Sept. 29, 1953 M. ZIMIC ET AL 2,653,460

KNITTING MACHINE

Original Filed Sept. 13, 1945 9 Sheets-Sheet 1

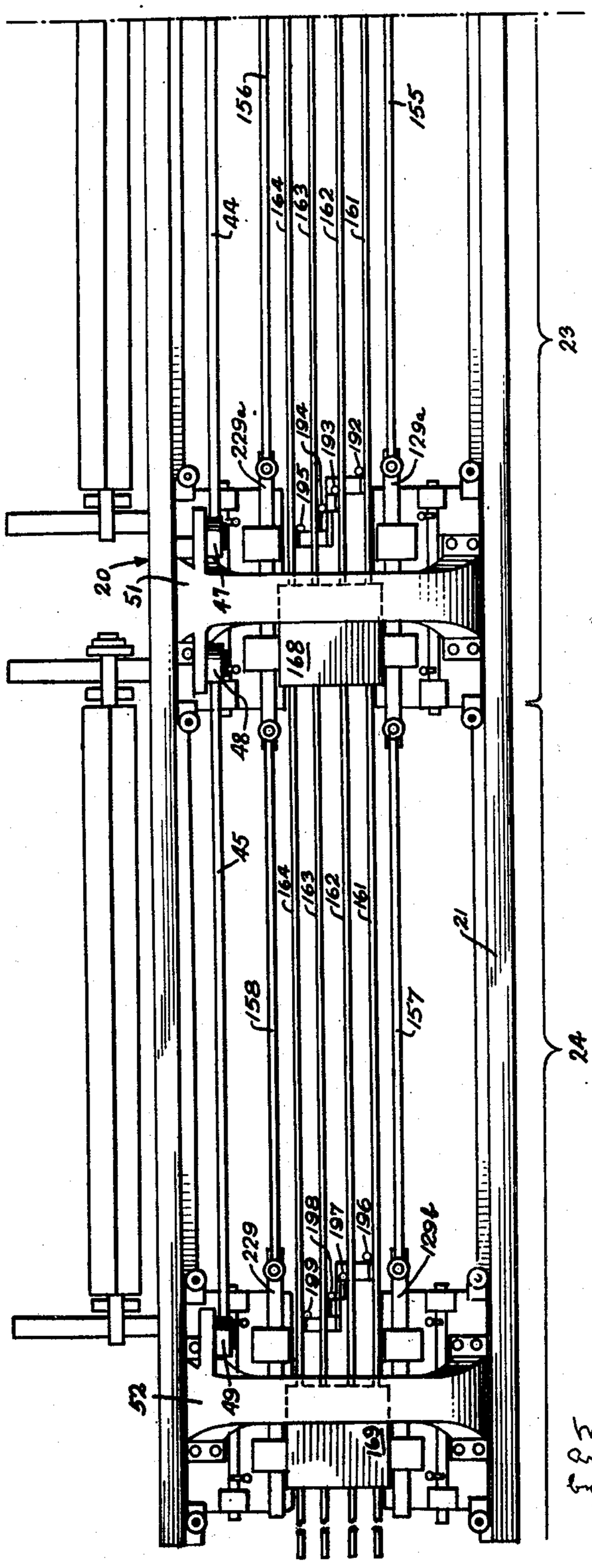


Fig. 1.

