Aug. 28, 1951 A. L. OBERHOLTZER 2,565,877

KNITTING MACHINE

Filed Dec. 28, 1945 8 Sheets-Sheet 1

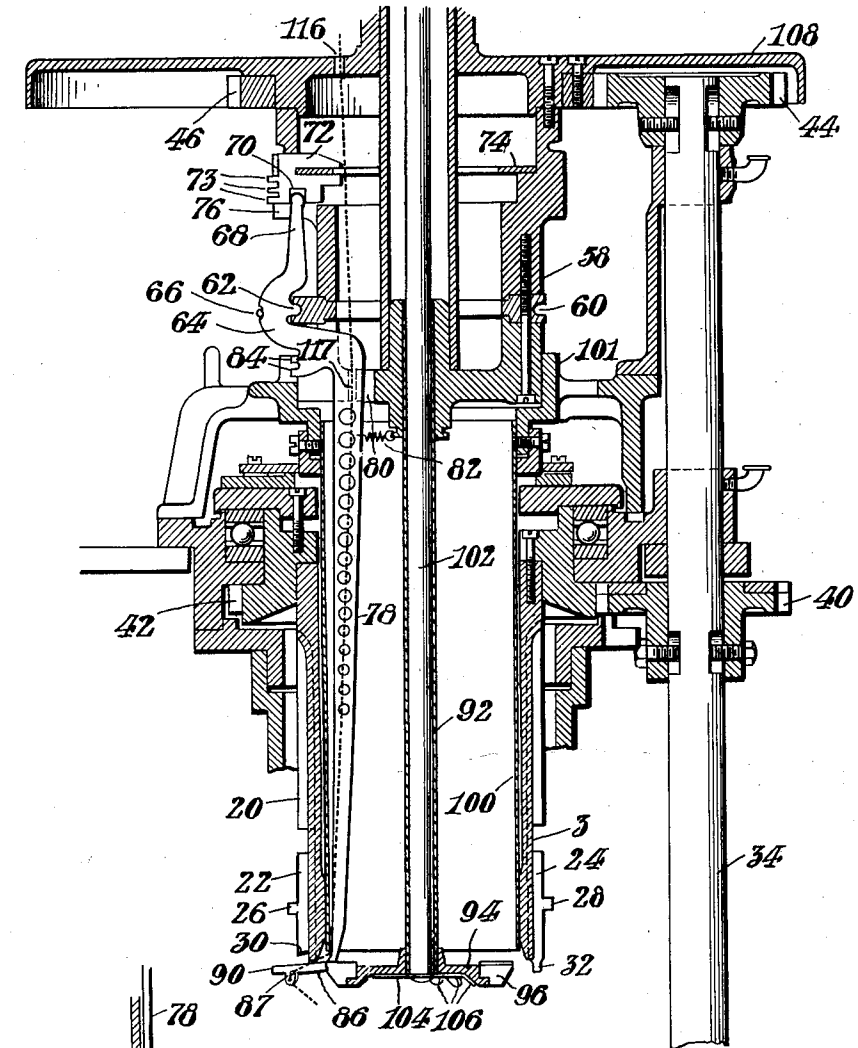


Fig 1

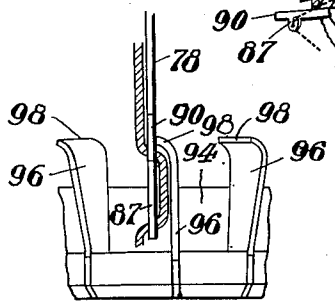


Fig 2

INVENTOR

Albert L. Oberholtzer

BY

Russell & Harding

ATTORNEYS.

Aug. 28, 1951 A. L. OBERHOLTZER 2,565,877

KNITTING MACHINE

Filed Dec. 28, 1945 8 Sheets-Sheet 2

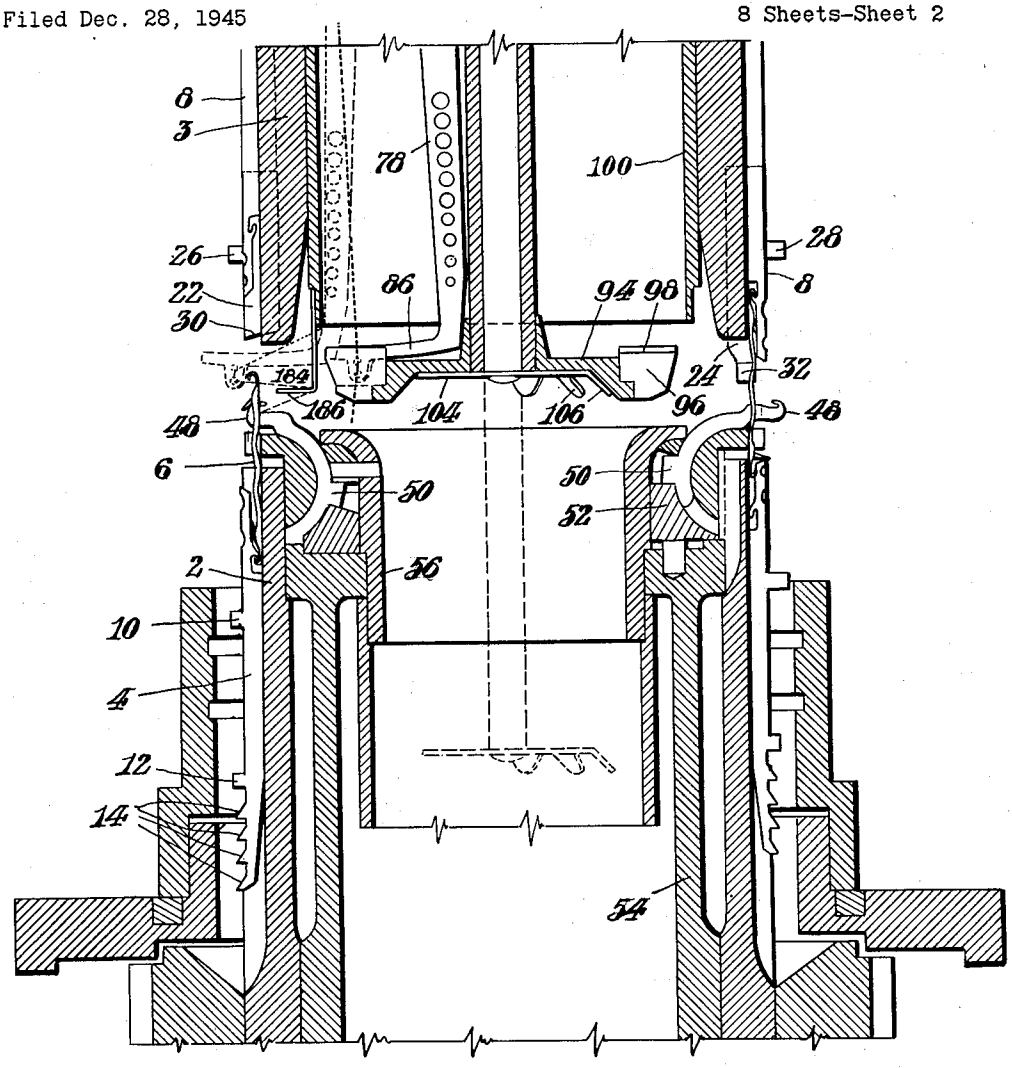


FIG 4

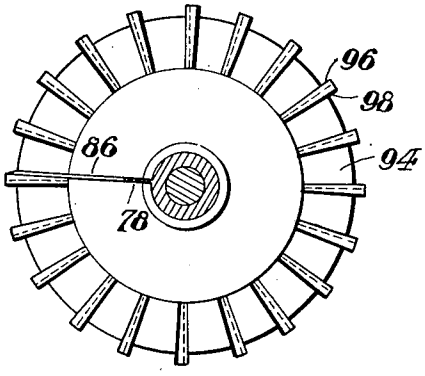


FIG 3

INVENTOR

Albert L. Oberholtzer

BY

Burns & Hawley

ATTORNEYS.

