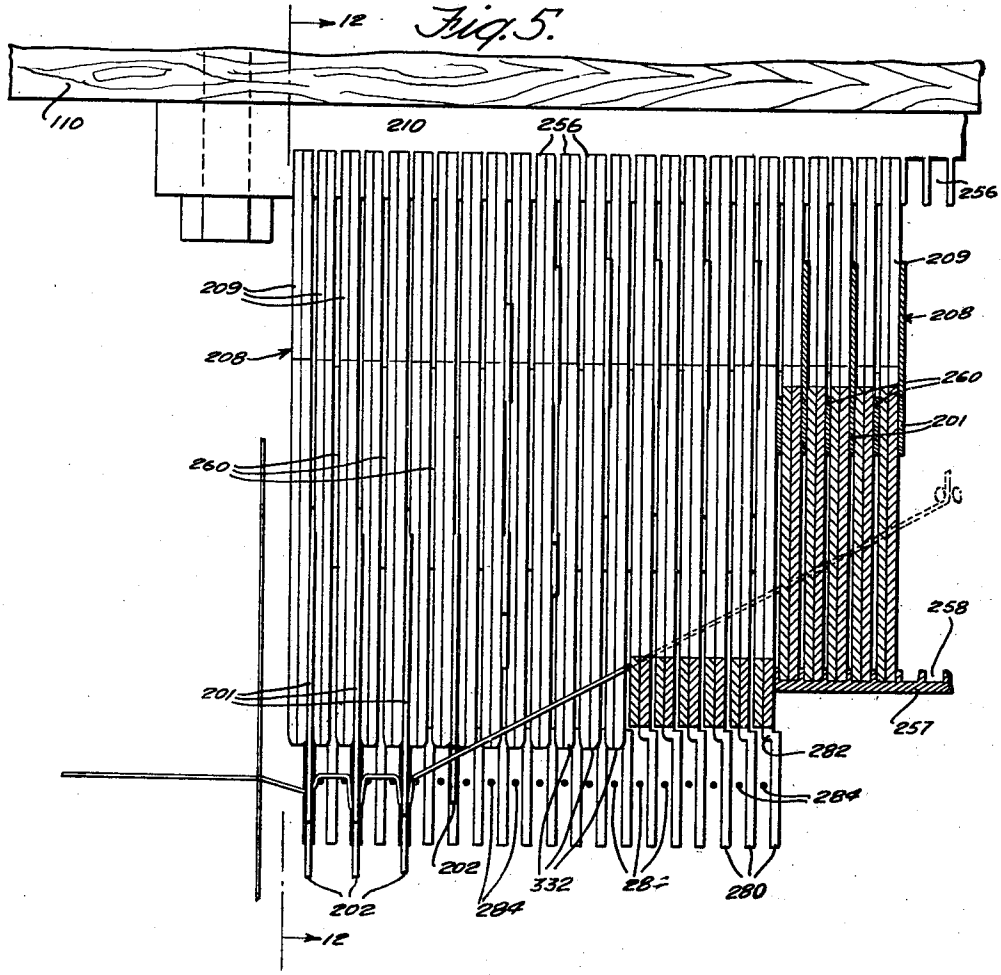


Fig. 14

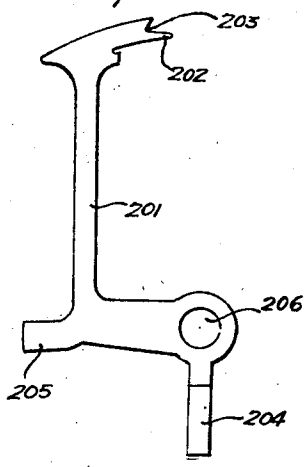
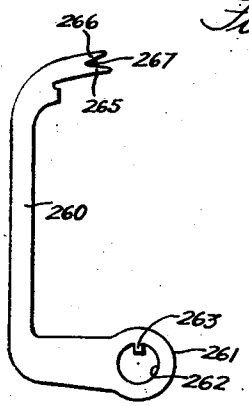


Fig. 15.



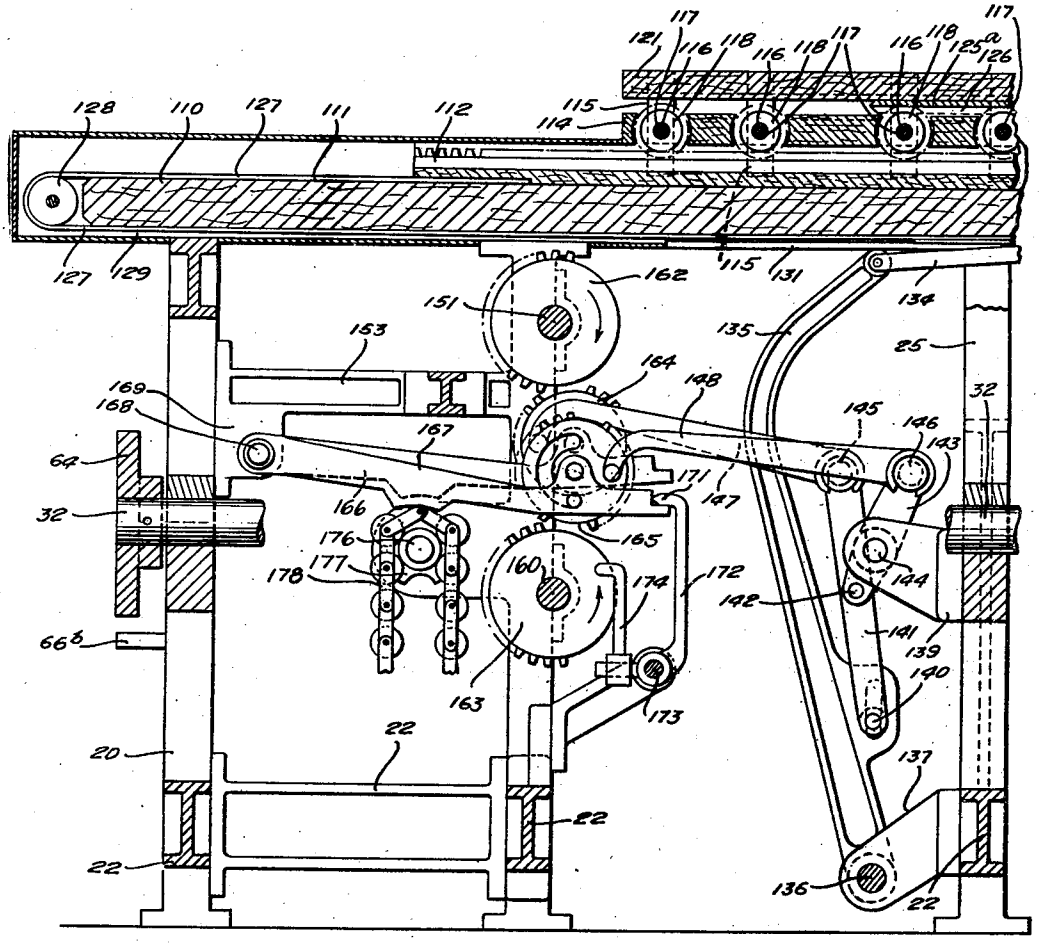
INVENTOR
George Crompton
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Jammy, Blair & Curtis
ATTORNEYS

Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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Fig. 6.



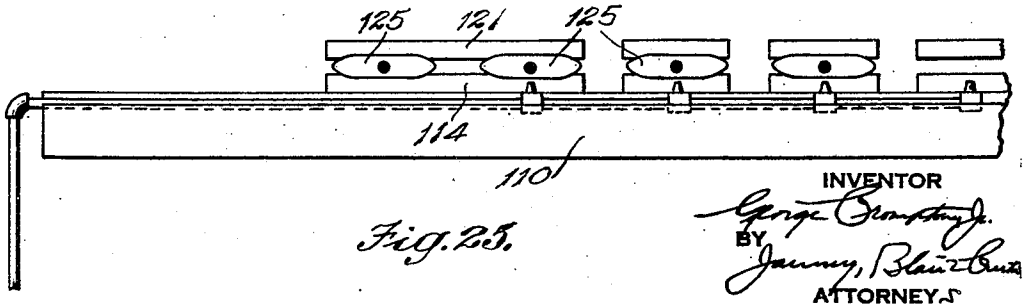


Fig. 25.

INVENTOR
George Crompton Jr.
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Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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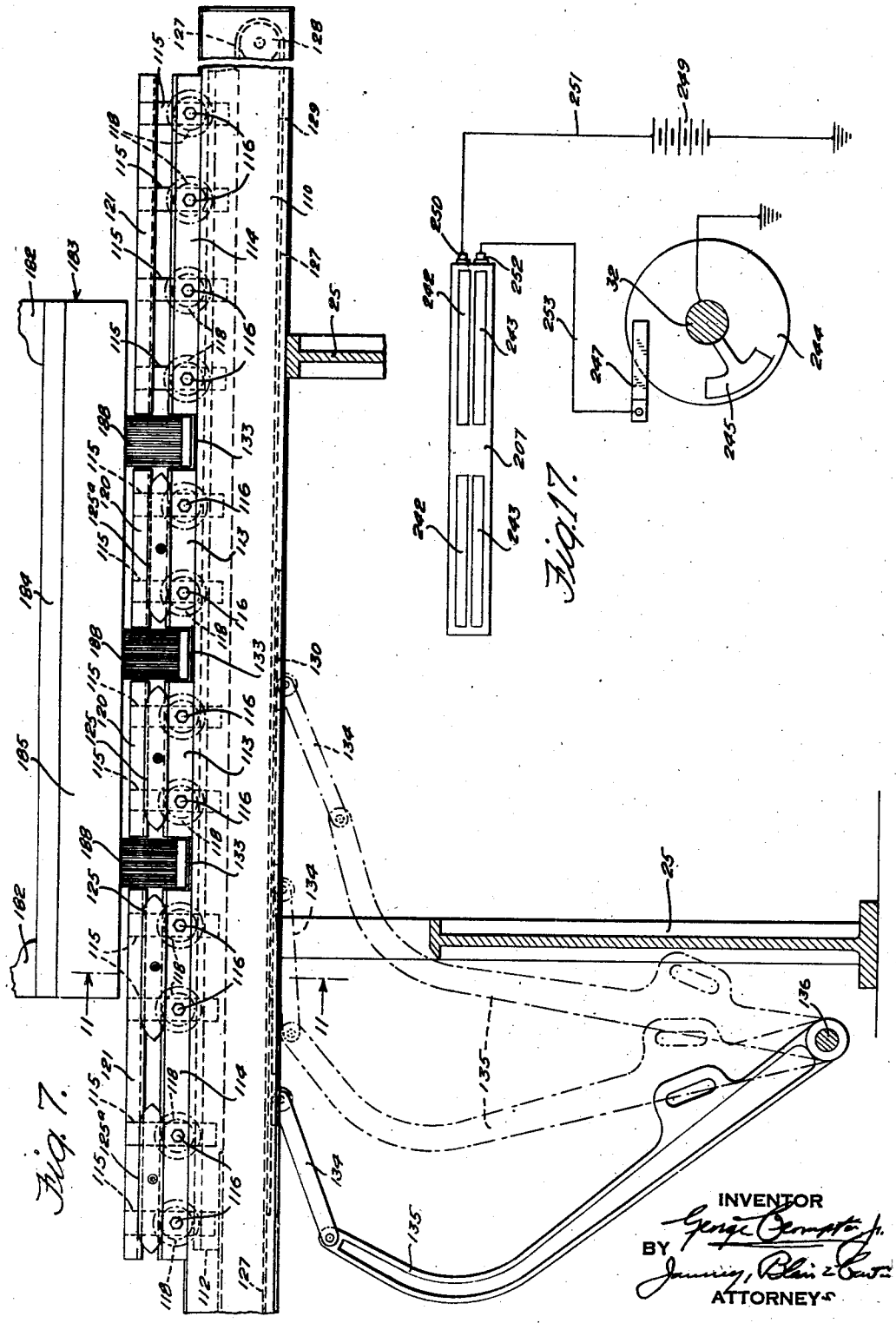


Fig. 7.

Fig. 17.

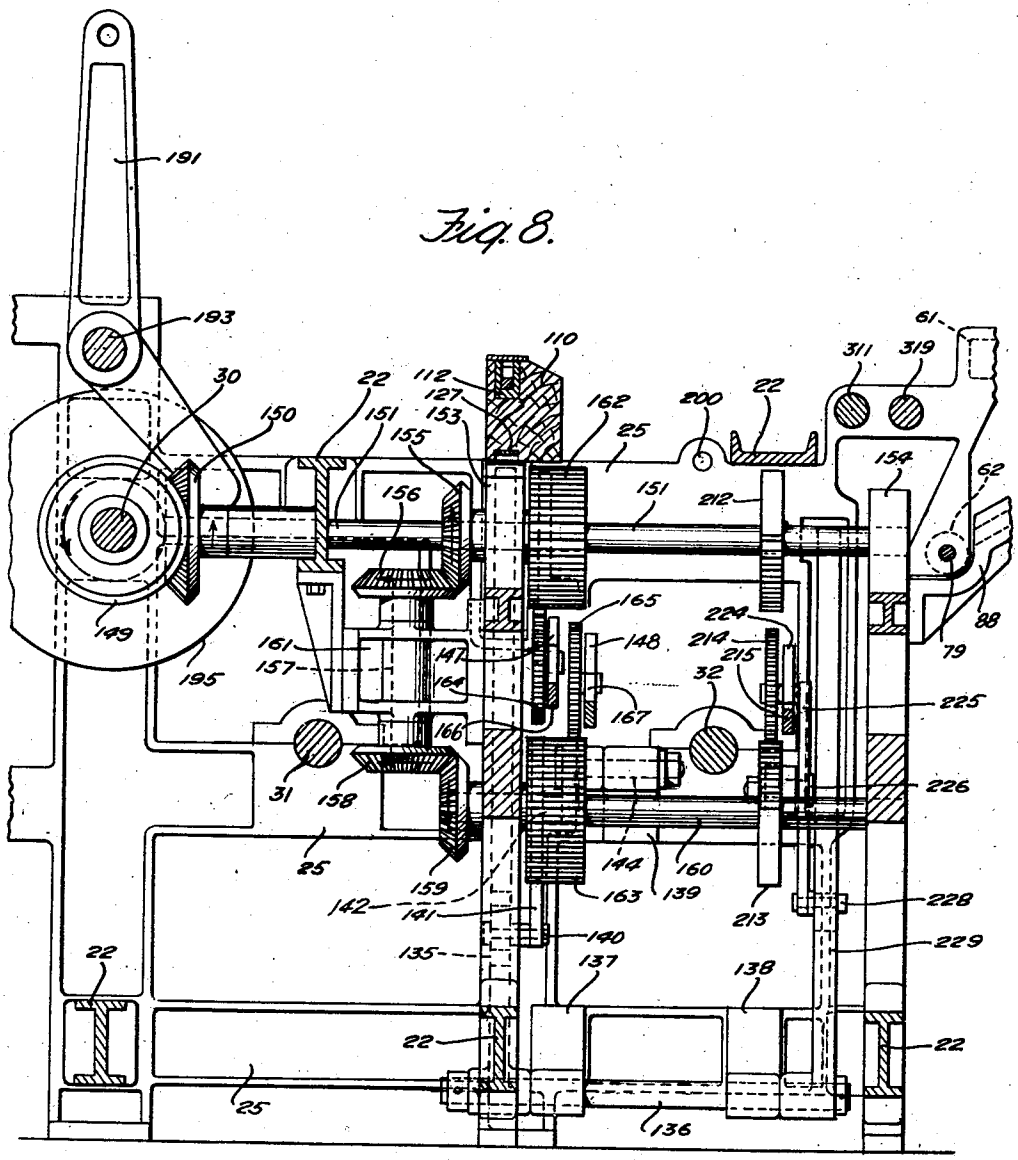
INVENTOR
George Crompton Jr.
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Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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Fig. 8.