Aug. 28, 1951 A. L. OBERHOLTZER 2,565,877

KNITTING MACHINE

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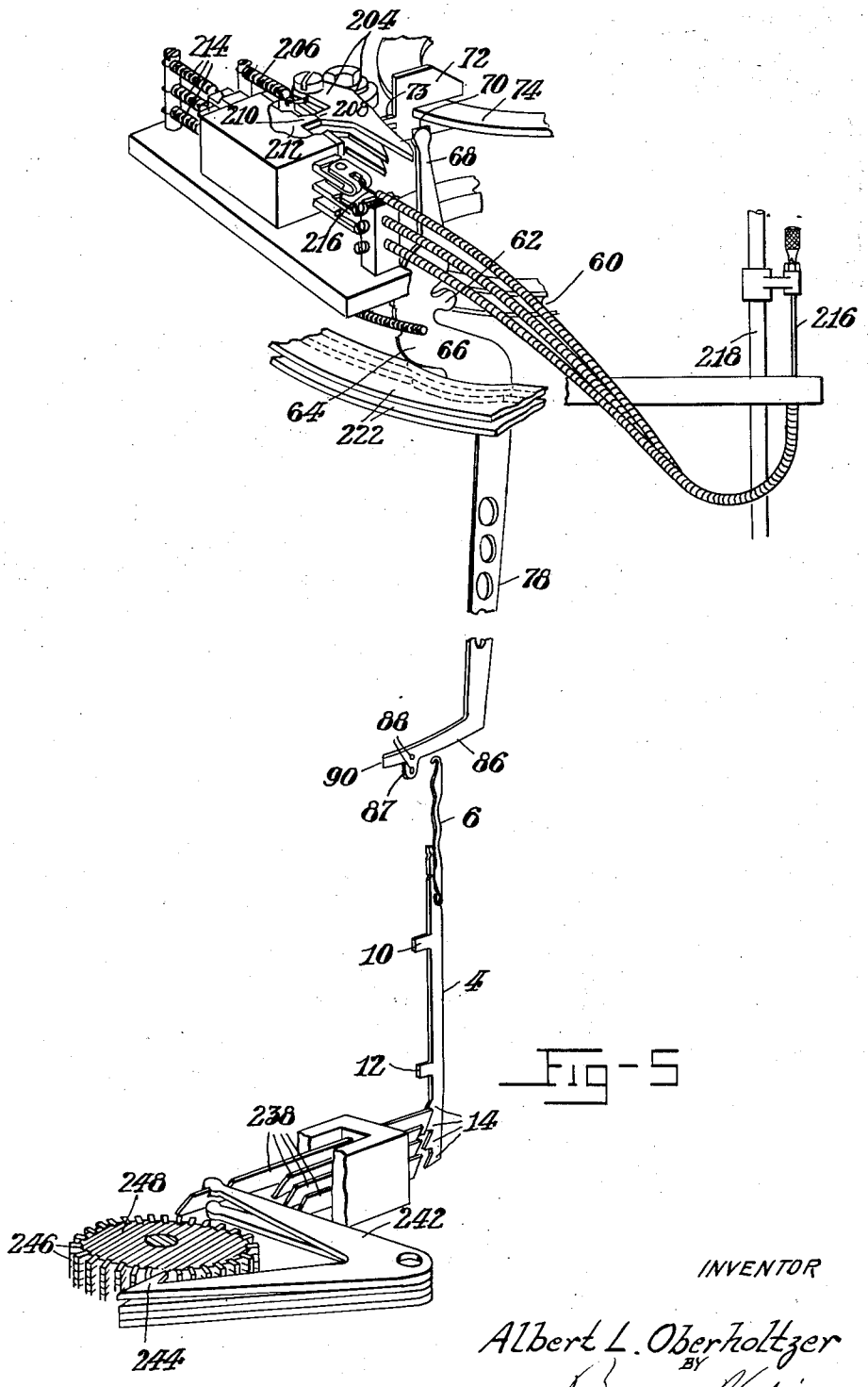


Fig-5

INVENTOR

Albert L. Oberholtzer

BY

Burson & Harding

ATTORNEYS.

Aug. 28, 1951 A. L. OBERHOLTZER 2,565,877

KNITTING MACHINE

Filed Dec. 28, 1945 8 Sheets-Sheet 4

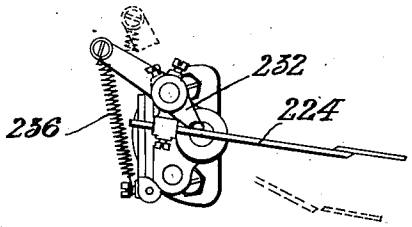


FIG-7

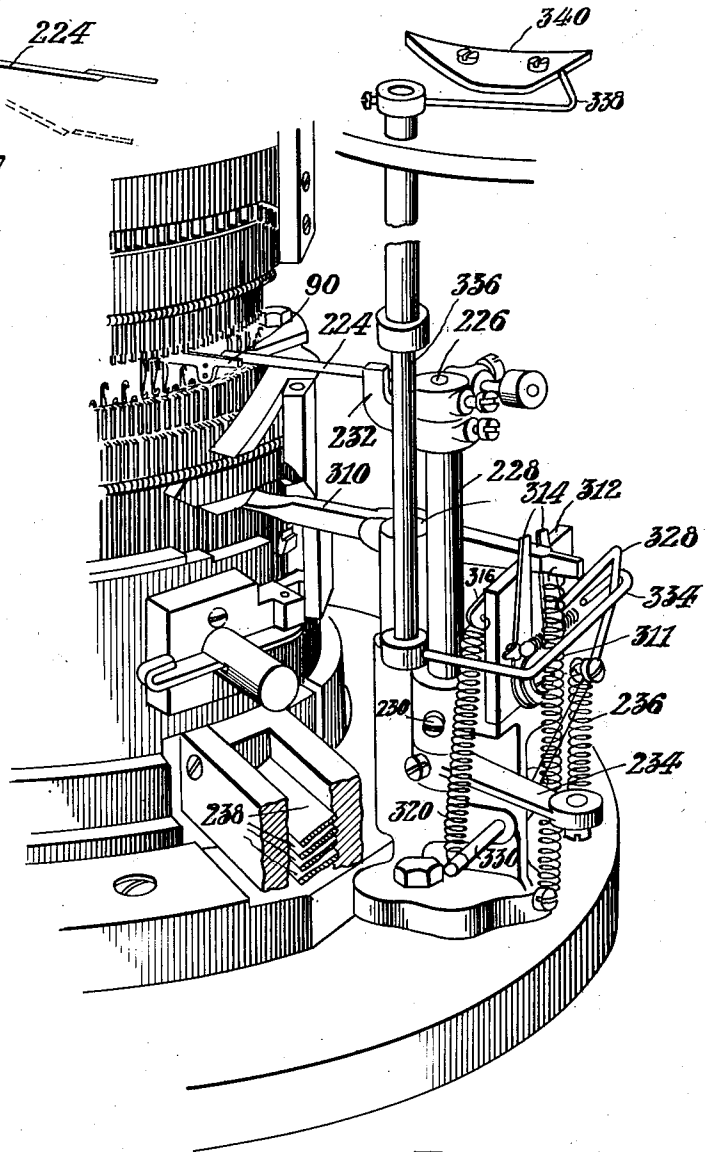


FIG-6.

INVENTOR

Albert L. Oberholtzer

BY

Russell & Harding

ATTORNEYS.