INVENTOR

BY George Crompton Jr.

Janney, Blair & Cook

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Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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Fig. 9.

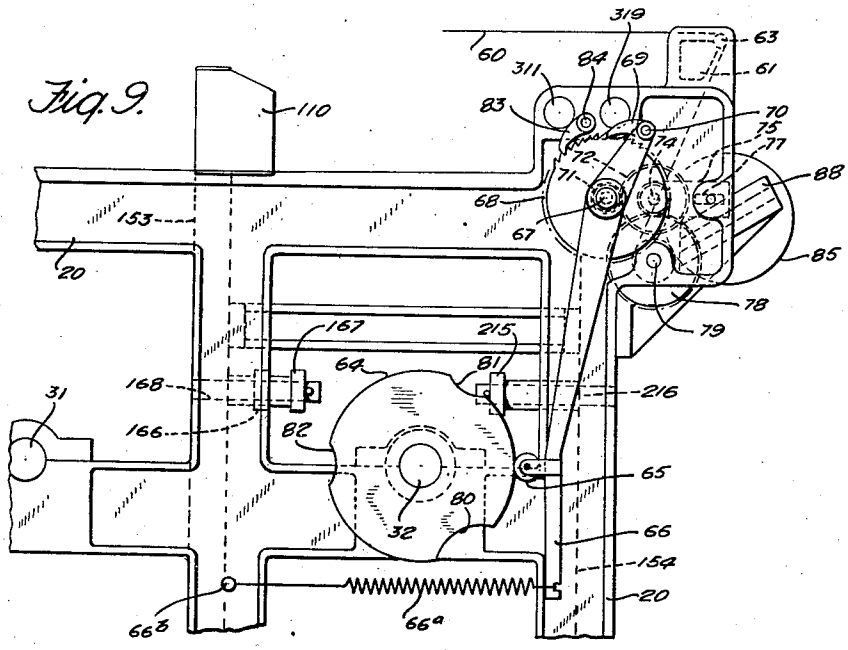
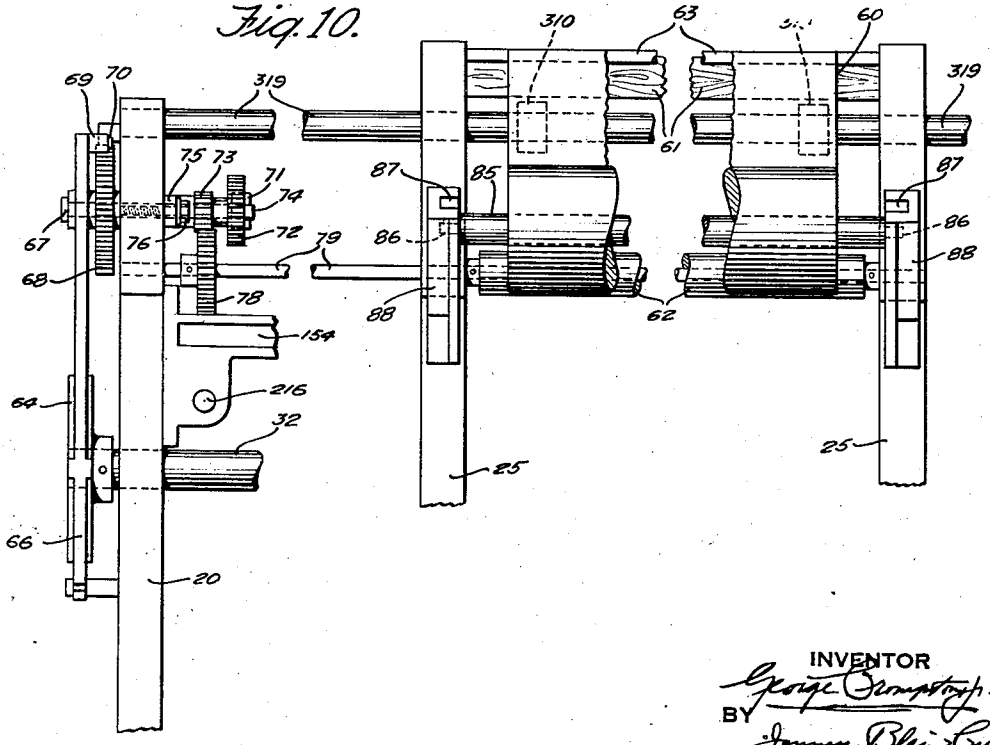


Fig. 10.



INVENTOR
George Crompton Jr.
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Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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Fig. 19.

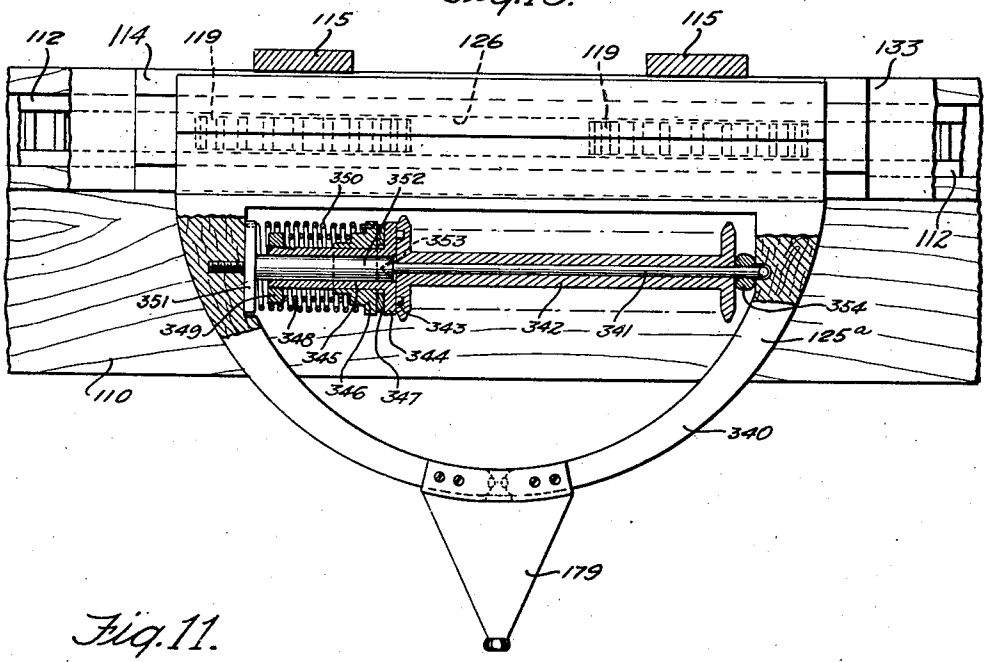


Fig. 11.

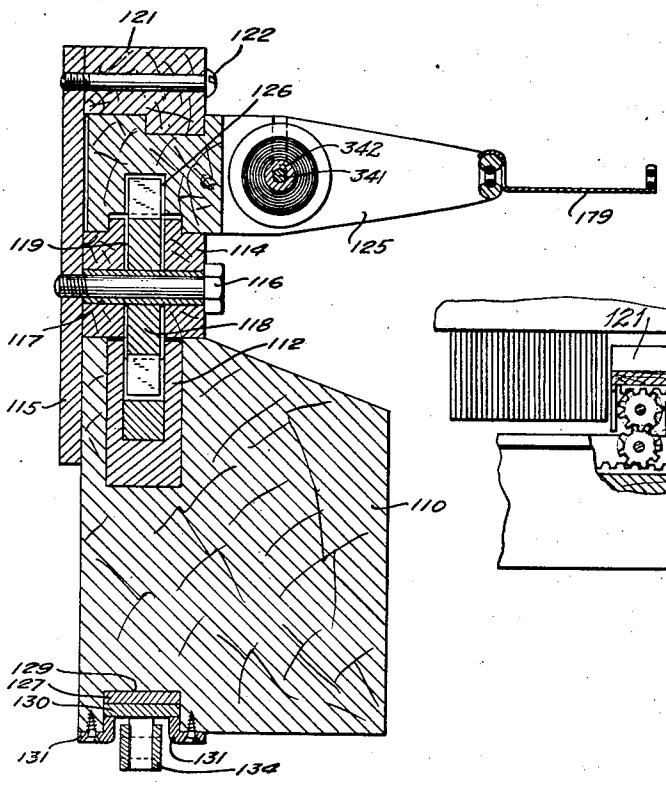
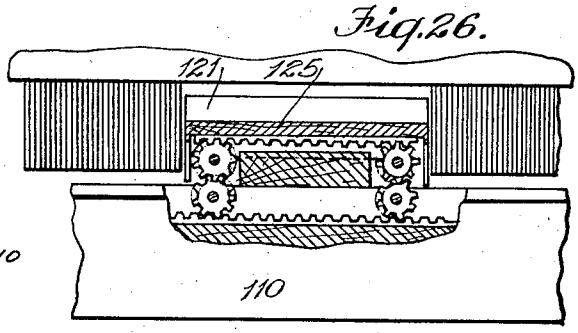


Fig. 26.



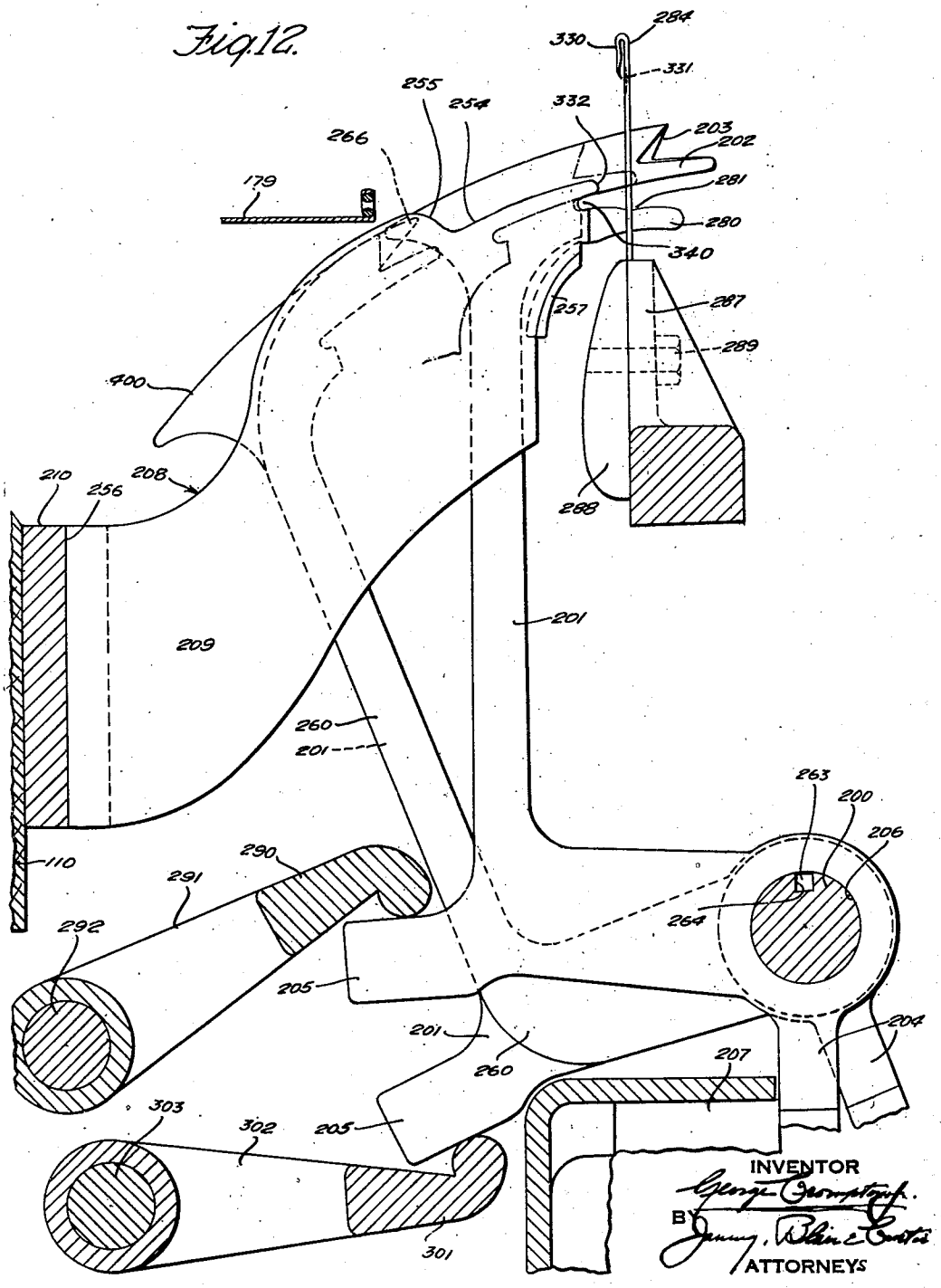
INVENTOR
George Crompton, Jr.
BY
Jenney, Blair & Curtis
ATTORNEYS

Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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Fig. 12.

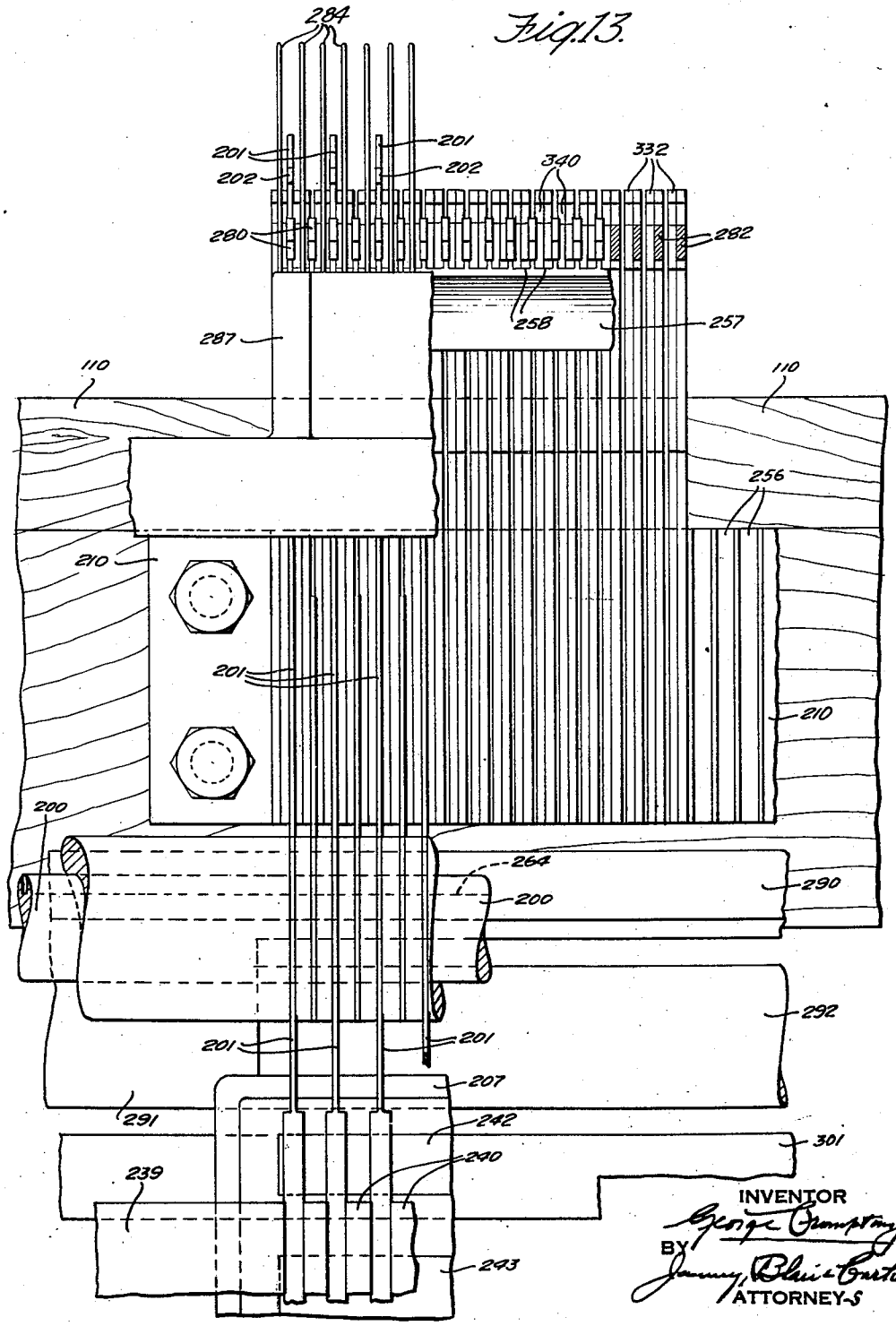


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LOOM AND FABRIC

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Fig. 13.



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Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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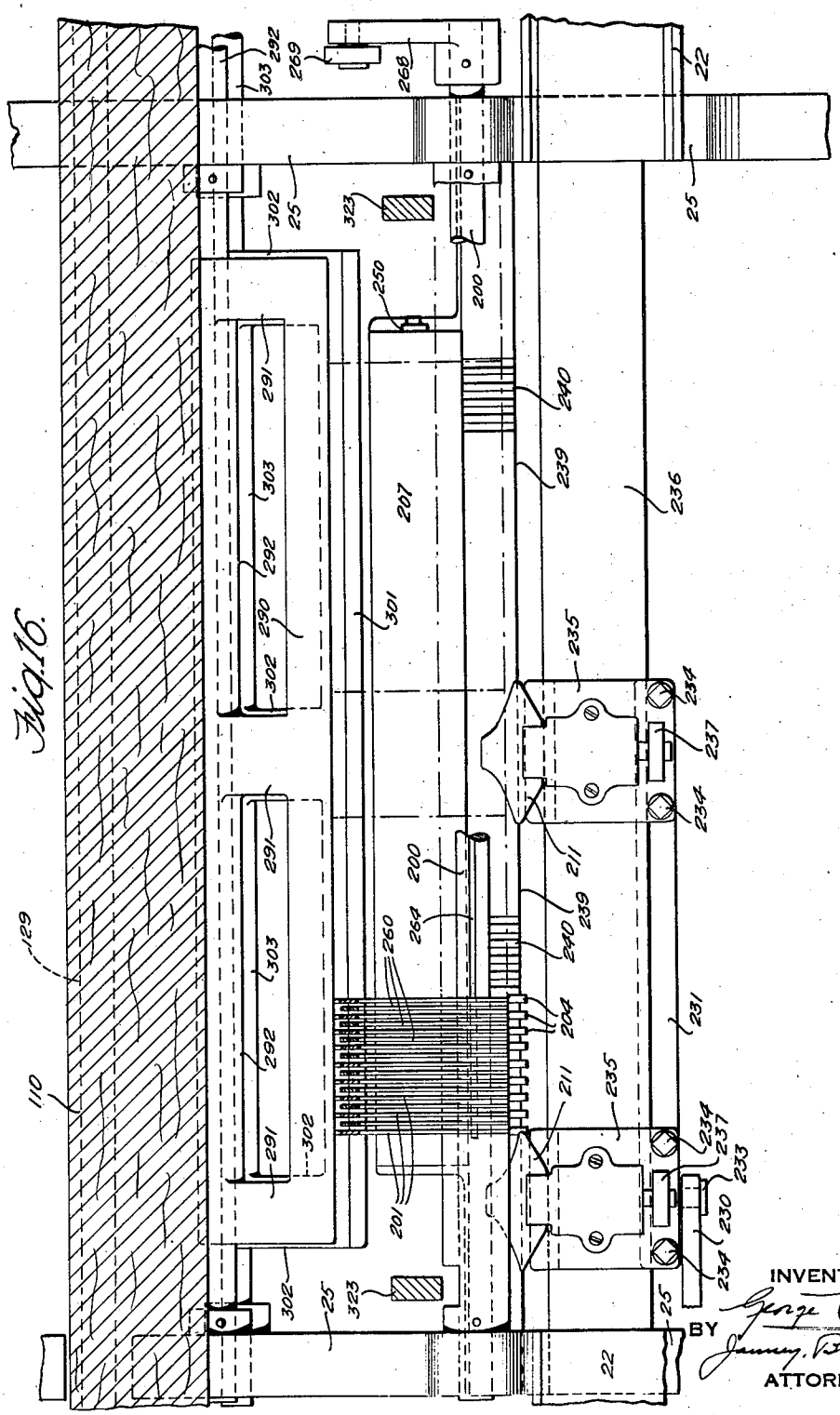


Fig. 16.

INVENTOR
George Crompton Jr.
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Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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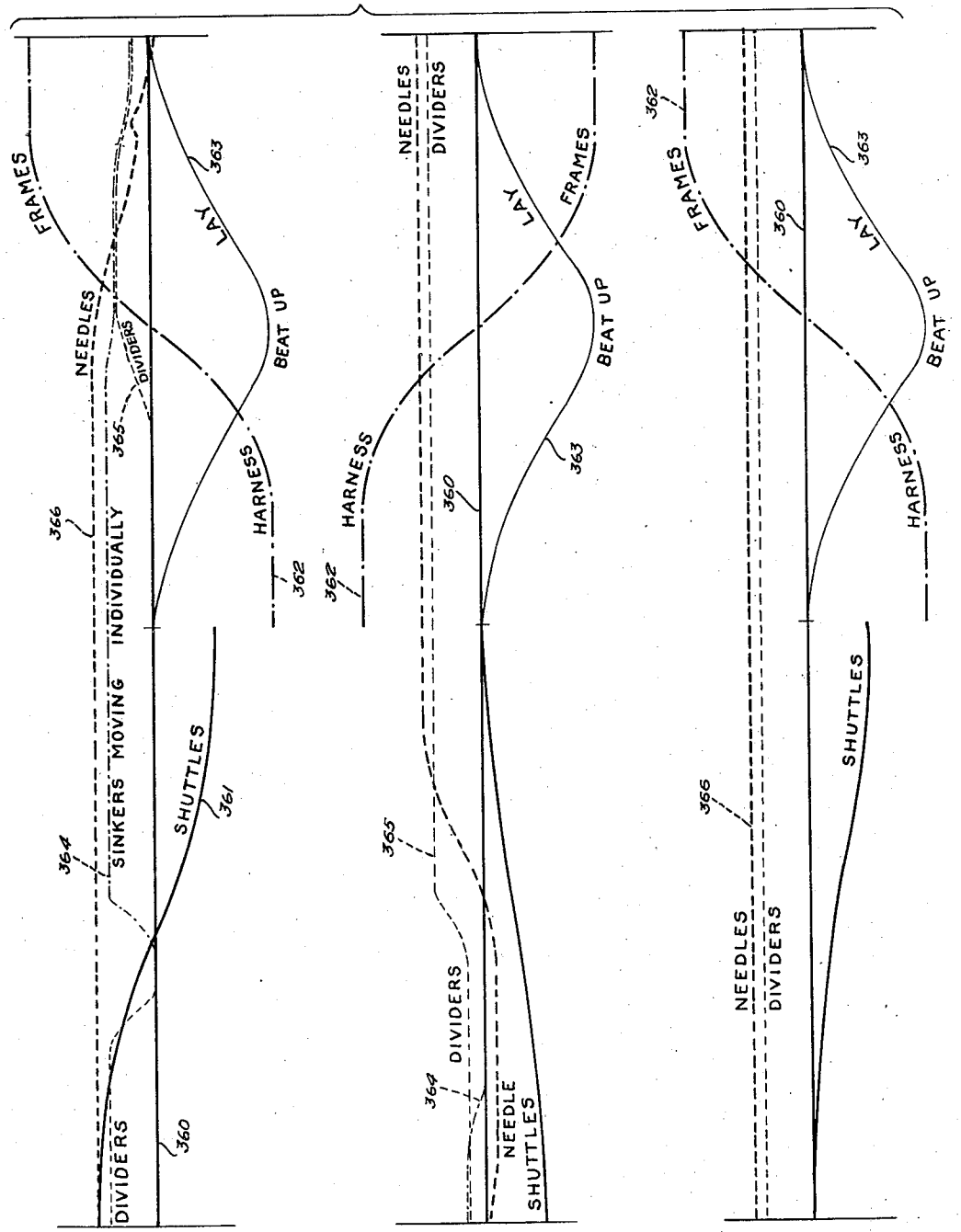


Fig. 21.

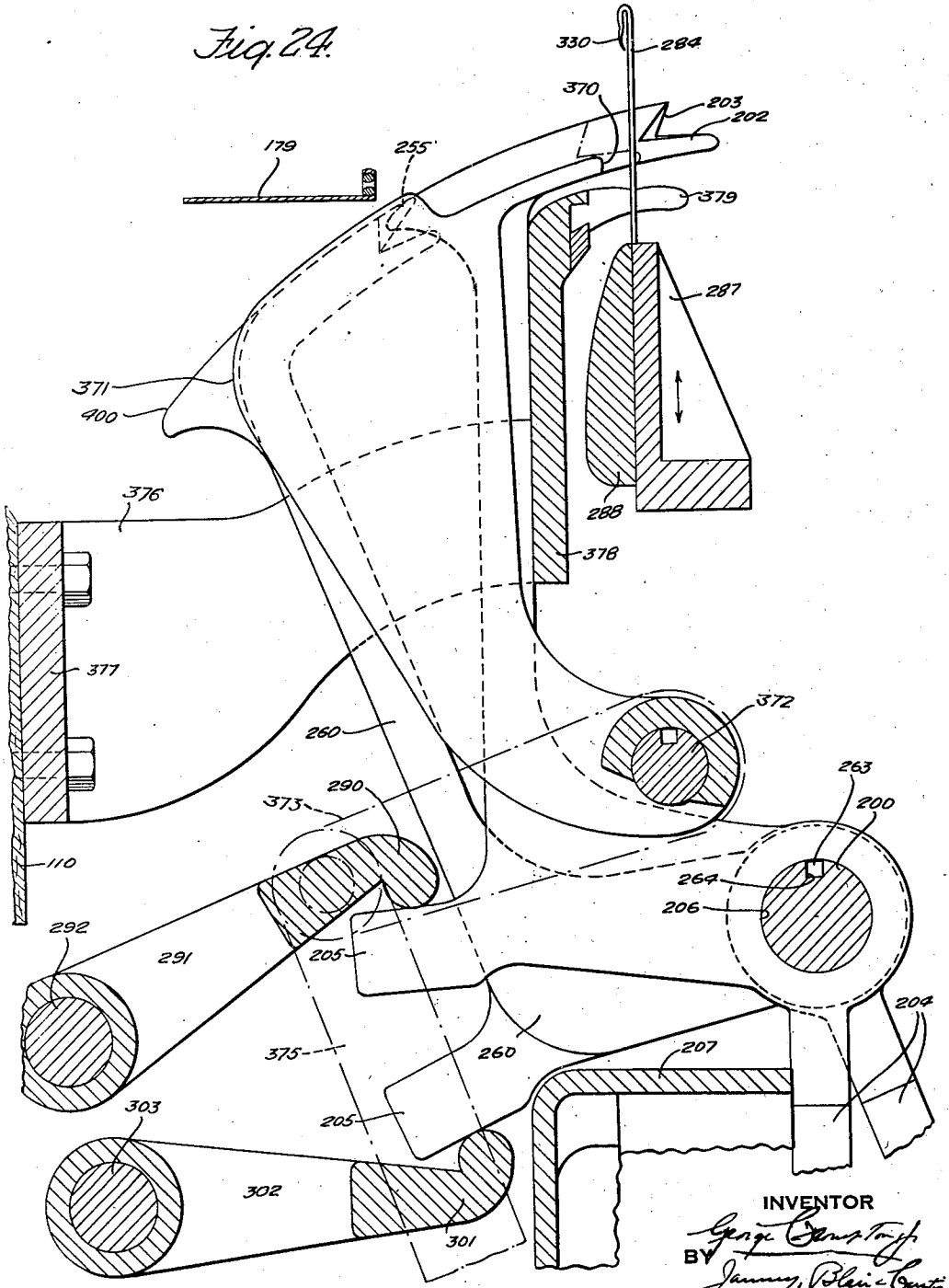
INVENTOR
George Crompton Jr
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Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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Fig. 24.



INVENTOR

George Crompton Jr.

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Nov. 13, 1934. G. CROMPTON, JR 1,980,666

LOOM AND FABRIC

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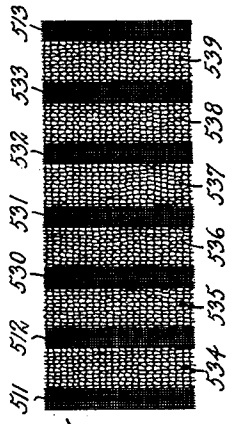


Fig. 27.