Aug. 28, 1951 A. L. OBERHOLTZER 2,565,877

KNITTING MACHINE

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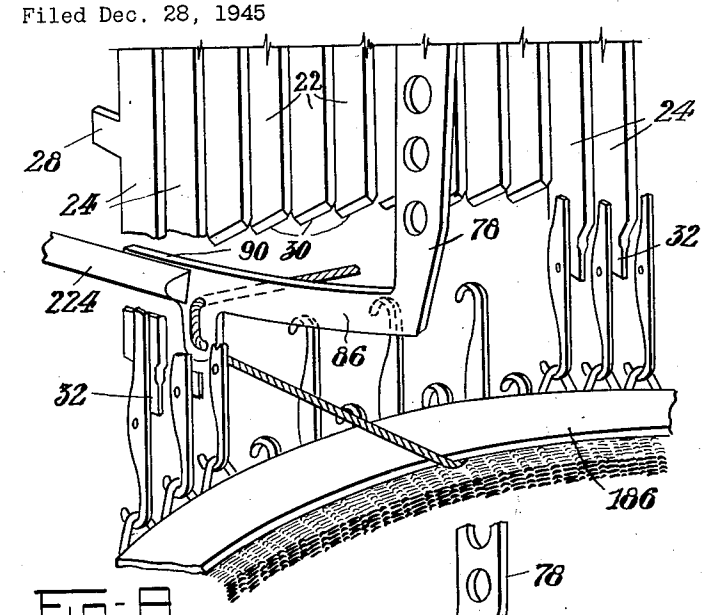


Fig 8

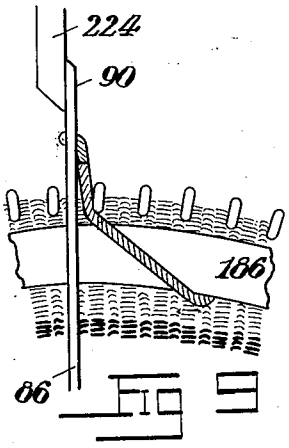


Fig 9

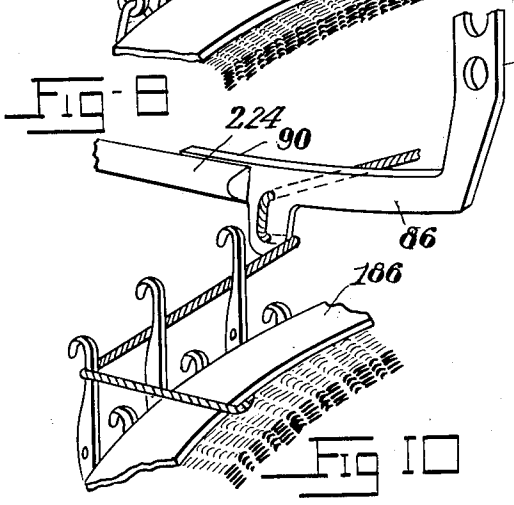


Fig 10

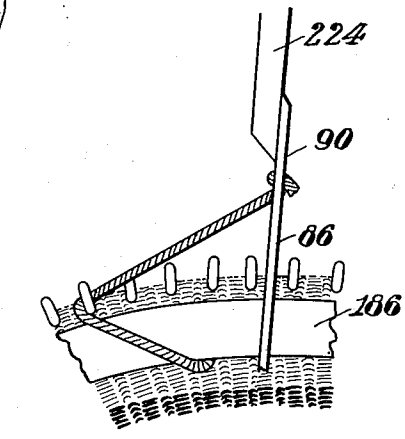


Fig 11



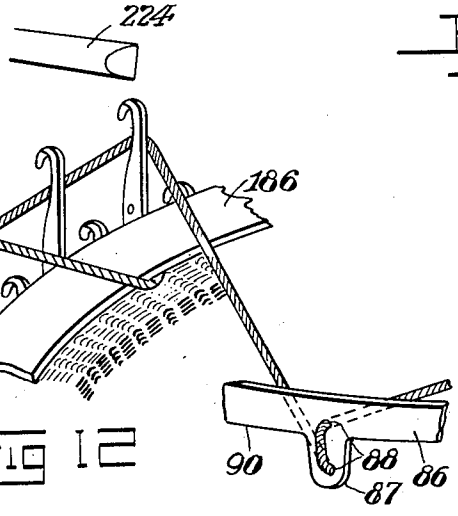


Fig 12

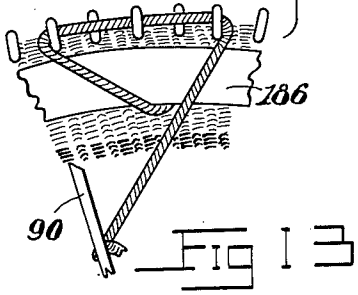


Fig 13

INVENTOR

Albert L. Oberholtzer

BY

Brisco & Hardy

ATTORNEYS.

Aug. 28, 1951 A. L. OBERHOLTZER 2,565,877

KNITTING MACHINE

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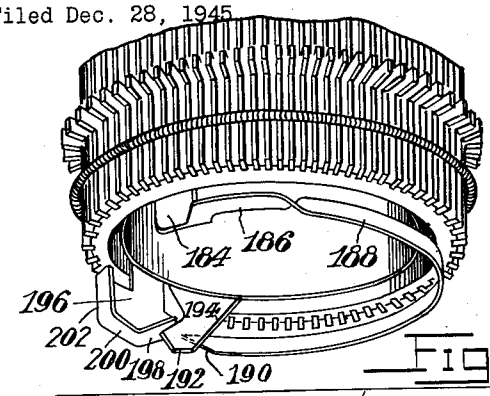


Fig 14

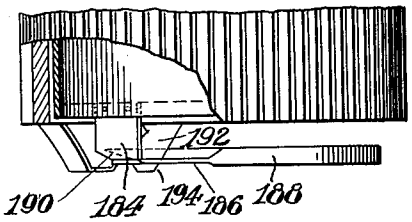


Fig 15

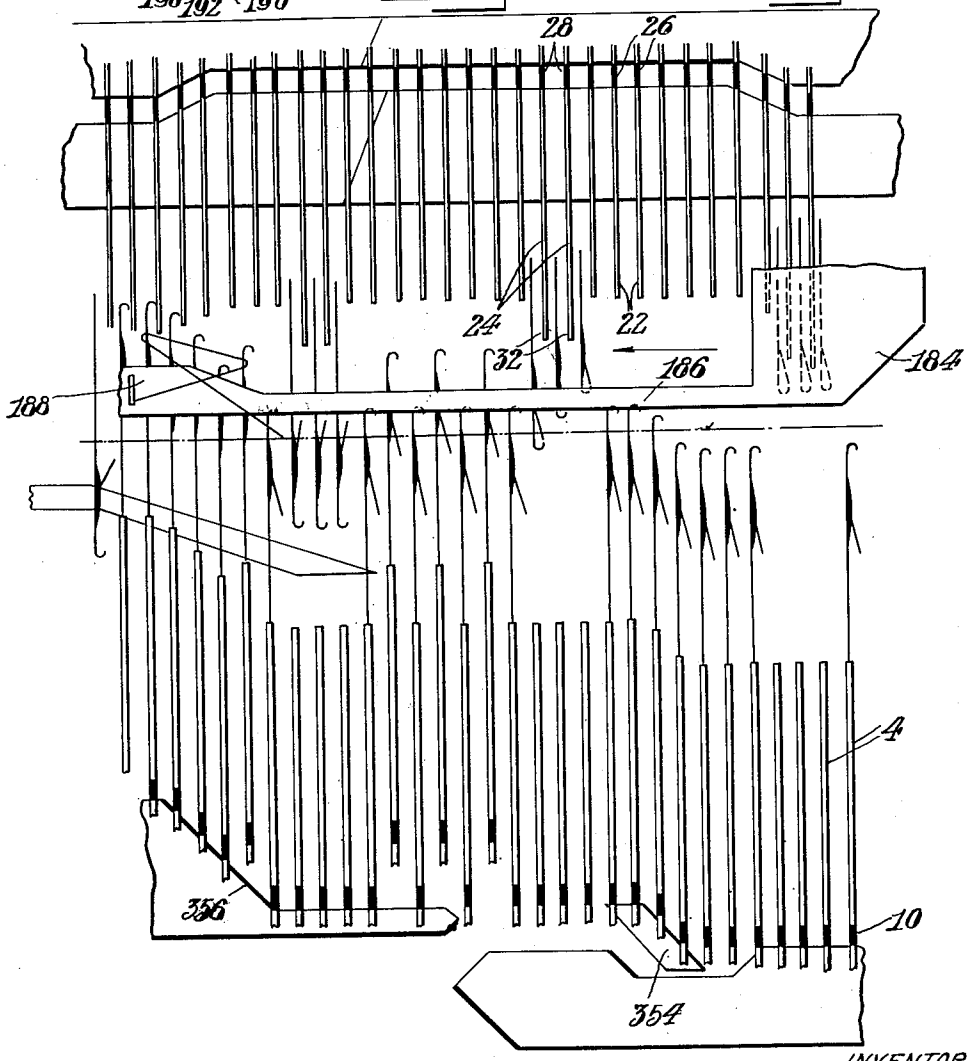


Fig 21

INVENTOR
Albert L. Oberholtzer
BY
Russell & Harding
ATTORNEYS.