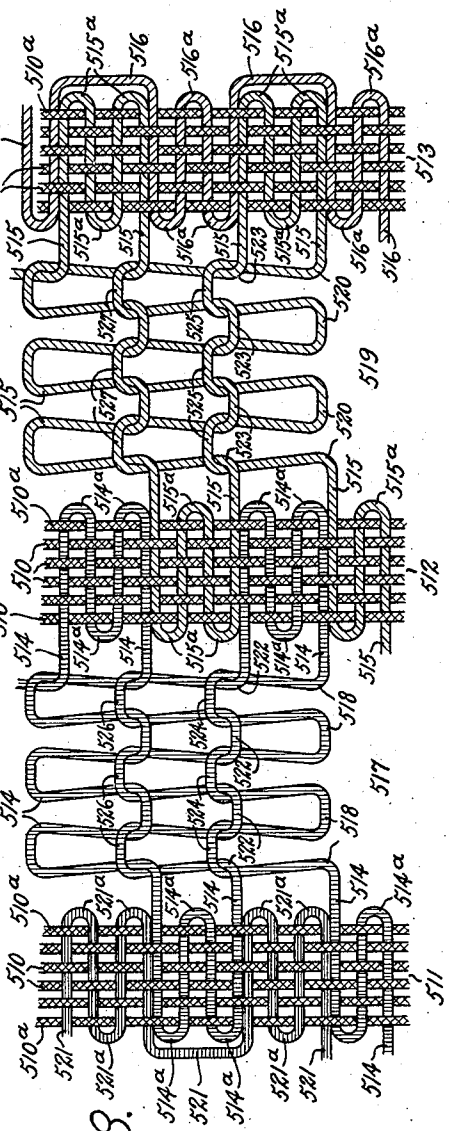


Fig. 28.

INVENTOR

George Crompton Jr.

Patented Nov. 13, 1934 1,980,666

UNITED STATES PATENT OFFICE

1,980,666

LOOM AND FABRIC

George Crompton, Jr., Flushing, N. Y.

Application January 30, 1933, Serial No. 654,139

40 Claims. (Cl. 139—1)

The invention relates to a loom and with regard to its more specific features to a loom for simultaneous knitting and weaving.

One object of the invention is to provide a practical loom for simultaneously knitting and weaving. Another object of the invention is to provide a loom adapted to produce a fabric comprising spaced sections of woven fabric connected by sections of knitted fabric. Another object of the invention is to provide a loom adapted for the production of textile goods in a variety of patterns of weaves and looped structure. Another object of the invention is to provide a loom of the type indicated which may readily be adjusted and set up for the manufacture of a wide variety of fancy goods. Another object of the invention is to provide a shuttle driving mechanism adapted also to lay yarn for knitting. Another object of the invention is to provide a simple and efficient mechanism for controlling the sinkers of a knitting mechanism. Another object of the invention is to provide a simple and efficient slur cock motion. Another object of the invention is to provide sinkers and an actuating mechanism therefor coordinated with picking or wefting mechanism for weaving. Another object of the invention is to allocate space in a loom for adjacent weaving and knitting mechanism without interference.

Another object of the invention is to produce a sectioned fabric, there being woven sections and knitted sections. Another object of the invention is to integrally unite knitted fabric to woven fabric. Another object of the invention is to provide a fabric of which certain sections consist of warp and weft, and other sections of merely one of these. Another object of the invention is to provide strips of woven material connected by certain picks of the weft thereof. Another object of the invention is to provide strips of woven material connected by certain picks of the weft thereof which is knitted. Another object of the invention is to provide integrally united woven and knitted material. Another object of the invention is to provide integrally united woven and knitted material, the woven material having a selvage. Another object of the invention is to provide a method for the manufacture of dress goods material whereby a great number of different designs may be produced. Another object of the invention is to provide a textile fabric which is extremely elastic in one direction and comparatively inelastic in another direction. Another object of the invention is to provide an attractive piece of dress goods. Another object of the invention is to provide a simple and practical method for the manufacture of combined knitted and woven goods. Another object of the invention is to provide textile goods such as curtainings, and upholstering goods susceptible of embodiment in a great number of different designs. Another object of the invention is to provide a type of textile material in which a lacelike fabric is incorporated with woven fabric in a single piece. Another object of the invention is to provide a combined woven and knitted fabric in which the demarcation between the woven and knitted portions is fixed and firm. Another object of the invention is to provide a combined knitted and woven fabric susceptible of embodiment in a single piece of goods in many colors. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangements of parts and in the several steps and relation and order of each of said steps to one or more of the others thereof, all as will be exemplified in the structure to be hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is shown one of various possible embodiments of the mechanical features of this invention.

Figure 1 is a front elevation of a loom embodying the invention, the elevation being, however, taken from behind the breast beam, and part of the frame being shown in cross-section on the line 1—1 of Figure 2;

Figure 2 is a vertical sectional view of the loom on an enlarged scale, the section being taken along the line 2—2 of Figure 1;

Figure 3 is likewise a vertical sectional view, complementary to Figure 2 showing the rear of the loom;

Figure 4 is a sectional plan view of the loom, the parts being shown on the same scale as Figure 1 and the section being taken along the line 4—4 thereof;

Figure 5 is a fragmentary plan view of a portion of the loom, the parts being shown on a larger scale than in Figure 2, and certain parts being shown in section;

Figures 6 and 7 are complementary sectional views showing the parts on the same scale as Figure 2, the section line being indicated by 7—7 in Figure 4;

Figure 8 is a sectional view taken on the line 8—8 of Figure 4, the parts being shown on the same scale as Figure 2;

Figure 9 is a side elevation of a portion of the loom showing the take-up;

Figure 10 is a fragmentary front elevation of the loom showing the cloth roll and brackets, the take-up roll and change gearing, the parts being shown on the scale of Figure 2 but foreshortened laterally by breaking away the shafts and rolls to save space;

Figure 11 is a fragmentary cross-sectional view on a further enlarged scale taken through the stationary lay on the line 11—11 of Figure 7;

Figure 12 is a sectional view on the same scale as and taken on the line 12—12 of Figure 5;

Figure 13 is a front elevation of the sinker and divider comb and associated parts, on the scale of Figures 5 and 12;

Figure 14 is a side elevation of a sinker;

Figure 15 is a side elevation of a divider;

Figure 16 is a plan view of a comb for the sinker tail pieces, sinker resetting bars, slur cocks, and a magnet box;

Figure 17 is a front elevation of a magnet box, and a side elevation of a commutator and a wiring diagram;

Figure 18 is a sectional view taken on the line 18—18 of Figure 3, showing the warp beams;

Figure 19 is a plan view of a shuttle, and a view, partly in section, of a quill rewinding device;

Figure 20 is a diagrammatic view of shuttles and blocks showing the shuttles successively in different positions;

Figure 21 is a loom timing chart;

Figures 22 and 23 are pattern chain drafts;

Figure 24 is a view similar to Figure 12, illustrating a modification of the invention.

Figure 25 is a front elevation of a lay showing humidifying piping therein;

Figure 26 is a fragmentary front elevation of a lay, a shuttle and shuttle blocks showing a modification of the invention whereby to increase the width of woven sections relative to knitted sections.

Figure 27 is a plan view of a textile fabric constructed in accordance with the invention; and

Fig. 28 is a diagrammatic plan view of the textile fabric of Figure 27, the yarn being shown on an enlarged scale for clearness, and certain proportions being arbitrarily chosen to more clearly illustrate in detail a typical structure.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Frame

Any desired frame may be adopted or designed, although hereinafter in the description specific frame structure will be referred to. As shown in the drawings, and referring particularly to Figures 1, 2 and 4, I provide loom sides 20 and 21 connected and supplemented by suitable cross-pieces and other frame structure, indicated by the reference character 22. Preferably the loom sides 20 and 21 are connected also by loom arches 23 and 24 spaced from each other as shown in Figure 2. Referring now particularly to Figure 1, I provide central supporting frame sections 25, 25 and if, as contemplated, the loom is increased in width by the addition of weaving sections and knitting sections, additional supporting frame sections 25 may be provided.

Drive

Referring now to Figures 2 and 4, I provide main shafts 30, 31 and 32 journaled in the loom sides 20 and 21 and if desired, in additional journal boxes supported by the central frame sections 25 or otherwise. I term the shaft 30 a crankshaft for convenience, because it actuates the lay that beats up the weft, but in the particular embodiment of the invention described it has no crank, the lay being operated by cams. I term the shaft 31 a loom camshaft, because it rotates at half the speed of the crankshaft 30 and has or may have shedding cams located thereon. I term the shaft 32 a knitting camshaft, because many of the knitting instrumentalities are more conveniently operated therefrom or thereby.

Referring now to Figure 4, mounted on the crankshaft 30 at one side of the loom is a gear 33 which meshes with a gear 34 mounted on the loom camshaft 31. In this particular embodiment of the invention the ratio of the diameters of the gears 34 and 33 is two-to-one so as to cause the loom camshaft 31 to revolve at half the speed of the crankshaft 30, as aforesaid. Also mounted on the shaft 31 is a gear 35 which meshes with a gear 36 mounted on the knitting camshaft 32, and the ratio of the diameters of the gears 35 and 36 is two-to-three, so that, in this particular embodiment of the invention, the knitting camshaft 32 revolves at one-third the speed of the crankshaft 30. In Figure 2 I have shown these gears by their pitch circles only. Any one of the gears 33, 34, 35 or 36 may be driven by a pinion gear connected with a motor and a clutch, or fast and loose pulleys may be mounted on any one of the shafts 30, 31 and 32, or any other suitable driving mechanism may be employed, as loom drives, including clutches and brakes and shipper levers are well known.

Let-off

Referring now to Figures 3 and 18, I provide a plurality of pairs of frame members 40, there being a pair for each woven section of the goods produced by the loom, and I provide in each frame member 40 an open journal portion 41 for the reception of a trunnion 42 of a warp-beam 43. Each warp-beam 43 has a trunnion 42 on each side thereof, and the warp-beams 43 are preferably of the type used in the production of narrow fabrics. One of the heads 44 of each warp-beam is grooved on its periphery and receives a strap or rope 45 which is anchored at 46 to the frame 40 and at the other end connected to the hook spindle 47 of a scale platform 48 adapted for the support of weights 49. This constitutes a friction let-off of a type well known in the narrow fabric industry, and reduction in diameter of the warp may be compensated for by removal of weights 49. The warp 50 extends upwardly over and between guide rolls 51, 52 and 53, and then forwardly to the heddles of the harness frames.

Take-up

Referring now to Figures 9 and 10 in connection with Figure 2, the completed fabric 60 is drawn forwardly over a breast beam 61 which is mounted in and extends between the frame

sections 25, 25. From the breast beam 61 the fabric goes direct to a take-up roll 62. The take-up roll 62 may be a "sand" roll, or it may be of the burred sheet metal variety, or of any other type, depending on the class of goods being produced. I have illustrated in the drawings a loom adapted for the production particularly of silks, rayons, cottons and mixed goods, and consequently the roll 62 may be considered to be a sand roll, and the goods 60 pass over a glass rod 63 secured to the breast beam 61, and it is noted that from the fell to the take-up roll 62 the goods touch nothing but the glass rod 63, excepting the usual temples if such are used, and the considerable distance between the fell and the take-up roll 62 makes possible a considerable elasticity of the fabric at the fell which assists in knocking over as will be hereinafter described. It is noted that the instrumentalities, motions and combinations of the invention are adapted for the production of a fabric out of any yarn, including woolens and worsteds as well as those heretofore mentioned, merely the gauge, size of material and certain instrumentatlities being properly selected for the desired type of fabric.

Referring now particularly to Figure 9, mounted on the knitting camshaft 32 is a take-up cam 64 which is engaged by a roller 65 on a lever 66 that is journaled on a stud 67 which in turn is journaled in and extends through the loom side 20. Fastened to the stud 67 on one side of the loom side 20 is a take-up ratchet wheel 68 which is engaged by a pawl 69 mounted on a pin 70 on one end of the lever 66.

Referring now particularly to Figure 10, fastened to the stud 67 is a pinion gear 71 which meshes with one of two change gears 72 and 73 which are fastened together and journaled on a stud 74 projecting from an adjustable bracket 75 which is fastened to the loom side 20 by means of a single bolt 76 which passes through a long slot 77 in the bracket 75. The change gear 73 meshes with a gear 78 fastened to the shaft 79 of the take-up roller 62. The roller 65 is held against the cam 64 by means of a spring 66*a* fastened to the end of the lever 66 and secured to the loom side at 66*b*.

The specific take-up described is in itself well known and readily adjustable by the substitution of different change gears 72, 73 as well as different ratchet wheels 68 and gears 78, but for the particular embodiment of the invention shown in the drawings I desire to take up double the amount for certain picks as compared with other picks by reason of the fact that periodically the loom lays two picks in a shed instead of one. To this end I have formed the cam 64 with actuating portions 80, 81 and 82, the actuating portion 80 having twice the displacement of the actuating portions 81 and 82 so that when the portion 80 engages the roller 65 the pawl 69 will move the ratchet wheel 68, for example, a distance equal to two teeth of said ratchet wheel 68, whereas the portions 81 and 82 cause movement of the ratchet wheel by a displacement of only one tooth. Referring again to Figure 9, I provide the usual hold-pawl 83 mounted on a stud 84 projecting from the loom side 20, and if desired the hold-pawl 83 may have incorporated with it a let-back motion.

Referring now to Figures 2 and 10, the fabric 60 winds upon a cloth roll 85 which has a shaft 86 the ends of which rest in open slots 87 formed in guide brackets 88 fastened to the frame sections 25, 25. It should be understood that other take-ups can be substituted for that shown, and other cams can be substituted for the cam 64 and this should preferably be done if and when the timing of the wefting is changed for the production of a different relationship between the courses and the picks as will be hereinafter indicated.

Shedding

Referring now to Figures 2 and 3, mounted on the loom camshaft 31 are shedding cams 90 engaging rollers 91 carried by tappet levers 92 which are journaled on a cross shaft 93 supported by the frame sections 25. Pins 94 extend laterally from the ends of the tappets 92 and straps 95 connect the pins 94 with connectors 96 connected to harness frames 97 having heddles 98 with heddle eyes 99. Connectors 100 are connected to straps 101 extending partially around and fastened to rolls 102 and 103 of an overhead motion, the rolls 102 and 103 being formed on or fastened to a shaft 104 journaled by means of brackets 105 extending from the loom arch 23. The ends of the warp 50 pass through the heddle eyes 99. The harness frames 97 have heddles 98 located at a plurality of portions to correspond with the number of separate warp beams 43 and warps 50 as in narrow fabric practice. Although I have shown and described briefly a typical cam operated shedding mechanism, it should be understood that any other type of shedding mechanism may be employed, such as a dobby or a jacquard, and I have shown the loom arches 23 and 24 spaced for reception of a great number of harness frames (Figure 2) and in Figure 1 I have shown the arches formed with receiving ends 106 and 107 for a Knowles head and also with an angle brace 108 to receive the shaft to support the jacks of a Knowles head, otherwise known as a vibrator gear motion or American wheel dobby, and such a shedding mechanism may be attached to my loom by this means, and indeed it is contemplated that in a majority of cases it will be, and the Knowles head may be driven from the crankshaft 30 which is suitably located for that purpose.

Wefting

Referring particularly to Figure 2 in connection with Figures 4, 5 and 6, I provide a stationary lay 110, preferably made of wood, and supported by the loom sides 20 and 21 and the frame sections 25. Mounted in a groove 111 in the upper part of the lay 110 is a rack rod 112, preferably made of wood in accordance with the usual narrow fabric practice. Located upon the lay 110 and over the rack rod 112 are a plurality of lower shuttle blocks 113, preferably of wood. Located in line with the blocks 113 are long lower blocks 114, there being two of the long lower blocks 114, one at either end of the series of blocks. The blocks 113 as well as the blocks 114 are fastened in position by means of metal backs 115 secured to the lay 110 and extending upwardly; as shown in Figure 11 the usual machine screws 116 pass through the blocks 113 and 114 and secure them to the backs 115, and tubes 117 surround the machine screws 116 and rotatably support fiber pinions 118 located in slots 119 in the blocks 113 and 114, as shown in connection with one of the blocks 114 in Figure 11 which is sectioned for that purpose.

Likewise fastened to the backs 115 and above

the blocks 113 are upper blocks 120, and above the long lower blocks 114 are long upper blocks 121, all of said upper blocks being fastened to the backs 115 by means of screws 122. There are thus provided races for a plurality of shuttles 125, of the narrow fabric type, and having rack teeth 126 on their under sides so that they may be driven by pinions 118.

Referring now to Figures 6 and 7, fastened to the bottom of the rack rod 112 are straps 127 which extend around rollers 128 journaled in slots in the lay 110 and the straps 127 extend under the lay 110, being preferably received in a groove 129 therein, and are connected to a slidable member 130 which is preferably held from dropping due to sagging of the straps by means of plates 131 attached to the bottom of the lay as best shown in the cross-sectional view of Figure 11. Movement of the slidable member 130, by reason of the straps 127, causes movement of the rack rod 112 a corresponding distance in the opposite direction, thereby rotating the pinions 118 and driving all of the shuttles 125 in unison, the shuttles 125 moving in the same direction as the slidable member 130 and an equal distance.

I have shown in Figure 4 three spaces 133 between shuttle blocks, and referring to Figure 7 I have shown four shuttles. Of course the loom may be made as wide as desired, and the number of shuttles, blocks and spaces increased. By moving the slidable member 130 I give to the shuttles 125 the usual motion to move each shuttle from a block to its next adjacent block, but I have further provided means to move the slidable member 130 and therefore the shuttles 125 double the usual distance, whereby each shuttle, except each end shuttle, will move through two spaces 133 without stopping until it comes to rest between shuttle blocks which are separated from the shuttle blocks from which it started by a pair of intervening shuttle blocks. The mechanism for this purpose is so organized that any desired variations of this compound motion may be achieved by merely making up different pattern chains.

Referring now to Figures 6, 7 and 8, the slidable member 130 is connected by means of a link 134 to a lever 135 which is journaled on a shaft 136 supported by brackets 137, 138 attached to one of the center frame sections 25. The part of the center frame section which supports the stationary lay 110 is cut away except for the portion which supports the very front of the lay in order to permit desired movement of the link 134 and the lever 135, as illustrated in Figure 7. Referring now to Figure 6, pivotally connected to the lever 135 by means of a stud 140 is a lever 141. The lever 141 is mounted on a stud 142 projecting from a lever 143. The lever 143 is mounted on a stationary stud 144 projecting from a bracket 139, projecting from the frame section 25.

Referring again to Figure 6, mounted on the upper end of the lever 141 is a stud 145 and mounted on the upper end of the lever 143 is a stud 146. These two studs are approximately in the same horizontal plane, but the stud 146 is located nearer the front of the loom than the stud 145 and they clear each other as the levers 141 and 143 are moved. Removably connected to the stud 145 is a vibrator connector 147, and removably connected to the stud 146 is a vibrator connector 148. These vibrator connectors 147 and 148 are vibrator connectors of a vibrator gear mechanism of the type used in looms to actuate the harness frames and also the box motion and referred to as a Knowles head when used to actuate the harness frames, as already mentioned. The construction of such vibrator gear mechanisms is well known, and I shall but briefly describe this particular one herein, making clear its relationship to the other parts of the loom, and it should be understood that the motions usually associated with a vibrator gear mechanism are intended to be included, even when not specifically mentioned or shown in the drawings, wherein I have not illustrated any drop weights (now usually springs) nor chain shaft drive, which may be of any usual or desired form.

Referring now to Figures 4 and 8, on the crankshaft 30 and suitably fastened thereto is a bevel gear 149 which meshes with a bevel gear 150 of equal size that is fastened to the end of a shaft 151 which is journaled in members 22 and brackets 153 and 154, the latter being also shown in Figure 1. The shaft 151 is thus revolved at the same speed as the crankshaft 30 and the direction of rotation is clockwise in Figure 6.

Fastened to the shaft 151 is a bevel gear 155 which meshes with a bevel gear 156 secured to the shaft 157 on the bottom of which is a bevel gear 158, likewise secured to the shaft 157, and the bevel gear 158 meshes with a bevel gear 159 secured to a horizontal shaft 160 whose axis is in the same vertical plane as the shaft 151. The shaft 157 is supported and journaled by a bearing bracket 161 extending laterally from the bracket 153. Thus the shaft 160 is revolved in a direction opposite to that of the shaft 151, and gears 155, 156, 158 and 159 are proportioned to cause the shaft 151 and 160 to revolve at the same speed.

Secured to the shafts 151 and 160 are partial cylinder gears 162 and 163 respectively, constituting the actuating cylinder gears of the vibrator gear mechanism heretofore referred to. The vibrator gears 164 and 165 are illustrated in Figures 6 and 8, in both figures the gear 165 being shown depressed, and the gear 164 being shown elevated. The vibrator gears 164 and 165 are partial gears and adapted to be rotated approximately one-half revolution upon being brought into contact with either of the gears 162 or 163, and are mounted respectively on vibrator levers 166 and 167 (see Figure 6) which are removably pivoted on a stud 168 secured to a bracket 169 of frame 153. I have not described the shape and all the features of the vibrator levers, vibrator gears, and vibrator connectors, as these are well known loom parts, and standard vibrator gears, levers and connectors may be used in carrying out my invention. I provide the usual lock knife 171 mounted on an arm 172 journaled on the stud 173 and actuated by an arm 174 which contacts with a cam, not shown, mounted on the shaft 160 in the usual position. A chain shaft 176 journaled in the bracket 153 has secured to it a chain carrier 177 that carries the pattern chain 178 which, to achieve the particular cycle described herein, is made up as will be hereinafter set forth under the section devoted to "timing". The chain shaft 176 is driven in any usual manner, for example from the shaft 160, this well known drive being omitted from the drawings in order to simplify them.

The size and relation and pivotal mounting of the levers 141 and 143 are such that with either

vibrator connector 147 or 148 forward, and the other one back the large lever 135 stands vertically, in the mid position illustrated in Figure 6. With both vibrator connectors 147 and 148 back, that is to say to the left in Figure 6, the large lever 135 occupies the right hand position as illustrated in dotted lines in Figure 7. With both vibrator connectors 147 and 148 forward, that is to the right in Figure 6, the large lever 135 occupies the left hand or full line position of Figure 7. Consequently this shuttle driving mechanism is adapted to place the shuttles 125 in three different positions of rest, and they can be moved from any one position to any other position at a single actuation of the vibrator gear mechanism, by making up the pattern chain 178 in the desired manner.

Referring to Figure 7, the end shuttles 125*a* pass through the end spaces 133, when desired, and at other times move between the long lower blocks 114 and the long upper blocks 121 without passing through any weaving space. The remaining shuttles 125 pass at each pick through at least one of the spaces 133, and when it is desired to lay a course for knitting, they pass through two spaces 133, one after the other, at a single actuation. In doing so they pass through intermediate blocks at which they do not stop and it is at that time that weft is laid for knitting, and at that time the shuttles and the shuttle driving mechanism becomes a knitting weft-laying mechanism as well as a picking mechanism, and with respect to the function of laying weft for knitting the shuttles and the shuttle motion take the place of the weft carrier and the Coulier motion of a knitting frame.

Referring now to Figures 2 and 4, I have shown extensions 179 extending forwardly from the shuttles 125 to lead the weft very close to the fell of the woven part of the goods and in the path of the sinkers to be hereinafter described, and this extension 179 is an advantageous feature in view of the fact that the lay 110 is stationary and the shuttles 125 and 125*a* are not carried forwardly beyond the fell at the beat-up, but with a different shed from that shown in Figure 2 and with other changes in the proportions of the parts the extensions 179 may be omitted and furthermore shuttles with very thin bows extending far inwardly might be substituted for the extensions 179 so far as certain features of the invention are concerned. I will describe the shuttles more in detail in a section hereinafter devoted to them, and at this point merely note that they deliver weft at the end of the extensions 179.

It is noted that the width of the woven sections may be increased, relative to the knitted sections, by mounting two or even three pinion gears 118 over each other at each end of each block, and placing them very near the edges of the blocks. Such pinions, being smaller, would have their axes nearer the edges of the blocks, thus increasing the distance to which the shuttles could be projected. Such a construction involving a pair of pinion gears at each end of a block is illustrated in Figure 26.

Beating up

Referring now to Figures 1 and 2, I provide a pair of similar brackets 180, 180 secured to the top of the loom arches 23 and 24 and these brackets 180 journal a rock shaft 181 upon which are mounted a pair of hanging lay-swords 182, 182 which support a swinging lay 183 constituted by a back reed bracket 184 and a front reed bracket 185 secured together by bolts 186. The back reed bracket 184 is secured to the lay-swords 182 by bolts 187. The reed brackets 184 and 185 are desirably made of wood. A plurality of reeds 188 are secured between the brackets 184 and 185 as better shown in Figure 2, and there is a reed 188 for each weaving space 133 and each reed is in line with its particular weaving space.

Referring now to Figures 2 and 3, connected to each lay-sword 182 by means of a pin 189 is a connector 190. Each connector 190 is pivotally connected to a lever 191 by means of a pin 192. The levers 191 are secured to a rock shaft 193 (see now Figure 4) journaled in the frame sections 25. Secured to the ends of the levers 191 are pins 194 which extend into track cams 195 fastened to the crankshaft 30. The cams 195 actuate the levers 191 and swing the lay-swords 182 on the rock shaft 181, and it is noted that the lay 183 is stationary during a large part of the cycle represented by each revolution of the crankshaft 30, and the reeds 188 move forward to beat up the weft into the fells of the several woven portions of the goods after the shuttles come to rest in the blocks.

Sinking

Referring now to Figure 2, I provide a horizontal shaft 200, journaled in the frame sections 25 and on this horizontal shaft 200 I mount a plurality of sinkers 201. Figure 14 is a side elevation of a sinker detached from the loom, and as shown in that figure each sinker 201 includes a front portion 202, a notch 203, a slur cock tail piece 204, and a resetting tail piece 205. Each sinker has somewhat the shape of a sickle, as shown in Figure 14, and there is a hole 206 just above the slur cock tail piece 204 through which the shaft 200 passes and by means of which the sinker is pivotally mounted on said shaft, each sinker being actuated and controlled by engagement with its two tail pieces and by a magnet box 207.

Referring now particularly to Figures 2 and 5, the sinkers 201, which are made of thin flat metal, are guided by a comb 208 which is attached to the front of the stationary lay 110, this comb 208 comprising a plurality of flat metal separators 209 secured to and projecting from a plate 210 which separators have the shape best illustrated in Figure 2. There is one sinker between every alternate space defined by the separator plates 209, and each sinker 201 is free to move about the axis of the shaft 200 between the plates 209. Referring now to Figure 12, the sinkers 201, prior to the knitting operation, occupy the lowermost left hand position indicated in this figure, and are raised one by one to the extreme right hand position shown in this figure, by a slur cock 211 (see Figures 2 and 16) the actuation of which will now be described.

Referring now to Figures 1, 4 and 8, mounted on the shaft 151, which as will be remembered is the shaft for the upper cylinder gear 162, is an upper partial gear 212. Mounted on the lower shaft 160 is a lower partial gear 213. These partial gears 212 and 213 are the actuating gears of a vibrator gear mechanism, and located between them is a vibrator gear 214 which, as shown in Figure 1, is mounted on a vibrator lever 215 fulcrumed on a stud 216 projecting from the frame piece 154 attached to the loom side 20. Cooperating with the vibrator lever is

a lock knife 219 on an arm 220 which is pivoted at 221 to a bracket 222 attached to the bracket 154, and an arm 223 fastened to the arm 220 engages a cam, not shown, which actuates the lock knife in the well known manner.

Connected to the vibrator gear 214 is a vibrator connector 224 the other end of which is connected to a lever 225 that is journaled on a stud 226 projecting from a bracket 227 attached to the frame section 25. The other end of the lever 225 is connected by means of a pin 228 and slot to a lever 229 which is mounted upon the shaft 136.

Referring now to Figures 1 and 16, at the upper end of the lever 229 is a link 230 which connects the lever 229 with a slur cock rod 231, which may also be seen in Figure 2. The link 230 is connected to the lever 229 by a pin 232 and to the slur cock rod 231 by means of a pin 233. Referring particularly to Figures 2 and 16, fastened to the slur cock rod 231 by means of bolts 234 are slur cock boxes 235 which rest upon a slur cock slide 236. The slur cocks 211 are mounted in the usual manner in the slur cock boxes 235 and the usual adjustment wheels 237 actuating adjustment screws may be provided. As shown in Figure 16 slur cock slide 236 is supported by the frame sections 25.

Referring now to Figure 16, the slur cock tail pieces 204 are spaced by combs or grids 239 whose separators or plates 240 guide the tail pieces 204 and take the side thrust of the slur cocks 211. At the front end of each grid 239 is a magnet box 207. A single magnet box 207 will suffice for a pair of knitting sections, but where, as contemplated, the number of knitting sections is increased, additional magnet boxes would be provided, partly for ease of replacement in case one magnet box becomes short-circuited, and also to provide room for the needle bar parallel linkage mechanism, to be described.