Aug. 28, 1951 A. L. OBERHOLTZER 2,565,877

KNITTING MACHINE

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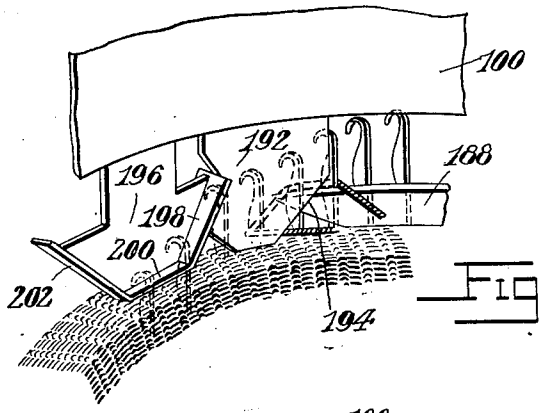


Fig 16

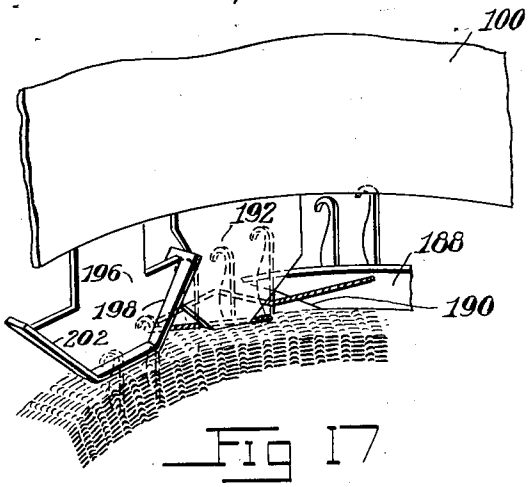


Fig 17

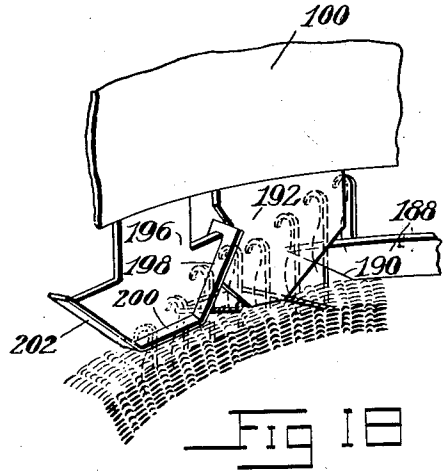


Fig 18

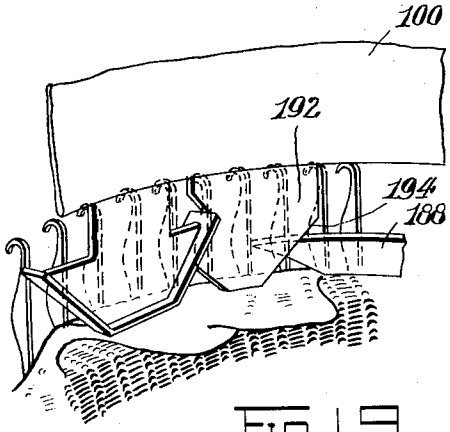


Fig 19

INVENTOR

Albert L. Oberholtzer

BY

Bussey & Harding

ATTORNEYS.

Aug. 28, 1951 A. L. OBERHOLTZER 2,565,877

KNITTING MACHINE

Filed Dec. 28, 1945 8 Sheets-Sheet 8

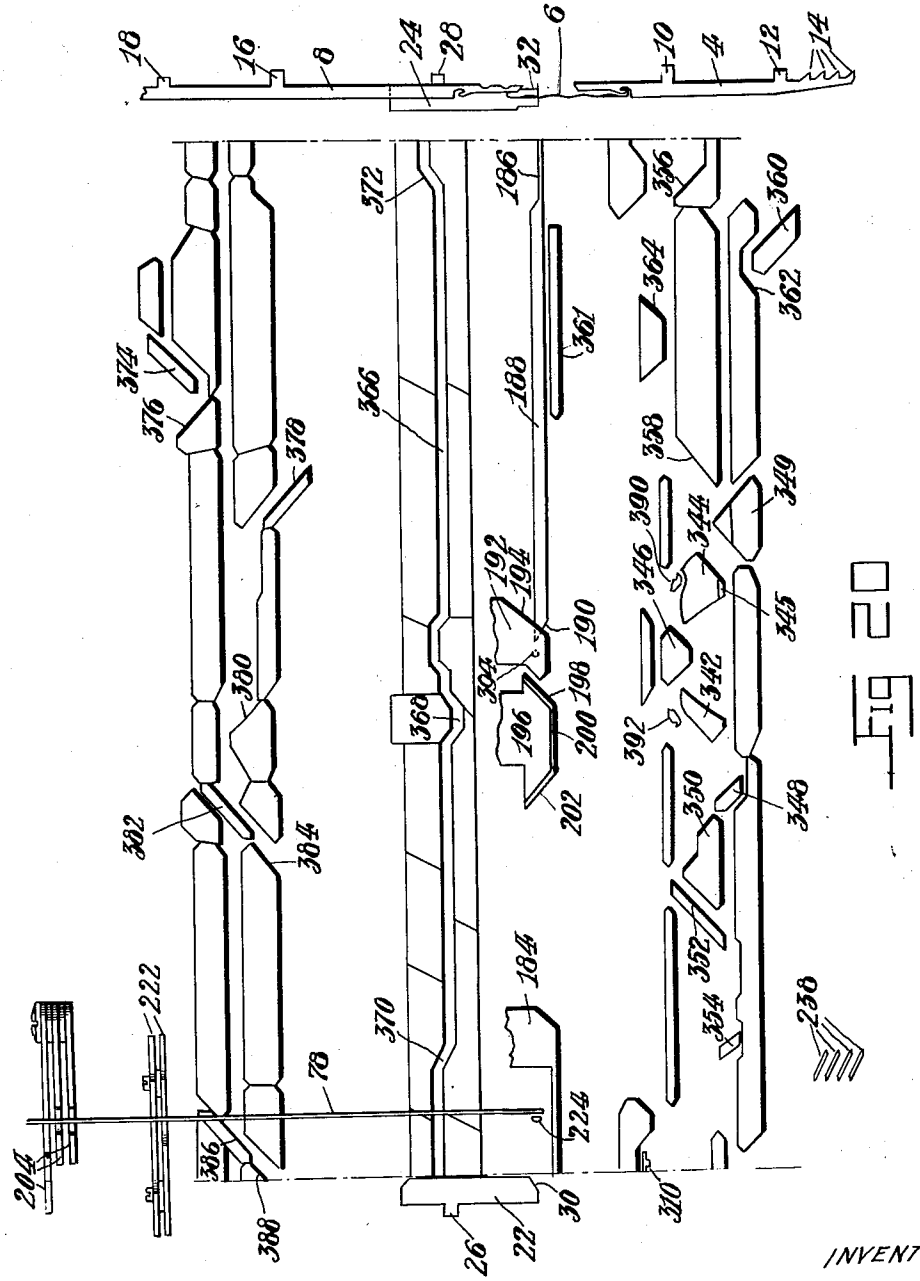


Fig 20

INVENTOR

Albert L. Oberholtzer

BY

Russell Harding

ATTORNEYS.

Patented Aug. 28, 1951 2,565,877

UNITED STATES PATENT OFFICE

2,565,877

KNITTING MACHINE

Albert L. Oberholtzer, Laconia, N. H., assignor to Scott & Williams, Incorporated, Laconia, N. H., a corporation of Massachusetts

Application December 28, 1945, Serial No. 637,607

14 Claims. (Cl. 66—14)

1

This invention relates to a knitting method and machine, and has particular reference to the type of machine comprising superposed needle cylinders and means for effecting panel wrapping therein, although it will be understood that certain features of the invention are not limited to this type of machine.