The slur cocks 211, as shown in Figure 2, are located above the level of the grid 239, and contact the tail pieces 204, the depending portions of which are guided by the plates 240. The magnet box 207 has upper pole pieces 242 and lower pole pieces 243 as shown in Figure 17, and when the tail pieces 204 are moved forwardly by the slur cock 211 they are individually gripped and held by the poles 242—243 of the magnet box 207. Owing to the use of a magnet box to hold the sinkers in position, the comb or grid 239 should be made of brass or some non-ferrous metal, and it will be noted that this provides an excellent bearing between the tail pieces 204 of the sinkers 201 which are made of malleable iron or steel of a type which does not readily become permanently magnetized.

The magnet box 207 for one purpose takes the place of a cap bar and it will be noted that the extraordinary pressure usually required in knitting machines to move the sinkers, owing to the pressure of the cap bar, may be dispensed with according to the present invention. In this manner I have provided a very easy acting slur cock and sinker motion. The magnet box 207 is energized as the slur cocks 211 start to move, but the magnetism is not strong enough to attract the tail pieces 204 until they have been moved at least part way by the slur cocks 211. When the sinkers are first retreated, to allow the dividers to divide the loops, the magnet box 207 is de-energized, to allow the resetting mechanism to retreat the sinkers.

Referring now to Figures 1 and 17, I provide a bakelite disc 244 adjustably fastened to the knitting camshaft 32. This bakelite disc has a commutator section 245 which is grounded by being connected to the shaft 32. A contact brush or the like 247 is in contact with the disc 244 in the path of the commutator section 245 and as shown in Figure 1 may be attached to the loom side 21 at 248, but is insulated therefrom. A battery 249 has one terminal connected to a terminal 250 of the magnet box 207 by a wire 251. The other terminal of the battery 249 is grounded as indicated in Figure 17. The other terminal 252 of the magnet box 207 is connected by a wire 253 to the brush 247. Of course the battery 249 may represent any source of direct current energy, for example a direct current generator or a pluality of storage batteries which do not need to be located anywhere near the loom.

When the shuttles 125 are moved through two spaces 133 the extension 179 of each shuttle lays yarn upon the separators 209 of the comb 208 lying between such spaces, and upon the trough portion 254 thereof (see Figure 12). The notches 203 of the sinkers 201 sweep successively upward through the trough 254 and pick up the yarn. Between knitting operations the notches 203 of the sinkers 201 are located back of an elevated portion 255 of the comb 208. Referring now to Figures 5 and 12, each flat metal separator 209 constitutes a pair of plates suitably fastened together as by welding, and each such built-up plate 209 is received in a notch 256 of the plate 210 and thereby held in the desired position; the front ends of the double plates 209 are received and spaced by an arcuate plate 257 having notches or grooves 258, the plates 209 being desirably soldered or welded to their respective holding plates 210 and 257. Figure 5 is illustrative of this construction, the parts being sectioned in different horizontal planes specifically for that purpose. The sinking of the yarn is controlled by a pattern chain 259 for the vibrator lever 215, actuated in the usual way by gearing, not shown, connected to the lower shaft 160 of the vibrator gear mechanisms.

Dividing

Still referring to Figure 5, alternating with the sinkers 201 are dividers 260, being received between adjacent plates 209 as are the sinkers 201. Referring now to Figures 12 and 15, each divider 260 has a hub portion 261 with a hole 262 located therein and into the hole 262 extends a key portion 263. The dividers 260 are mounted upon the shaft 200 which extends through the holes 262, and each key portion 263 is located in a spline 264 in the shaft 200. Thus by angularly moving the shaft 200 all the dividers 260 may be moved, without however affecting the sinkers 201 which are merely journaled on the shaft 200, not keyed to it.

Referring again to Figure 15, each divider has a forwardly extending bottom portion 265 and a forwardly extending top portion 266, forming together a notch 267 for dividing the loops formed by the sinkers. The dividers are generally similar in shape to the sinkers as shown by Figures 14 and 15 in comparison; in this specific embodiment of the invention they have no tail pieces being entirely controlled by rocking of the shaft 200.

Referring now to Figures 1, 2, 4 and 16, fastened to the shaft 200 is an arm 268 which has

pivotally connected to the end thereof an actuating rod 269 the other end of which has a fork 270 extending around the camshaft 32. The outer end of the fork 270 is closed by a bar 271 which has attached thereto a spring 272 the other end of which may be fastened to any suitable stationary part of the loom or to the floor. The fork 270 constitutes a guide to permit the rod 269 to reciprocate and also to adjust itself angularly as the arm 268 moves; side of the rod 269 is a cam 273 fastened to the shaft 32, and a roller 274 carried by the rod 269 rests upon the periphery of the cam 273. Thus any angular movement may be imparted to the shaft 200, and viewing the shaft 200 in Figure 2 it will be seen that a very fast angular movement in a counter clockwise direction may be imparted to the shaft 200 as the cam 273 may have an almost radial portion, the spring 272 acting to move the shaft counter clockwise.

Referring again to Figure 5 in connection with Figure 12, extending forwardly from each plate 209 (but one) is a knockover bit 280. Each knockover bit may have the usual contour, including the wide angle notch 281, as shown in Figure 12. Figure 5 shows one manner of readily constructing the plates and knockover bits; as aforesaid, each plate 209 is constructionally two plates welded together, and one of these has the knockover bit 280 formed integrally with it, each knockover bit being located in line with a sinker or a divider, the flat metal being therefore offset as shown at 282. The knockover bits 280 serve to support the knitted part of the fabric as the loops are drawn through, and it is noted that the knitted part of the fabric is likewise supported by the woven part, and helps to support it, temples being desirably provided at the selvages as is the practice in the weaving of broad goods (as distinguished from narrow fabrics e. g. tapes and ribbons).

Still referring to Figure 5, located between each pair of knockover bits 280 is a needle 284. Each needle is parallel to all of the others and, as shown in Figure 12, is embedded in a bed or bar 287, and the needles are all locked in place by a locking plate 288 secured to the bar 287 by bolts 289, the needles and needle bar construction being preferably substantially in accordance with regular full-fashioned hosiery machine practice.

The yarn from the shuttles 125 is formed into loops around pairs of needles, as shown in the left hand lower corner of Figure 5, and the dividers divide these loops in the well known manner, to form a loop on each needle, the sinkers at that time backing off as will now be described.

Referring to Figures 12 and 16, above the tail pieces 205 is an actuating bar 290 supported by arms 291 fastened to a shaft 292 which is journaled in the frame sections 25. Referring to Figure 2, fastened to the shaft 292 is an actuating arm 293 which has pivotally connected to the end thereof an actuating rod 294, like the rod 269, having a fork 295 extending around the camshaft 32 and having a bar 296 to which is connected a spring 297 attached to a pin or stud 298 fastened to the section 25.

Referring to Figures 1 and 2, on the rod 294 is a roller 300 which rests on the periphery of a cam 299, and the position of the bar 290 is thus controlled by the cam 299, and when it is desired to have all the sinkers withdrawn the bar 290 is moved downwardly.

Simultaneously with downward movement of the bar 290 which withdraws all the sinkers 201 by contact with their tail pieces 205, the electromagnetic box 207 is de-energized, the commutator section 245 at that moment leaving the brush 247. Thus the sinkers 201 are withdrawn far enough to permit the dividers 260 to divide the loops. I might provide another commutator section on the disc 244 to attract the tail pieces 204 in order to prevent the sinkers 201 from moving beyond the desired position on this occasion but I prefer to use positive means as exemplified in a bar 301 located under the tail pieces 205 and attached by arms 302 to a shaft 303 located just below the shaft 292 as shown in Figures 12 and 16. The shaft 303 is controlled like the shafts 200 and 292 by means of an actuating arm 304, an actuating rod 305, having a fork 306 straddling the shaft 32 and a spring 307 connected at one end to a bar on the end of the fork 306 and at the other end to a pin or to the floor, a cam 308 and a roller 309 giving the rod 305 its upward motion.

Loop drawing

Referring now to Figure 2, the needle bar 287 is supported by a pair of arms 310 extending from a shaft 311 oscillations of which raise and lower the needles 284. The extreme ends of the arms 310 are pivotally connected to brackets 312 secured to the bar 287. As shown in Figure 4 the arms 310 may be located anywhere near the center of each knitting section. Bolts 313 are provided to adjustably secure the arms 310 to the shaft 311. Referring now to Figures 1 and 4, the shaft 311 is journaled in the loom sides 20 and 21 and also in the frame sections 25 and attached to it is an arm 314 which extends downwardly and has a roller 315 engaging a cam 316 on the shaft 32, the cam 316 controlling the needles 284 as to vertical position. Attached to the end of the arm 314 is a spring 317 the other end of which is anchored to any convenient part of the loom frame such as a rod 318.

In front of the shaft 311 and in the same horizontal plane is another horizontal shaft 319 which controls the angular position of the needles 284. Referring to Figures 2 and 4, fastened to the shaft 319 are depending arms 320 which are connected by links 321 with arms 322 that are secured to the needle bar 287, there being in this embodiment of the invention a pair of the parallel linkage mechanisms comprising the arms 320, links 321 and arms 322, these parallel linkage mechanisms being located substantially opposite the spaces 133.

Shaft 319, as shown in Figures 1 and 4, is journaled in the loom sides 20 and 21 and frame sections 25 and has attached to it an arm 323 having a roller 324 contacting a cam 325 which determines the angular position of the needles 284 there being a spring 326 which extends from the bottom of the arm 323 to the rod 318. The means for determining the vertical and angular positions of needles 284 described is similar to that used in full-fashioned hosiery machinery.

Referring again to Figure 12, each needle 284 has a spring beard 330 whose point may be pressed into a needle eye 331. Referring now to Figure 5 in connection with Figure 12, the front ends of the plates 209 above the knockover bits 280 constitute presser surfaces 332. The upper ends and the beards of the needles 284 may be caused to approach and recede from the presser

surface by oscillation of the shaft 319, and it is noted that this motion may be adjusted by bolts 333 securing the arms 320 to the shaft 319.

After the loops are formed on the needles 284 by the sinkers and dividers as already described, the needles 284 are drawn downwardly until the loops, at that time supported by the portions 202 of the sinkers and 265 of the dividers, have entered under the beards 330, whereupon both sinkers and dividers are caused to retreat by the mechanism already described for controlling them respectively, and the beards 330 are closed into the eyes 331 by pressing the beards 330 against the presser surfaces 332 whereupon the needles 284 are drawn still further downwardly drawing the new loops through the old loops, the fabric being at that time supported by the knockover bits 280. The exact path traced by the needles 284 is determined by the cams 316 and 325, which should have the proper contour to give the needles the desired motion at that part of the cycle of loom operation which will be hereinafter indicated, and the path of movement of the needles is itself well known and will be found discussed for example in the July 11, 1931 edition of Textile World, page 40, and in the August 8, 1931 edition, page 34, and in the September 19, 1931 edition, page 30, by Max C. Miller, M. E.

Knocking over

Referring now to Figures 1, 5 and 12, the loops having been drawn downwardly as described and having been drawn through previously formed loops by reason of the closing of the beards 330, the needles 284 move to the right, Figure 12, and the loops are released by the front portions 202 and 265 respectively of the sinkers and dividers, whereupon the tops of the needles 284, continuing downwardly move to the left in Figure 12, the fabric being at that time supported by the knockover bits 280. This places the needles in condition to rise without reentering the old loops. As previously mentioned there is a long distance between the fell of the goods and the take-up roll 62, and this permits sufficient tension and elasticity of the fabric to allow the needles to move through the regular knitting stroke, such as described by Mr. Miller in the above noted articles. As the needles move forwardly, that is to the left in Figure 12 and rearwardly with respect to the entire loom, the fabric tension assists in causing the knocking over.

Clearing

The needles now rise, as in the usual manner, and in doing so swing preferably well to the left, Figure 12, a space 340 being provided to accommodate the needle heads during this motion. As the needles rise, the dividers 260 move clockwise, Figure 12, in order to hold the fabric down as the needles rise above the level of the dividers and sinkers. Thus the clearing takes place substantially in the known manner.

Shuttles

Referring now to Figure 19, the shuttles 125 may be of the usual straight shuttle narrow fabric type, with bows 340 as shown. In the marginal shuttles 125*a* I desirably incorporate a quill rewinding mechanism to prevent loose ends at the selvages of the goods. Referring to Figure 20, I have therein shown diagrammatically the successive positions of the shuttles, in a loom according to the present invention, in which but one knitting space is provided in order to simplify the diagram. Considering now the third and fourth positions represented, reading from the top down, the left hand shuttle 125*a* is farther to the left of the warp in the third position than it is to the right of the warp in the fourth position. Accordingly to prevent a loose pick, I cause the weft in the shuttles 125*a* to rewind for a limited length upon the quills whenever tension upon such weft is released.

Referring again to Figure 19, I provide the usual spindle 341 having thereon a quill 342 which has holes or slots in the left hand head to receive projecting pins 343 on a flange 344 of a tubular member 345. Mounted on the tubular member 345 is a driving member 346 which is pressed against a washer 347 by a spring 348 the other end of which engages a nut 349. The washer is urged against the head 344 so that when the driving member 346 is rotated the head 344 will be rotated, and conversely when the head 344 is rotated, the member 346 will be wound up, unless the resistance becomes too great. A spring 350 is anchored at one end to a disc-like portion 351 of a spindle 352 which rotatably supports the tubular member 345, and the other end of the spring 350 is attached to the driving member 346. The spindle 341 is seated in a notch 353 in the spindle 352, and a bead 354 is provided at the other end of the spindle 341 to reduce friction. When yarn is drawn from the quill 342 the spring 350 is wound up until such time as the tension of this spring 350 becomes greater than the friction on the washer 347 due to the pressure of the spring 348, whereupon the parts slip, thus providing tension for the yarn but allowing it to be drawn from the quill 342. When, however, tension on the yarn is released, the spring 350 turns the quill 342 to wind back upon it some of the yarn extending to the selvage of the goods or otherwise. As this quill mechanism constitutes tensioning means as well as a rewinding device, it can be used in the shuttles 125 as well as in the shuttles 125*a*, and certain advantages inhere in such use, such as the withdrawal of the weft out of the path of the sinkers and dividers when the yarn is not to be sunk, but on many occasions any usual or desired type of yarn tensioning means may be employed in the shuttles 125, according to the class of weft being used.

Humidity

When using silk, or other weft yarns requiring a great deal of humidity, various expedients may be adopted. Of course the atmosphere of the room can be kept at the desired degree of humidity, but on the other hand the loom of the present invention lends itself particularly to the incorporation of means for directly humidifying the weft yarn. To this end, piping, as shown in Fig. 25, may be located in the lay 110, in the top part thereof, with orifices in front of the blocks 113 and 114, to direct steam or humid air upwardly against the quills 342.

Timing

Instead of showing side views of all the cams I have laid out the relative motions of the parts in Figure 21 from which diagram suitable cams to perform these motions can be readily constructed. Referring to this figure, the central line 360 represents the axis of abscissæ and displacement along this line represents motion of

the loom, equal parts spacing off equal angular displacements of the shafts 30, 31 and 32. Each entire line 360 represents a pick, that is a revolution of the shaft 30, one-half revolution of the shaft 31, and one-third revolution of the shaft 32. All three lines 360 represent a complete revolution of the shaft 32, which is the knitting camshaft.