One of the objects of the present invention is the provision of an improved wrapping mechanism, and particularly an improved construction of wrap fingers and the utilization of a yielding abutment for the purpose of causing relative movement between wrap fingers and needles to be wrapped in such fashion as to avoid damage in the event that the relative movement cannot freely take place.

A further object of the invention is to provide an improved cam to cooperate with the plating cam to assist in plating and also to insure that the heel pocket will not interfere with knitting and will be so located that it may be readily caught by the heel pocket takeup.

Still another object of the invention is to provide an improved dropper pick control.

These and other objects of the invention, particularly relating to details of construction and operation, will become apparent from the following description, read in conjunction with the accompanying drawings, in which:

Figure 1 is an axial section through the upper cylinder and associated parts of the machine illustrating particularly the wrap head;

Figure 2 is a fragmentary elevation of the lower end of a wrap yarn guide and the means for maintaining its normal position when it is inactive;

Figure 3 is a view showing in plan the means for positioning the lower end of a wrap yarn guide, one in which is illustrated in section;

Figure 4 is an axial section showing the needles and the parts in the vicinity thereof and directly cooperating therewith;

Figure 5 is a diagrammatic perspective view showing in particular the needle selecting means and the wrap yarn guide controlling means;

Figure 6 is a perspective view showing in particular the abutment for the wrap yarn guide and the lowering pick and the means for controlling the same;

Figure 7 is a fragmentary plan view showing the yielding action of the abutment;

Figure 8 is a perspective view illustrating the beginning of a wrapping operation and the initial engagement of a wrap yarn guide with the abutment;

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Figure 9 is a fragmentary plan view of the same event;

Figure 10 is a perspective view similar to Figure 8, but showing a later event in the needle wrapping operation;

Figure 11 is a fragmentary plan view of the last mentioned matter;

Figure 12 is a further view similar to Figure 8, but showing the completion of a needle wrapping operation;

Figure 13 is a fragmentary plan view of the parts in the condition of Figure 12;

Figure 14 is a perspective view and Figure 15 is an elevation, partly broken away, of certain elements cooperating with the wrap yarns and the fabric;

Figures 16 to 19, inclusive, are perspective views illustrating the functions of the elements of Figures 14 and 15;

Figure 20 is a developed view of the cams looking, in general, outwardly from the axis of rotation, and showing at the right thereof a needle and cooperating elements and at the left thereof a sliding wall; and,

Figure 21 is a similar but enlarged view showing, in particular, the wrapping and interlacing operations of the machine.

The knitting machine embodying the inventions indicated above is of the superposed cylinder type comprising a lower cylinder 2 and an upper cylinder 3. Arranged to slide in slots in the lower cylinder are sliders 4 adapted to engage the lower hooks of double hook latch needles 6, the upper hooks of which are engageable by sliders 8 in the upper cylinder.

The lower sliders 4 are provided with butts at two levels 10 and 12 as hereafter more fully described and, in addition, with saw tooth butts 14 arranged to provide for selection by suitable cams. The upper sliders 8 are provided with butts at two levels 16 and 18. The cylinders are preferably provided with inserted fixed walls to define the slots for reception of the sliders and these walls 20 in the case of the upper cylinder terminate substantially above its lower end so that the lower portions of the slider slots are bounded not by stationary walls but by movable walls of two alternative forms arranged to slide in the wall slots in the upper cylinder. One set of these indicated at 22 carry butts 26 (see Figures 4 and 20) and are provided with outwardly and downwardly sloping lower ends as indicated most clearly at 30 in Figure 8. The other slidable walls indicated at 24 are provided with butts 28 and have verge bit extensions such as indi-

cated at 32 in Figure 8. The arrangement and functions of these lower ends 30 and the verge bits 32 will be hereafter described. The verge bits are located between the positions of needles which, in the formation of broad ribs, are located in the upper cylinder.

The cylinders are rotated in unison through the medium of a vertical shaft 34 which, through the usual gearing (not illustrated) is driven by the lower cylinder and which, through gearing indicated at 40 and 42, drives the upper cylinder. The present machine additionally involves the driving of a wrapping assembly which is effected through gears 44 and 46, the former being carried by the shaft 34.

Arranged to cooperate with the needles are arcuate sinkers 48 which are provided with butts 50 arranged to be acted upon by stationary cams 52 supported by a stationary cylinder 54 inside the lower rotating cylinder. This stationary cylinder 54 also supports the fabric guiding tube 56.

The rotary support for the wrap yarn carrying means is indicated generally at 58 (Figure 1). It is secured to the gear 46 and includes a member provided with an annular groove 60, in which groove are receivable the rounded pivot-forming projections 62 of wrap yarn carriers 64 surrounded by a spring band 66. Each of the wrap yarn carriers 64 has an upper extension 68 receivable in a notch 70 in an individual slider 72. These sliders 72 are provided with slots arranged so that they may embrace an annular ring 74 carried by the support 58. In order to guide the sliders 72 for radial movement and to position them in fixed circumferential locations they are received in slots 76 in the support 58. Each of the sliders is provided with a plurality of butts 73 indicated in the present instance as three in number. As will be evident hereafter, these butts may be selectively broken away so as to provide selection in the operation of the wrap yarn carriers.

Each of the wrap yarn carriers 64 is provided with a downward extension 78 extending through the upper cylinder and guided at its upper end in a radial slot 80 in the support 58. Individual springs 82 serve to urge the lower ends of the wrap yarn carriers inwardly. Butts 84 are provided on the wrap yarn guides to provide for the positive inward movements of their lower ends.

At its lower end each wrap yarn carrier is provided with a radially directed extension 86 which has a downwardly extending branch 87 provided with the yarn guiding openings 88. The downwardly extending branches 87 are provided with smooth lower inner edge portions arranged to cam the wrap yarn downwardly as the wrap yarn finger or carrier is withdrawn inwardly following a wrapping movement. Beyond these openings each carrier is provided with an abutment-engaging extension 90.

A tube 92, the upper end of which is secured in the assembly 58, carries at its lower end a disc 94 which is provided with radial fins 96, the upper edges of which are turned, as indicated at 98, in a clockwise direction as viewed in the plan view constituting Figure 3. These edges 98 provide rests for the purpose of definitely positioning the lower ends of the wrap yarn guides which are flexed in a counterclockwise direction as viewed in Figure 3 in order to insure normal engagement with these edges.

Extending downwardly within the upper cylinder 3 is a stationary cylinder 100, this being interposed between the cylinder 3 and the wrap yarn guides. The cylinder 100 is carried by a portion of the frame which supplies a lower bearing 101 for the rotating support 58.

An axially extending rod 102 is guided for lengthwise movement through the tube 92 and carries at its lower end a fabric take-up disc or pusher 104 provided with rounded fingers 106.

The rotating wrap yarn carrying assembly includes a disc 108 on which are supported the wrap yarn bobbins (not shown) of which there is one for each wrap yarn. The wrap yarns pass from these bobbins through conventional individual tension devices and take-up sweeps and thence downwardly through openings 116 and 117 about the lower edge of the cylinder 100 (when the wrap yarn guides are outwardly projected) and through the eyes 88 in the individual wrap yarn carriers.

The wrap head supporting means forms not part of the present invention and is, therefore, not shown. For its details reference may be made to the application of Paul W. Bristow, Serial No. 635,644, filed December 18, 1945.

At the lower end of the stationary cylinder 100 there is carried by a bracket member 184 a wrap horn 186 which at its initial end is in the form of a horizontal strip and which, beyond the region of presentation of wrap yarns to the needles, is turned to a vertical position indicated at 188, this, as indicated hereafter, being to insure a high position of the wrap yarns on the needles as they are raised following wrapping. The trailing end of this horn is upwardly bevelled as indicated at 190 and overlaps a cam 192 also carried by the stationary cylinder 100. This cam is provided with a downwardly sloping forward edge 194 for the purpose of forcing downwardly a wrap yarn as hereafter described. Another function is to assist yarn take-up in tightening the wrap yarn when interlacing takes place. Immediately beyond this cam is a second cam 196 which is provided with flat fabric engaging members 198, 200 and 202. The function of these is to hold downwardly, in particular, heels and toes during the knitting operations, to position the pocket so it will be caught by the fabric takeup disc 104, and to assist the yarn take-up in control of the wrap yarn while stitches are being drawn during wrap patterning.

For the purpose of controlling the wrap yarn carriers there are provided cams 204 pivoted on the machine frame and arranged to cooperate with the butts 73 of the sliders 72 as hereafter described. These cams 204 are provided with tail portions 208 which are urged by individual springs 206 into engagement with cam projections 210 on slides 212, one of which corresponds to each of the cams 204. These slides 212 are urged in a rearward direction, as viewed in Figure 5, by individual springs 214 against the pull of Bowden wires 216 connected to vertical rods 218 which are acted upon by cams on the main cam drum of the machine.

To provide positive return of the wrap yarn carriers following their projection of wrap yarns across the needle cylinders there are provided cams 222 arranged to act upon the butts 84. These cams act to return the wrap yarn carriers at slightly different times for the reasons given hereafter.

For the proper control of the wrap yarn carriers to cause them to wrap a possible plurality of needles in each operation, there is provided a yielding abutment shown at 224 engageable by the ends 90 of these carriers. This abutment 224

is carried by a shaft 226 extending downwardly through a stationary tube 228 secured at 230 to the machine frame and carrying at its upper end a stop 232 which is adjustable for the accurate positioning of the abutment 224. At its lower end the shaft 226 carries an arm 234 which is acted upon by a tension spring 236 serving to maintain normally the abutment in contact with the stop 232. The spring 236 is fairly strong so that normally the abutment 224 presents a fixed stop for the wrap yarn carriers. In case of an accident, however, for example, engagement of a wrap yarn carrier with a needle, the abutment 224 may yield against the action of 236 to permit the wrap yarn carrier to pass without mechanical damage.

To serve for the control of the lower sliders 4 by engagement with their butts 14 there are provided cams 238 mounted for radial sliding movement with respect to the lower cylinder. Each of these cams is provided with a notch at its outer end engageable by an individual lever 242 of a stacked group, which levers are provided with follower ends 244 engageable with the butts of elements 246 mounted in a trick wheel 248, suitable springs serving to urge the levers 242 in a clockwise direction, as viewed in Figure 5. The control of the lever 242 need not be described herein. Reference may be made to the Bristow application referred to above for details of construction and operation.

A lowering picker 310 is pivoted in the usual fashion to a vertical post arranged to oscillate about a vertical axis, the tail end of the picker being urged downwardly by a spring 311 so as to follow a double cam 312 during oscillatory movements of the supporting post upon engagement of the picker by a needle moving in either direction. The conventional spring controlled arrangement indicated at 314 normally maintains the picker in central position. A lever 316 pivoted underneath the tail of the picker carries a cam arranged to act thereon when the lever is rocked against the action of the spring 320 by a Bowden wire the arrangement and connections of which are illustrated and described in said Bristow application. When the cam on lever 316 acts on the picker its active end is held depressed to proper level for picking down heel sliders.

There is pivoted on a horizontal pin 330 an arm in the form of a bent stiff wire 328, which arm is normally urged inwardly in a direction toward the needle cylinder by a spring. A wire 334 carried by a vertical shaft 336 has a turned end embracing the lever 328. The upper end of the shaft 336 is provided with a cam following arm 338 adapted to be engaged during rotation of the needle cylinders by a cam 340 carried by the upper needle cylinder. The arrangement is such that when the picker is operated so that its tail is raised the wire lever 328 which normally rests against the tail will drop beneath the same, holding the active end of the picker in a lowered position between the raised slider butts at heel height and the butts at normal cleared level until release is effected by the action of the cam 340.

The cam sequence of the machine will become apparent upon consideration of Figure 20, which shows an interior developed view of the cams cooperating with the sliders as well as illustrating the circumferential positions of other elements such as the cams for controlling the wrap yarn carriers and the narrowing and widening pickers.

Cooperating with the knitting butts 10 of the lower sliders are the forward stitch cam 342, the reverse stitch cam 344, the lower tip of which is relieved at 345 so that it will engage long butts only, and the top center cam 346. Cam 348 is in action during the formation of the heel and toe. It also helps in making a press-off draw thread, which, however, is not involved in the present invention and need not be described. Cam 350 is arranged to raise the lower sliders to clearing level as described hereafter. Cam 352 is arranged to lower the lower sliders for the press-off draw thread. Cam 354 is arranged to raise the lower sliders preparatory to the action of the cams 238 upon the saw tooth butts 14. Following the position of wrapping, there is a cam 356 arranged to raise the lower sliders preparatory to their approach to the stitch cams. Cams 349 and 358 are arranged to raise active lower long butt sliders to a clearing level during reverse rotation of the cylinders.

Arranged to cooperate with the transfer butts 12 of the lower sliders are cams 360 and 362, the latter being followed by cam 364 cooperating with the butts 10 to lower the sliders after a needle transferring operation.

The movable walls 22 and 24 are controlled by the action on their butts of cams forming a race 366, which includes a depression 368 for the purpose of moving the verge bits 24 downwardly at the time stitches are drawn by the needles in the upper cylinder, a rise 370 which, though it incidentally raises the verge bits, is primarily provided for the purpose of getting the walls 22 out of the way of the wrap yarn carriers, and a depression 372 arranged to cause the walls provided with the lower ends 30 to engage the wrap yarns to effect correct interlacing.

Arranged to act upon the upper transfer butts 18 of the upper sliders are cams 374 and 376, which impart to the upper sliders a needle transferring wave, the dividing cam 361 operating in the usual fashion to release the sliders in both the upper and lower cylinders from the needles when transfer is to be effected. Following a transferring wave of the upper sliders, they are restored to normal clearing level by cam 376 from which level the cam 378, acting on their lower butts 16 raises the needles in the upper cylinder from their clearing level to the knitting level. An upper stitch cam 380 is provided followed by cams 386 and 388 arranged to effect clearing. Cams 382 and 384 are provided to lower long butt sliders for heel and toe knitting, the long butts being provided at the level 16.

A forward narrowing picker 390 and a reverse narrowing picker 392 are provided to cooperate with the long knitting butts at the level 10 of the lower sliders. The widening or lowering picker 310 has been referred to heretofore.

The arrangement of the slider butts for the purpose of securing proper transfer to form the welt and a 1 x 1 rib top followed by a broad rib leg and instep is fundamentally the same as described in the patent to Harold E. Houseman No. 2,170,078, dated August 22, 1939, and this may be referred to both for the arrangement of the transfer butts and the operations involved in the successive transferring actions. The present invention is not concerned with these features and it will suffice to begin the description of operation with the assumption that the division of the needles has been effected in the upper and lower cylinders to provide multiple needle panels in the lower cylinder to receive the warp yarns. It may, however, be pointed out that, differing from the Houseman patent just referred to, the instep sliders in both cylinders are provided with short

butts at 10 and 16, while the sole sliders in both cylinders are provided with long butts in the same positions.

In the formation of the leg, the lower sliders follow a path over the reverse stitch cam 344 and run down the center cam 346 and the forward stitch cam 342, taking the main yarn or yarns from the usual yarn feeding fingers, the position of which is indicated at 394. While only the active position of a yarn feeding finger is illustrated, it will be understood that the conventional Komet yarn changing mechanism is provided as illustrated, for example, in Bentley et al. Patent 1,838,651. Following the drawing of the yarn below the cam 342, the needles are raised by the action of cam 354, which positions them at a level for selection by the action of the cams 238 upon their lower butts 14. At this time the cams 238 are controlled by the trick wheel 248, the control of which is as described in said Bristow application. By the selective action of the cams 238 on the butts 14, some of which butts are removed in the usual fashion to provide the proper selections, the needles 6 are either selectively raised to a level (the tuck level or slightly lower) to receive the wrap yarns, or remain at a lower level so as not to be engaged by the wrap yarns. As the lower sliders reach the cam 356, however, all of them are raised thereby to the clearing level, though, as will be pointed out hereafter, the rise to this level is not effective to cause the wrap yarns to drop below the latches, the wrap yarns being held high by the portion 188 of the horn so that only previous stitches are cleared. The lower sliders are then in the proper path of approach to ride over the reverse stitch cam 344.