The ordinates, as to the shuttles, represent the positions thereof across the loom, and when the graph line 361 of the shuttles crosses the line 360, the shuttles occupy the second or fifth position, see Figure 20. Considering the shuttle line 361, the highest position of that line represents the first and third positions of the shuttles, Figure 20, and the lowest position of that line represents the fourth and sixth positions of the shuttles, Figure 20.

Considering now the motion of the harness frames, this is timed with respect to the shuttle motion so that the shuttles are not moving except when the harnesses are at rest. Where the harness motion lines 362 cross the line 360, the warps are in a plane, that is the shed is closed, and the abscissæ as to the harness frames, represent vertical motion thereof.

Considering now the motion of the movable lay 183, this is indicated by the line 363, with the lowest position of that line representing the beat-up, and where the line joins the line 360 the lay is in the position indicated in Figure 2.

The motion of the sinkers is represented by the line 364, and where this line strikes the line 360 all the sinkers are down, in the left hand position shown in Figure 12 (the main body part of the nearest sinker being behind a divider in that figure, but its tail-piece 205 indicating its position). The highest position of the line 364 represents the right hand full line position of a sinker shown in Figure 12, and intermediate positions are represented by intermediate abscissæ. Referring to the top of Figure 21, the sinkers first move individually, but at the end of the flat part of the line 364 all of them have moved upwardly, and from that point on the line 364 represents united motion of the sinkers.

The dividers always move in unison, as previously explained, and their motion is shown by the line 365, abscissæ representing motion similar to the abscissæ of the sinkers.

The motion of the needles 284 is represented by the line 366, the abscissæ representing vertical motion of the needles, the highest part of the line representing the highest position of the needles and the line 360 representing that position of the needles in which the tops thereof are substantially on a level with the tops of the knockover bits 280. This line in Figure 21 thus represents angular movement of the shaft 311, and movement of the shaft 319 is not indicated in Figure 21, as such angular or forward and back motion of the needles is determined in accordance with the vertical position thereof, to give the needles the proper stroke as hereinbefore indicated, for example such a stroke as described in the articles by Mr. Miller hereinbefore referred to.

Considering again the movement of the shuttles, the shuttles 125 are marked with crossed lines in Figure 20, and it is when they move completely by the intermediate block that a course is laid for knitting. This occurs on motion from the third to the fourth position and on motion from the sixth to the first position. Of course the shuttle 125 in Figure 20 may represent any number of such shuttles, with a corresponding increase in the number of sections being knitted and woven.

Referring now to Figure 22, I therein show a pattern chain diagram for the vibrator gear mechanism that actuates the shuttles, being the pattern chain 178. Such pattern chain diagrams are well understood, the black sections representing rollers or risers and the white sections representing washers or sinkers. The various picks represented in Figure 22 correspond to the positions indicated in Figure 20.

Figure 23 represents the pattern chain draft for the pattern chain 259 which controls the slur cocks. This mechanism, as will be remembered, has but a single vibrator gear. The pattern chain draft of Figure 23 corresponds to the pattern chain draft of Figure 22.

The timing of the loom should be done in accordance with the diagrams of Figures 20, 21, 22 and 23, as no particular attempt has been made to cause the several views of the loom to show the parts in the same position. Rather on the other hand, different views in some cases show parts in different positions in order to more clearly show the mechanism. The diagram of Figure 20 represents one possible shuttle motion that may be adopted, but a greater number of picks can be inserted into the woven parts of the goods between knitting strokes, if desired, or on the other hand every pick may include the laying of a course for knitting. To effect such a change in the loom different pattern chains 178 and 259 may be made up, and different cams placed upon the camshaft 32. In other words, the loom may be readily changed over to make many different classes of goods, without the alteration of any fundamental structure.

Modification

Referring now to Figure 24, a modification is shown in which the needles 284 do not move forward and back, in other words the shaft 319 is kept stationary or this mechanism to move the needles forward and back may be omitted altogether, and the needle bars 287 rigidly attached to the levers 310. In this modification of the invention presser surfaces 370 on the front of a plurality of separator plates 371 are moved forward and back to effect the pressing operation by reason of the fact that all the plates 371 are attached to a shaft 372 which is oscillated by an arm 373 actuated by an actuating rod 375 like the actuating rod 294, for example, which actuating rod 375 may be moved by a cam on the shaft 32, there being associated with the rod 375 mechanism, not shown, like that associated with the rod 294.

The plates 371 are received between side plates 376 connected by a portion 377 bolted to the lay 110. Formed integral or secured to the plates 376 is a front plate 378 which supports the knockover bits 379. The rest of the mechanism shown in Figure 24 is substantially as already described, differences being readily apparent by comparison of Figure 24 with Figure 12. According to this modification of the invention, when it is desired to press the beards 330, the shaft 372 is revolved slightly to bring the surfaces 370 against the beards 330. Plates 371 separate the sinkers and dividers. In this embodiment of the invention the tension on the fabric is relied upon to knock over the loops.

Operation

After drawing in the warp, a lot of it is drawn through at each weaving section as well understood by weavers, and the warp should then be made fast to the cloth roll 85. At this point it is desirable to disconnect the divider actuating mechanism, which may be readily done by holding the actuating rod 269 in its upper position against the action of the spring 272. All the dividers will then occupy the extreme right hand position of Figure 12.

At the same time the sinker motion should be made inoperative for the time being. This may readily be done by stopping the action of the slur cocks 211, for example by taking the chain 259 from the chain shaft altogether which will leave the vibrator gear 214 in its lowermost position.

The loom should now be turned over, whereupon the shuttles will proceed to weave at all of the sections, and at the same time, as the courses for knitting will be laid, the weft will connect the various woven sections. When a certain amount of woven goods has thus been produced, the rod 269 should be released, thus putting the dividing mechanism in operative condition, and the chain 259 may be placed in position so that the slur cocks will be actuated. The loom should then be turned over until a course has been laid for knitting and such course sunk on all the sets of needles 284, and divided and the loops formed. Thereupon each loop is connected to the hook of a rake, or welt bar, in the known manner, there being a rake or welt bar for each knitted section of the goods. These rakes or welt bars should then be attached to elastic bands extending over the breast beam 61 and to any convenient part of the building, or to the opposite loom across the alleyway. The loom is then set in operation, and succeeding courses and picks laid until the knitted part reaches the glass rod 63. Thereupon all the welt bars should be shifted and connected to elastics leading behind the take-up roller 62 and attached to the floor, for example. When the knitted part reaches to the take-up roller 62, the elastics may again be shifted to a horizontal position, and at that time it is desirable to take the woven goods from the cloth roller 85, or unwind the warp ends therefrom, until enough length of knitted section has been formed to allow the entire width of the goods to be properly and securely fastened to the cloth roller 85 in the usual manner. From that point forward the goods will be formed complete the operative being required merely to replace quills 342 in the several shuttles 125 and 125*a* as they are emptied. When a new warp is drawn in, unless alteration is made in the knitted sections by shifting the number of needles to a section, weaving can be started immediately without the use of welt bars, as the last loops will be on the needles 284.

Considering now Figure 20 in connection with Figure 21, the first motion of the shuttles, represented by the movement from the first position to the second position, results in laying a pick in the sheds of all the woven sections. The second motion of the shuttles results in laying another pick in each of the woven sections, the left hand shuttle 125*a* at this time laying no pick. The third motion, namely, from the third to the fourth position, moves the shuttles 125 through knitting sections, laying courses for knitting. This pick is represented by the top part of Figure 21. It will be seen that the dividers, at the start of this pick, are up. They are maintained in this upper position preferably at all times when knitting is not actually going on, as thereby they form guards to prevent the yarn getting entangled in the sinkers or the dividers, or perchance over the presser edges 332, when it is not desired to knit. Referring now to Figure 21, when the arms 179 of the shuttles 125 are somewhere near the center of the central block through which they are rapidly passing, the sinkers start moving individually upward. Just prior to that the dividers had all moved down, having been maintained up until the picks had been moved into the several sheds of the first sheds through which they pass on this double motion. It is possible to give the dividers a rapid downward movement owing to the fact that this downward movement is spring-actuated.

The yarn need not be completely sunk until after the shuttles have stopped moving, but when the shuttles come to rest the slur cocks have moved at least half of their total distance, so as to avoid the sinking of any yarn in the last block. It will be understood by this time that the terms "first block", "intermediate block", and "last block" are relative terms, being such in reference to a particular shuttle, and being well illustrated in Figure 20, so that each block in the center of a loom having a great many repeats is both a first, a last and an intermediate block with respect to some shuttle, but the term "first block" means the block from which a particular shuttle moves, and the term "last block" means the block in which it stops, all during that part of the cycle of operation during which a course for knitting is laid.

When all the sinkers have moved to their uppermost position, the dividers move upwards and forward, that is to say to the right in Figure 12, to divide the loops, the sinkers at that time retreating in a body by action of the bar 290. The dividers, in their lowermost position, are below the portion 255, Figure 12, and in order to prevent them from sinking yarn in the last block at this time, the sinkers are provided with upper tail pieces 400, which constitute guards to prevent the dividers from acting as sinkers. When the dividers move upwardly, the harnesses may be moving, and the lay 183 may also be moving. The needles start downwardly about this time, and about the time the pressing occurs (indicated by the hump in the line 366 near the right of the top portion of Figure 21), the dividers and sinkers both retreat to permit the loops to be drawn off the front pieces 202 and 265 of the sinkers and dividers.

Referring now to the middle part of Figure 21, as the shuttles start to move again from the fourth to the fifth position in Figure 20, the sinkers all retreat to the lowermost position, and the dividers move upwardly during the time the arms 179 of the shuttles are in the sheds. This timing is adopted to minimize the chance of catching the yarn at this point, and furthermore I have made the upper part 266 of the dividers 260 very long so that even when in the intermediate position indicated at the left hand side of the middle part of Figure 21, the upper portions 266 are interlocked with the needles 284 to effectually prevent the catching of yarn in anything.

The needles thereupon move upwardly, as al-

ready described, the dividers at this time holding down the knitted part of the goods. When the needles have moved all the way upwardly a complete knitting cycle has been finished, and thereupon the dividers remain up, the needles up, and the sinkers down for a little over a pick and a half, and until the shuttles are again taking a long stroke, as has already been described.

Other systems of timing of the various motions of the loom may be adopted, and it is noted that the particular timing system described is adopted with a view to complete elimination of any possibility of interference by the knitting mechanisms or parts with the weaving operations and vice versa. It is noted that the edge plates 209 may be formed without the recesses 340 for clearing, in order to further reduce possibility of catching of the yarn under the presser surfaces 332. It is further noted that the edge sinkers 201 have notches 203 formed deeper so as to displace less yarn than the other sinkers, on account of the difference between the level of the woven part of the goods and the level of the front portions 202 and 265 of the sinkers and dividers. Corresponding variations should be made in the right hand and left hand dividers for each section of dividers.

During the portion of the complete loom cycle when the shuttles are moving through the long stroke, two picks of weft are placed in every woven section, which is the reason for the provision of the extra shuttles at either side of the goods, which lay weft only at this time. This double pick, however, is compensated for by causing the take-up mechanism to take two teeth of the ratchet wheel 68 on these occasions.

Fabric

Considering now the textile fabric of this invention, in one embodiment thereof, and which may be produced on a loom such as has already been described, and referring particularly to Figure 28, I provide parallel warp ends 510 in a series of sections 511, 512 and 513. Forming simultaneously a shed in the ends 510 of each of sections 511, 512, and 513, I lay a pick of weft 514 in the shed of section 511, a pick of weft 515 in the shed of section 512, and a pick of weft 516 in the shed of section 513. I next form new sheds in the sections 511, 512 and 513, and it is noted that I nowise limit myself to the particular weave employed, which may be the same in sections 511, 512 and 513, or altogether different in each of them. In fact succeeding sheds in any or all of the sections may differ from each other only in the position of the selvage ends 510*a*, if for any reason it is desired to have certain warp ends "float", and I note that a one-and-one weave, a sateen weave, a twill of any description, or any other desired weave may be formed in the sections 511, 512 and 513, and in short the sections 511, 512 and 513 may have any desired woven characteristics known. In the second sheds of sections 511, 512 and 513 I lay a second pick each of weft 514, 515 and 516, the second pick being laid in an opposite direction to that of the first. I then form third sheds in each of sections 511, 512 and 513 and lay a third pick of weft 514, 515 and 516 therein respectively.

Maintaining the third sheds open, I move the weft 514 across a space 517 intervening between sections 511 and 512 and as I so move it I cause sinking means to act thereon to form loops 518 therein. Simultaneously I move the weft 515 across the space 519 and form loops 520 therein. I then move the weft 514 through the shed in warp section 512, and the weft 515 through the shed in the warp section 513, and at the same time I introduce a pick of weft 521 into the shed in section 510. The loops 518 and 520 are partially formed, that is to say the yarn is sunk, before the picks 514 and 515 are beaten into the fell.

I next form new sheds in each of the sections 511, 512 and 513, and lay a pick of weft 521 in the shed in section 511, a pick of weft 514 in the shed in section 512, and a pick of weft 515 in the shed in section 513. The weft 516 I hold to one side of the warp 513 without interweaving at this particular moment. I then form new sheds in the sections 511, 512 and 513, and lay picks of weft 521, 514 and 515 therein respectively. Next, in the opposite direction, I lay in new sheds in sections 511, 512 and 513 picks of weft 521, 514 and 515 respectively, but again I do not close the sheds but move the weft 514 back across the space 517 and the weft 515 back across the space 519, by sinking this weft forming loops 522 in the weft 514 and loops 523 in the weft 515.

In forming loops 518, complementary loops 524 are formed which I cause to be engaged by needles or the like. Similarly in forming loops 520 complementary loops 525 are formed likewise engaged by needles. Through the loops 524 I draw loops 526 complementary to the loops 522, and through the loops 525 I draw loops 527 complementary to the loops 523. This may be done by knitting needles, or in any other suitable manner. It will thus be seen that I have formed a looped or knitted fabric between the sections 511, 512 and 513 and joining them. Substantially simultaneously with the drawing through of the loops, I continue the movement of the weft 514 and 515 through the sheds in sections 511 and 512 respectively, that is through the same sheds through which I have just drawn weft 521 and 514 respectively. I also, at this time, again interweave the weft 516, drawing it through the shed which had just received the weft 515 in the section 513.

Weft 521 is now kept from interweaving preferably for a number of picks equal to that during which the weft 516, on the other side of the goods, was maintained from interweaving. The weaving and the knitting is repeated from this point on, as already described, but it is noted that variations to produce any fancy design may be introduced if desired.