The wrapping operation will be made clear from a consideration of Figs. 5 and 8 to 19, inclusive. Selection of the wrap yarn is effected by the control of the sliders 212 from the main cam drum of the machine through the plungers 218. The cams 204 are thus rendered selectively active and if an active cam is reached by a butt 73 of a sliding element 72, the corresponding wrap yarn finger or carrier is projected outwardly across the needle circle in advance of a series of needles in the lower cylinder and generally immediately following a group of needles in the upper cylinder. The outward projection of the lower end of the wrap yarn carrier occurs just prior to engagement with the abutment 224 and at a position following the completed rise due to a cam 238 of a lower slider which controls a needle supposed to take the wrap yarn. The condition immediately following the rocking outwardly of the lower end of the wrap yarn carrier is illustrated in Figures 8 and 9. The wrap yarn extends from the point at which it was last knit into the fabric and accordingly it is drawn about the horizontal portion of the wrap horn 186. As will be clear from Figure 8, the wrap yarn extends across the needle circle at a level below the upper ends of the upwardly selected needles but at a level above the hooks of the needles which were not selected.

The cams 204 and 222 may be arranged as indicated in Figure 20. The uppermost cam 204 is arranged to provide for the wrapping of wide panels and is sufficiently long to delay the return of a wrap yarn carrier by its spring until the last needle of a wide panel is passed by the carrier, the positive return cam, the upper one of the cams 222, being arranged for correspondingly delayed action. The two lower cams 204 and the lower return cam 222 act upon the carriers for the more usual narrower multiple needle panels. The middle cam 204 acts on carriers associated with instep needles, while the lowermost cam 204 acts on carriers associated with sole needles. Thus when the lowermost cam is withdrawn, the wrapping in the instep may be continued without wrapping in the sole.

As rotation proceeds, the wrap yarn carrier is retarded by the abutment 224, the spring which holds this abutment being sufficiently strong so that it will retain its fixed position while the long wrap yarn carrier flexes relative to the cylinders and away from the edge 98 of its corresponding fin 96, with which it was previously in contact and which guided its outward movement. Accordingly, as indicated in Figures 10 and 11, the wrap yarn is presented to the selected needles below the bills of their hooks.

In the event that a needle is in the wrong position, due either to a faulty transfer or to a broken butt on its slider, then the abutment will move against action of spring 236 so as to avoid damaging the wrap yarn finger.

The action of one of the cams 222 then returns the lower end of the wrap yarn carrier inwardly, releasing it from the abutment 224, whereupon it immediately snaps into its original position in contact with its fin 96, the latter condition being illustrated by the position existing in Figures 12 and 13. During this inward movement of the lower end of the wrap yarn carrier, the yarn is cammed downwardly about the depending extension 87.

Up to this time the sliding wall elements 22 have been raised due to the action of the cam rise 370, so that they are out of position to interfere with the movements of the wrap yarn carrier. They are now lowered by the cam 372 at the time of rise of the unselected needles due to the cam 356. As these unselected needles rise, the lower edges 30 of the movable walls engage the wrap yarn, and due to the slope of these edges, the wrap yarn extending between the selected needles is cammed or held inwardly, so that the rising unselected needles will pass outside the wrap yarn to provide proper interlacing. At about the same time, the needles carrying the wrap yarn pass beyond the horizontal portion of the wrap horn 186 and reach the vertical portion 188, the upper edge of which is at a higher level than the upper surface of the horizontal portion of horn 186. As a consequence of this, despite the rise of the wrapped needles over the cam 356 (which rise of wrapped needles begins later than the rise of the unwrapped needles due to the higher approaching level of the former), the wrap yarn is held high in the hooks and some degree of tension is imparted thereto which is thereafter maintained to insure that the wrap yarn takes a plating position in the stitches which are drawn. The needles accordingly rise to the clearing level without any possibility that the wrap yarn will get below the latches. The entry of the elements 22 between the needles serves to limit their flexure by the wrap yarns and thus they have an additional function in avoiding damage.

As the needles move down the cam 346, the wrap yarn is brought into contact with the slope 194 of the cam 192, which overlaps the end 190 of the wrap horn. As indicated in the successive views, Figures 16, 17 and 18, this results in a substantial tensioning of the wrap yarn further maintained by cam 196, resulting in plating when the wrap yarn, along with the main yarn taken at the main yarn feed, is drawn for the

formation of stitches. Both the wrap yarn and the main yarn are thereafter held down by the sinkers as the needles rise to clear the latches.

The verge bits **24** having the ends **32** function in convention fashion to cause the proper formation of rib stitches by the needles in the upper cylinder.

In order to make possible the immediate wrapping of instep needles upon completion of the heel, the heel and toe of a stocking knit in the present machine are formed while holding the inactive instep needles at a low welt level.

As mentioned above, the instep sliders are provided with short knitting butts **10**, while the butts **10** of the sole sliders are long. In order to segregate the sole and instep sliders, the stitch cam **342** is withdrawn sufficiently to cause it to engage long butts only. This withdrawal is solely for the purpose of preventing the stitch cam from acting repeatedly on the short butt sliders in order to avoid undue tensioning of the loops held thereby. The cut-away lower end **345** of the reverse stitch cam **344** has the same object and makes it unnecessary to move this cam, the lower end **345** engaging the long butts but missing the short butts. Cam **348** is stepped in to engage long butts at **10** but miss short butts. Cam **349** is relieved at its upper end so that short butts may pass it while long butts will be raised during reverse reciprocations.

In the last rotation prior to the first reverse reciprocation in going on the heel, the short butt sliders will accordingly fail to rise over the cam **354**, this cam being moved outwardly prior to the cam **342**, which has its outward movement following the passage of the last short butt sliders. Cam **348** comes in to raise long butts only. Accordingly, the short butt sliders ride at the low inactive level, while the long butts pass through knitting waves in both directions of movement.

Narrowing now takes place in conventional fashion, the leading long butt in each reciprocation being raised by one of the pickers **390** and **392** so that the needles engaged by long butt sliders are successively raised out of action. At this time the lowering picker **310** occupies an upper position above the level of the raised inactive long butts.

When the narrowing is completed, the widening is to begin, the lowering picker **310** has its active end moved downwardly by the action of cam **318** on its tail portion. It is then in position to be engaged by the leading inactive long butts, which are to be picked downwardly.

A problem now arises, however, in the operation of the lowering picker, in that unless proper precautions were taken, it would be engaged by the leading inactive long butts at the ends of the long butt series of sliders in both directions of reciprocation rather than merely the leading inactive long butts following the group of lower active long butts. Accordingly, there comes into operation the lever **328**. The initial lowering of the lowering picker by the cam **318** is caused to occur at the end of the stroke as the picker is reached by the central group of active long butt sliders. Accordingly, it will engage the two inactive long butts following this group and they will carry it forwardly so that, by the action of one of the same **312**, its inner end will move downwardly to lower these butts to the active level. When it is so lowered, the lever **328** will drop below its tail portion to hold it at a level between the active and inactive levels of the long

butts. It is accordingly passed by the inactive long butts at the ends of the long butt series in both directions of reciprocation, being released to an upper level by the action of the cam **340**, which rocks the lever **328** out from beneath the tail portion of the picker at the end of each reciprocation when the picker is reached by the central long butt sliders. Picking accordingly takes place in proper fashion despite the lower inactive positions of the short butts which, in conventional picking operations, ride at a high level and prevent the undesired action of the lowering picker. The widening accordingly proceeds with the lowering of two sliders and the raising of one in each reciprocation, the latter action being due to the continued action of the narrowing pickers.

In the restoration of the short butt sliders to operation following the completion of the heel, they ride upwardly over the cam **354**, which is moved inwardly to engage them so that, immediately upon coming into action, they will pass through selection to render them ready to take the wrap yarn.

The control of the cams **238** and of the wrap fingers to interrupt wrapping during the formation of the heel and toe and to secure wrapping only in the instep during the formation of the foot is described in the Bristow application to which reference may be made for details.