Still referring to Figure 28, it will be observed that the edges of the fabric, on the left hand side of section 511, and on the right hand side of section 513, are true selvages. It will further be observed that the weft 514 forms a selvage at 514*a* on the inner side of section 511, and the weft 521 likewise forms selvage portions 521*a* on the inner side of section 511. Similarly selvage loops 515*a* and 514*a* will be noted on both sides of the section 512, and selvage loops 516*a* and 515*a* on both sides of the section 513. Thus sections 511, 512 and 513 are completely woven sections, but nevertheless they are integrally joined to the knitted sections lying therebetween.

The number of repeats across the goods in Figure 28 is illustrative merely, as many more than three sections of woven material may be provided, with a corresponding increase in the number of interposed knitted sections.

Referring now to Figure 27, I therein show a

piece of finished goods constructed in accordance with the description already given in connection with the diagrammatic view of Figure 28. By way of example I have shown seven separate sections of woven material 511, 512, 530, 531, 532, 533 and 513. Interposed between these sections, are sections 534, 535, 536, 537, 538 and 539 of looped structure. For the formation of the fabric on the type of loom described, the sections 534, 535, 536 etc. are preferably of the order of two and one-half to three times the width of sections 511, 512, 530 etc. Variations in width of sections 534, 535, 536 etc. and of sections 511, 512, 530 etc. may be introduced, if desired.

In certain cases it may be desired to make a knitted structure whose loops are smaller in proportion to the distance between successive picks than the loops shown in Figure 28. In that event, each successive pick may extend through sheds in two sections of warp. If it is desired to increase the relative size of the looped structure, so as to make very open work, the number of weaving repeats in which the shuttles move through one shed only may be increased between successive movements of the shuttles through two sheds in adjacent sections. Furthermore, successive courses of the knitted material may vary, as to the length of the loops, by varying the number of repeats of weaving between the knitting operations. The foregoing variations in weave and in looped structure may be employed for the production of fancy fabrics, while a design may be formed in the knitted portion of the goods by transferring loops in the known manner.

It will thus be seen that there has been provided by this invention a method of weaving, a loom adapted to carry out the method and otherwise, and a textile fabric which may be produced upon the loom, in which severally the various objects hereinabove set forth, together with many practical advantages, are successfully achieved. As many possible embodiments may be made of the above invention in all of its phases, and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a loom, the combination with shedding means, and means for beating up in spaced sections, of knitting means in spaced sections complementary to the sections of the means for beating up, and wefting means cooperating with both said shedding means and said knitting means.

2. In a loom, a plurality of shuttles, shuttle blocks for said shuttles, means to reciprocate said shuttles each from one block to and from the adjacent block, means to reciprocate all the shuttles each from a block to and from the block beyond said adjacent block, and means to select one or the other of said means.

3. In a loom, a plurality of shuttles, shuttle blocks for said shuttles, means to move all the shuttles each from a block to the block beyond an adjacent block and knitting means at the intermediate blocks arranged to knit the weft delivered by said shuttles.

4. In a loom, a stationary lay, shuttle blocks on said stationary lay, shuttles in said blocks, means to move said shuttles in said blocks, a movable lay, reeds carried by said movable lay, and knitting mechanisms arranged to knit the weft delivered by said shuttles located in front of some of the shuttle blocks, the reeds swinging forward between the knitting mechanisms.

5. In a loom, a stationary lay, shuttle blocks on said stationary lay, knitting mechanisms in front of some of said blocks, shuttles in said blocks, means to move said shuttles in said blocks, a separate movable lay, reeds carried by said separate movable lay, means to move said movable lay to carry the reeds forward between said knitting mechanisms, the shuttles cooperating with the knitting mechanism by laying yarn therefor, and the reeds acting to beat up the yarn in sheds formed in spaced sections of warp.

6. In a loom, shedding means, a lay, a shuttle race on said lay, a shuttle, means to move said shuttle on said race, a reed, means to move said reed to beat up, a plurality of needles located outside of lines drawn normal to the reed, a plurality of sinkers associated with said needles, means to successively move said sinkers to sink yarn delivered by said shuttle, and means to move the needles to draw new loops of yarn through old loops.

7. In a loom, a plurality of sinkers mounted for movement, means to successively move said sinkers to sink yarn, and holding means for said sinkers to hold them in yarn sinking position comprising an electromagnet.

8. In a loom, a plurality of sinkers, a shaft on which said sinkers are pivotally mounted, means for moving said sinkers one by one to sink yarn, a plurality of dividers keyed to said shaft, and means to rock said shaft to move said dividers in unison.

9. In a loom, a lay, shuttle blocks on said lay, shuttles in said blocks, means to reciprocate said shuttles between blocks, weaving spaces between said shuttle blocks, and knitting mechanism between said weaving spaces the knitting mechanism being arranged to form goods integral with that woven by the shuttles.

10. In a loom, needles, a set of sinkers operating in connection with said needles, means to lay weft in front of said sinkers, said means also acting to lay weft on either side of said set of sinkers, and means on either side of said sinkers to interweave the yarn with warp.

11. In a loom, a plurality of knitting needles, means operating in connection with said needles to form a plurality of courses and wales of knitted fabric, means on either side of said knitting needles to form sheds in warps, means to extend part of the yarn that is being knit into said sheds, and means to beat up said yarn to form woven sections alongside of and integral with said knitted fabric.

12. In a loom, a lay, a plurality of shuttle blocks on said lay, a plurality of shuttles in said blocks, a rack and pinions to actuate said shuttles, a compound lever, means connecting said compound lever to said rack, vibrator connectors connected to the several arms of said compound lever, vibrator gears operating said connectors, and partial cylinder gears operating said vibrator gears.

13. In a loom, a plurality of sinkers mounted for movement, a slur cock to actuate said sinkers, a vibrator connector connected to said slur cock, a vibrator gear to actuate said connector, and partial gears to actuate said vibrator gear.

14. In a loom, a plurality of spring beard needles, means to sink yarn onto said needles, means to periodically press said needles and close the

beards thereof, means to move said needles downwardly after the beards are closed and to subsequently return them to original position, warp supporting means, shedding means, means to deliver yarn to said sinking means and to lay yarn in sheds in said warp, and means to beat up the yarn so laid in the sheds.

15. In a loom, a stationary lay, positively driven shuttles mounted on said stationary lay, a movable lay, reeds mounted on said movable lay, shedding means, means to drive said shuttles through weaving spaces to lay a pick in each of the sheds, knitting mechanism located between the weaving spaces, the means to drive the shuttles through weaving spaces being so formed as to drive each shuttle through the distance defined by two weaving spaces and a knitting space when desired, and when so driven laying weft for the knitting mechanism to operate upon and means to cause the knitting mechanism to operate when the shuttle driving means is so operated.

16. In a loom, shedding means, a lay, a plurality of reeds carried by said lay, yarn sinking mechanism between sections occupied by the reeds, knitting needles cooperating with said sinking means, and picking means to insert picks in sheds in front of said reeds, the loom mechanism being arranged to form an integral piece of goods partly knitted and partly woven.

17. In a loom, a plurality of knitting mechanisms comprising means for drawing yarn from a supply, and means for pulling it through previously formed loops, in combination with a plurality of weaving sections, alternately located, comprising means for shedding, picking means, and means for beating up, the loom mechanism being arranged to form an integral piece of goods partly knitted and partly woven.

18. In a loom, a plurality of warp delivering means delivering warp in spaced sections, a plurality of sets of knitting instrumentalities spaced between the aforesaid sections, wefting means, shedding and beating up means to cause said weft to form woven sections with said warp, and actuating means to cause said knitting instrumentalities to knit sections joining said woven sections.

19. In a loom, a plurality of warps, a plurality of knitting instrumentalities, wefting means to lay weft, shedding and beating up means to cause said weft to form woven sections with said warp, and actuating means to cause said knitting instrumentalities to knit sections, joining said woven sections, and means to form selvages on each side of each of the woven sections.

20. In a loom, a plurality of needles, a plurality of sinkers to sink yarn on said needles, means to operate said sinkers, means to lay yarn in the path of all of said sinkers, means to lay yarn adjacent some only of said sinkers, and protective means to prevent yarn being caught in said sinkers when said operating means is not actuated.

21. In a loom, a plurality of needles, a plurality of sinkers to sink yarn on said needles, means to operate said sinkers, dividers to divide said yarn, means to lay yarn in the path of all of said sinkers, means to lay yarn adjacent some only of said sinkers, said dividers being formed to prevent yarn being caught in said sinkers when said operating means is not actuated.

22. In a loom, a plurality of needles, sinkers to sink yarn on said needles, dividers to divide said yarn, means to lay yarn in the path of said sinkers, means to individually move said sinkers, means to move said dividers, and guards on said sinkers to prevent said dividers from sinking yarn.

23. In a loom, shedding mechanism, a movable lay, a reed carried by said lay, knitting mechanism alongside said reed when it is beating up, a shuttle, means to cause said shuttle to pass through a shed formed by said shedding mechanism and to return through another shed, and means to cause said shuttle to pass in front of said knitting mechanism to lay yarn to be knitted.

24. In a loom, shedding means, a shuttle, knitting mechanism, means to propel said shuttle in a course only through a shed formed by said shedding means and alternatively to propel said shuttle in a course past said knitting mechanism, and means to select one or the other of said courses.

25. In a loom, shedding mechanism, knitting mechanism, a shuttle, means to selectively propel said shuttle through a long course or through a short course the long course carrying the shuttle through a shed laying yarn therein and past said knitting mechanism laying yarn to be operated upon thereby and the short course carrying said shuttle through a shed laying yarn therein, and selective means to select one or the other of said courses.

26. In a loom, a plurality of sinkers, a slur cock to actuate said sinkers, mechanism to propel said slur cock at selected intervals, a shuttle, mechanism to propel said shuttle in two courses one of which carries it through a shed laying yarn therein and the other of which carries it through a shed laying yarn therein and past said sinkers laying yarn thereon, and selective means to select a course for said shuttle.

27. In a loom, a pair of spaced warps, shedding mechanism for said warps, knitting mechanism between said warps, three shuttles in tandem and means to reciprocate one of said shuttles through sheds in both warps laying yarn therein and past said knitting mechanism laying yarn to be operated upon thereby some of said shuttles forming selvages on the inside of said warps and the knitting mechanism uniting the warps which are formed into woven material.

28. In a loom, a stationary lay, shuttles carried on said stationary lay, a movable lay, reeds carried by said movable lay, a needle bar in front of both of said lays, bearded needles on said bar, means to actuate said needle bar, a shaft below said needle bar, sinkers mounted on said shaft shaped to engage said needles from the bearded side thereof, and a slur cock to actuate said sinkers.

29. In a loom, a plurality of warp holding means holding warps in spaced relation, a lay, wefting means carried by said lay to weave with the warps, a needle bar located under the warps, a plurality of needles carried by said bar and located between a pair of warps, means to raise and lower said needle bar, sinkers to sink yarn from said wefting means onto said needles, and means to actuate said sinkers timed in relation to said wefting means to sink the yarn after the wefting means has laid it in position.

30. In a loom, a lay, a plurality of shuttles mounted on said lay, shuttle blocks holding said shuttles, needle bars in front of said lay, a plurality of sets of needles rigidly mounted in said bars and in front of said blocks, a shuttle mo-

tion to move said shuttles each from its starting block through an intermediate block to a block therebeyond laying weft in front of said needles, sinkers located between certain needles and mounted for movement in an inclined upward and forward direction, a slur cock to actuate said sinkers, and means to actuate said slur cock in timed relation to said shuttle motion to sink the yarn deposited by said shuttles onto said needles.

31. A fabric comprising a plurality of woven sections comprising warp and weft, each selvaged at both edges and at least one knitted section integrally joined thereto and between two woven sections, said knitted section consisting of a plurality of courses and wales of entirely looped structure.

32. A fabric comprising a pair of woven sections, a knitted section between the woven sections, certain weft threads of the woven section extending through the knitted section and being formed into courses of knitting, and certain picks of the weft being interwoven without passing through the knitted section.

33. A fabric comprising a series of parallel woven sections and a series of parallel knitted sections intervening therebetween, the woven sections being selvaged adjacent the knitted sections and the knitted sections being integrally joined to the woven sections.

34. A fabric comprising a woven section and a knitted section integrally joined thereto, the distance between successive courses in the knitted section being greater than that between successive picks in the woven section and there being a greater number of picks than courses, the yarn in the knitted section being entirely knitted.

35. A fabric comprising spaced parallel woven sections and intervening spaced parallel knitted sections the yarn of each knitted section being extended into adjacent woven sections forming part of the weft thereof and being extended no further.

36. In a combined knitted and woven fabric, the combination with a plurality of woven sections and a plurality of knitted sections integrally joining the woven sections and extending in the direction of the warp thereof, of a weave for the woven sections comprising a greater number of picks than there are courses in the knitted sections and a structure for the knitted sections being free from unlooped weft and free from warp, the yarn of the knitted sections extending into adjacent woven sections and forming part of the weave structure thereof.

37. In a combined knitted and woven fabric, the combination with a plurality of woven sections and a plurality of knitted sections integrally joining the woven sections and extending in the direction of the warp thereof, of knitted sections comprising entirely weft of looped structure of plain stitches and woven sections each selvaged on both sides, some of the weft of the woven sections being a continuous piece of yarn with the weft of an adjacent knitted section.

38. A fabric comprising a series of parallel woven sections and a series of parallel knitted sections intervening therebetween, some of the woven sections being selvaged adjacent the knitted sections, the knitted sections being integrally joined to the woven sections, and a single pick in the total woven structure being discontinuous across the goods, that is comprising a plurality of weft threads.

39. A fabric comprising at least three spaced parallel woven sections and two intervening spaced parallel knitted sections, the yarn of each knitted section being extended into adjacent woven sections forming part of the weft thereof and being extended no further, and the two knitted sections being of different colors.

40. The method of weaving goods comprising spaced woven and knitted sections and having both warp and weft in the knitted sections, which consists in providing spaced warps, shedding said warps, moving a plurality of weft supplies through the sheds in said warps, each weft supply moving through the shed in one warp only, beating up the weft thus laid in the several sheds, repeating the cycle so far described, then forming new sheds in each of said warps, then moving each of the said weft supplies through the sheds in two warps successively, concurrently sinking the weft that is laid between adjacent warps starting the sinking just after each weft supply has moved out of the shed in the first of the two warps through which it moves at this period, thereafter beating up the weft in all of the warps, thereafter shedding all of said warps again, moving said weft supplies through the sheds in said warps, each weft supply moving through the shed in one warp only, beating up the weft, then repeating the shedding, short motion of the weft supplies and beating up, repeating the complete cycle so far described over and over again, at some time after the weft is sunk drawing it into loops, then after the next sinking drawing new loops through the old loops, and continuing the drawing of loops after each sinking.

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The above entitled patent was extended August 21, 1951, under the provisions of the act of June 30, 1950, for 6 years and 63 days from the expiration of the original term thereof.

Commissioner of Patents.