In the formation of the toe, narrowing and widening are carried out as described above for the heel. During the formation of the toe, retiming of the trick wheel takes place as described in said Bristow application.

What I claim and desire to protect by Letters Patent is:

1. A knitting machine comprising a cylinder, needles carried by said cylinder, a wrap yarn carrier, means for mounting for radial pivotal movement the end of the wrap yarn carrier remote from the needles, means for moving said wrap yarn carrier radially to present a wrap yarn to the needles, a rest having a laterally turned edge abutting the yarn carrying end of the wrap yarn carrier, said rest rotating with the needles, and an abutment engageable by the wrap yarn carrier to provide a relative circumferential movement between it and the needles away from the rest, said wrap yarn carrier being flexible so that the last mentioned movement occurs while the mounted end of the carrier moves circumferentially with the needles.

2. A knitting machine comprising a cylinder, needles carried by said cylinder, a wrap yarn carrier, means for mounting for radial pivotal movement the end of the wrap yarn carrier remote from the needles, means for moving said wrap yarn carrier radially to present a wrap yarn to the needles, a rest having a laterally turned edge abutting the yarn carrying end of the wrap yarn carrier, said rest rotating with the needles, and an abutment engageable by the wrap yarn carrier to provide a relative circumferential movement between it and the needles away from the rest.

3. A knitting machine comprising a cylinder, needles carried by said cylinder, a wrap yarn carrier, means for mounting for radial pivotal movement the end of the wrap yarn carrier remote from the needles, means for moving said wrap yarn carrier radially to present a wrap yarn to the needles, and an abutment engageable by the wrap yarn carrier to provide a relative circumferential movement between it and the

needles, said abutment normally presenting a fixed position to the wrap yarn carrier but being yieldable in the event the relative circumferential movement between the wrap yarn carrier and the needles is prevented.

4. A knitting machine comprising a cylinder, needles carried by said cylinder, a wrap yarn carrier, means for mounting for radial pivotal movement the end of the wrap yarn carrier remote from the needles, means for moving said wrap yarn carrier radially to present a wrap yarn to the needles, and an abutment engageable by the wrap yarn carrier to provide a relative circumferential movement between it and the needles, said wrap yarn carrier being flexible so that the last mentioned movement occurs while the mounted end of the carrier moves circumferentially with the needles, and said abutment normally presenting a fixed position to the wrap yarn carrier but being yieldable in the event the relative circumferential movement between the wrap yarn carrier and the needles is prevented.

5. A knitting machine comprising superposed cylinders, needles carried by said cylinders, a wrap yarn carrier, means located adjacent to the end of one of the cylinders remote from the needle-carrying end thereof for mounting said carrier, means for moving said wrap yarn carrier radially to present a wrap yarn to the needles, a rest having a laterally turned edge abutting the yarn carrying end of the wrap yarn carrier, said rest being located adjacent to the needles, and rotating therewith, and an abutment engageable by the wrap yarn carrier to provide a relative circumferential movement between it and the needles away from the rest.

6. A knitting machine comprising superposed cylinders, needles carried by said cylinders, a wrap yarn carrier, means located adjacent to the end of one of the cylinders remote from the needle-carrying end thereof for mounting said carrier, means for moving said wrap yarn carrier radially to present a wrap yarn to the needles, a rest having a laterally turned edge abutting the yarn carrying end of the wrap yarn carrier, said rest being located adjacent to the needles, and rotating therewith, and an abutment engageable by the wrap yarn carrier to provide a relative circumferential movement between it and the needles away from the rest, said wrap yarn carrier being flexible so that the last mentioned movement occurs while the mounted end of the carrier moves with the needles.

7. A knitting machine comprising superposed cylinders, needles carried by said cylinders, a wrap yarn carrier, means located adjacent to the end of one of the cylinders remote from the needle-carrying end thereof for mounting said carrier, means for moving said wrap yarn carrier radially to present a wrap yarn to the needles, and an abutment engageable by the wrap yarn carrier to provide a relative circumferential movement between it and the needles, said abutment normally presenting a fixed position to the wrap yarn carrier but being yieldable in the event the relative circumferential movement between the wrap yarn carrier and the needles is prevented.

8. A knitting machine comprising superposed cylinders, needles carried by said cylinders, a wrap yarn carrier, means located adjacent to the end of one of the cylinders remote from the needle-carrying end thereof for mounting said carrier, means for moving said wrap yarn carrier radially to present a wrap yarn to the needles, and an abutment engageable by the wrap yarn carrier to provide a relative circumferential movement between it and the needles, said wrap yarn carrier being flexible so that the last mentioned movement occurs while the mounted end of the carrier moves circumferentially with the needles, and said abutment normally presenting a fixed position to the wrap yarn carrier but being yieldable in the event the relative circumferential movement between the wrap yarn carrier and the needles is prevented.

9. A knitting machine comprising superposed cylinders, needles carried by said cylinders, wrapping means for said needles, a stationary member within one of said cylinders, and a cam carried by said member inside the needle circle adjacent to the point where needles move to draw stitches and having a surface engageable with a heel pocket.

10. A knitting machine comprising superposed cylinders, needles carried by said cylinders, wrapping means for said needles, a stationary member within one of said cylinders, and a cam carried by said member inside the needle circle adjacent to the point where needles move to draw stitches and having a surface engageable with a heel pocket, said cam also serving to hold down a wrap yarn inside the needle circle to improve plating thereby.

11. A knitting machine comprising a cylinder, needles carried by said cylinder, a wrap yarn carrier, means for mounting for radial pivotal movement the end of the wrap yarn carrier remote from the needles, means including a radially slidable element interengaged with the wrap yarn carrier near said mounting means for moving said wrap yarn carrier radially to present a wrap yarn to the needles, and an abutment engageable by the wrap yarn carrier to provide a relative circumferential movement between it and the needles, said wrap yarn carrier being flexible so that the last mentioned movement occurs while the mounted end of the carrier moves circumferentially with the needles.

12. A knitting machine comprising superposed cylinders, needles carried by said cylinders, a wrap yarn carrier, means located adjacent to the end of one of the cylinders remote from the needle-carrying end thereof for mounting said carrier, means including a radially slidable element interengaged with the wrap yarn carrier near said mounting means for moving said wrap yarn carrier radially to present a wrap yarn to the needles, and an abutment engageable by the wrap yarn carrier to provide a relative circumferential movement between it and the needles, said wrap yarn carrier being flexible so that the last mentioned movement occurs while the mounted end of the carrier moves with the needles.

13. A knitting machine comprising a cylinder, needles carried by said cylinder, an axially extending wrap yarn carrier, means for mounting for radial pivotal movement the end of the wrap yarn carrier remote from the needles, means acting on the wrap yarn carrier near said mounting means for moving it radially to present a wrap yarn to the needles, and an abutment mounted radially outside of the needle circle engageable by the wrap yarn carrier at a point adjacent to the needles to control a relative circumferential movement between it and the needles, said wrap yarn carrier being flexible and free throughout an extended axial length thereof between its mounted end and its wrap yarn

carrying end so that the last mentioned movement occurs by deflection of the wrap yarn carrying end of the carrier effectively about a radial axis while the mounted end of the carrier moves circumferentially with the needles to avoid disturbance of timing relative to the means for acting thereon irrespective of the deflection of the wrap yarn carrier.

14. A knitting machine comprising superposed cylinders, needles carried by said cylinders, an axially extending wrap yarn carrier, means located adjacent to the end of one of the cylinders remote from the needle-carrying end thereof for mounting one end of said carrier, means acting on the wrap yarn carrier near said mounting means for moving it radially to present a wrap yarn to the needles, and an abutment mounted outside of said cylinders engageable by the wrap yarn carrier at a point adjacent to the needles to control a relative circumferential movement between it and the needles, said wrap yarn carrier being flexible and free throughout an extended axial length thereof between its mounted end and its wrap yarn carrying end so that the last mentioned movement occurs by deflection of the wrap yarn carrying end of the carrier effectively about a radial axis while the mounted end of the carrier moves circumferentially with the needles to avoid disturbance of timing relative to the means for acting thereon irrespective of the deflection of the wrap yarn carrier.

ALBERT L. OBERHOLTZER.

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