Inventors
Michael Zimic
Anton Miskovsky
by Denny Rubb
Attorney

Sept. 29, 1953 M. ZIMIC ET AL 2,653,460

KNITTING MACHINE

Original Filed Sept. 13, 1945 9 Sheets-Sheet 2

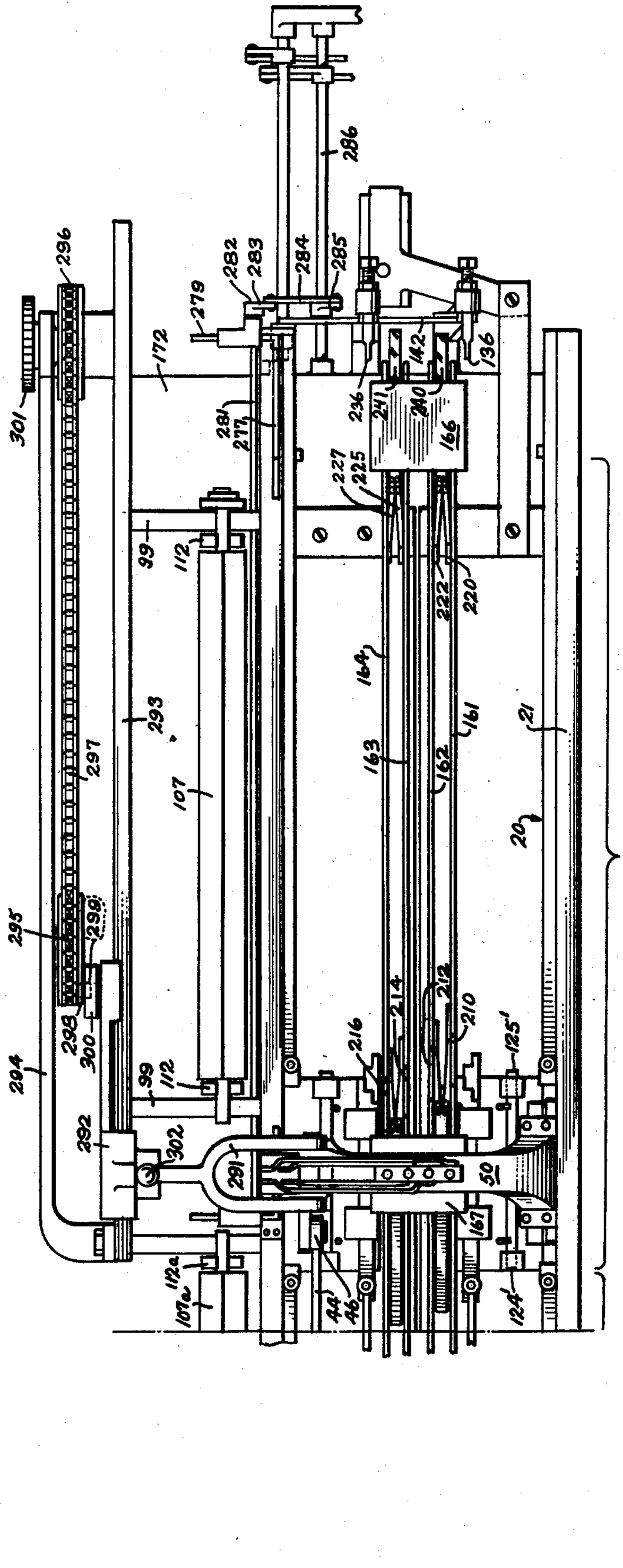


Fig. 1A.

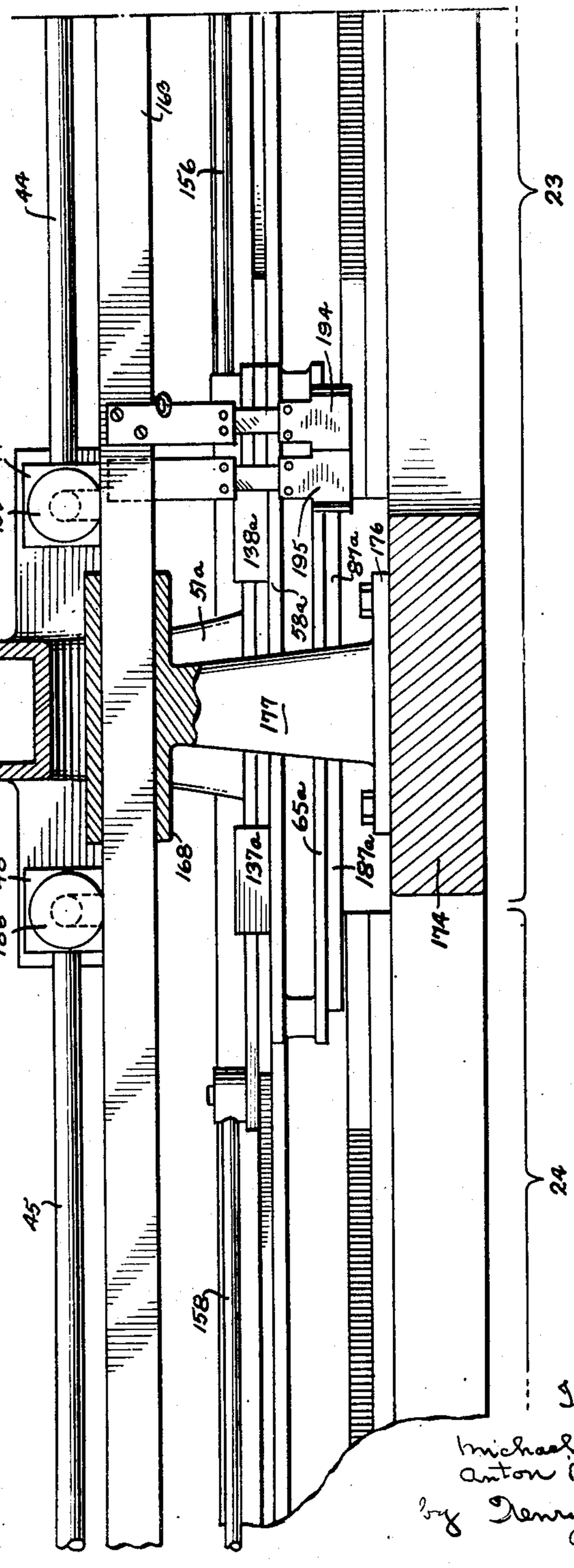
Inventors
Michael Zimic
Anton Miskovsky
by Denny Ruhl
Attorney

Sept. 29, 1953 M. ZIMIC ET AL 2,653,460

KNITTING MACHINE

Original Filed Sept. 13, 1945 9 Sheets-Sheet 3

Fig. 12.



Inventors
Michael Zimic
Anton Miškovsky
by Henry Ruhl
Attorney

Sept. 29, 1953 M. ZIMIC ET AL 2,653,460

KNITTING MACHINE

Original Filed Sept. 13, 1945 9 Sheets-Sheet 4

Fig. 2A.

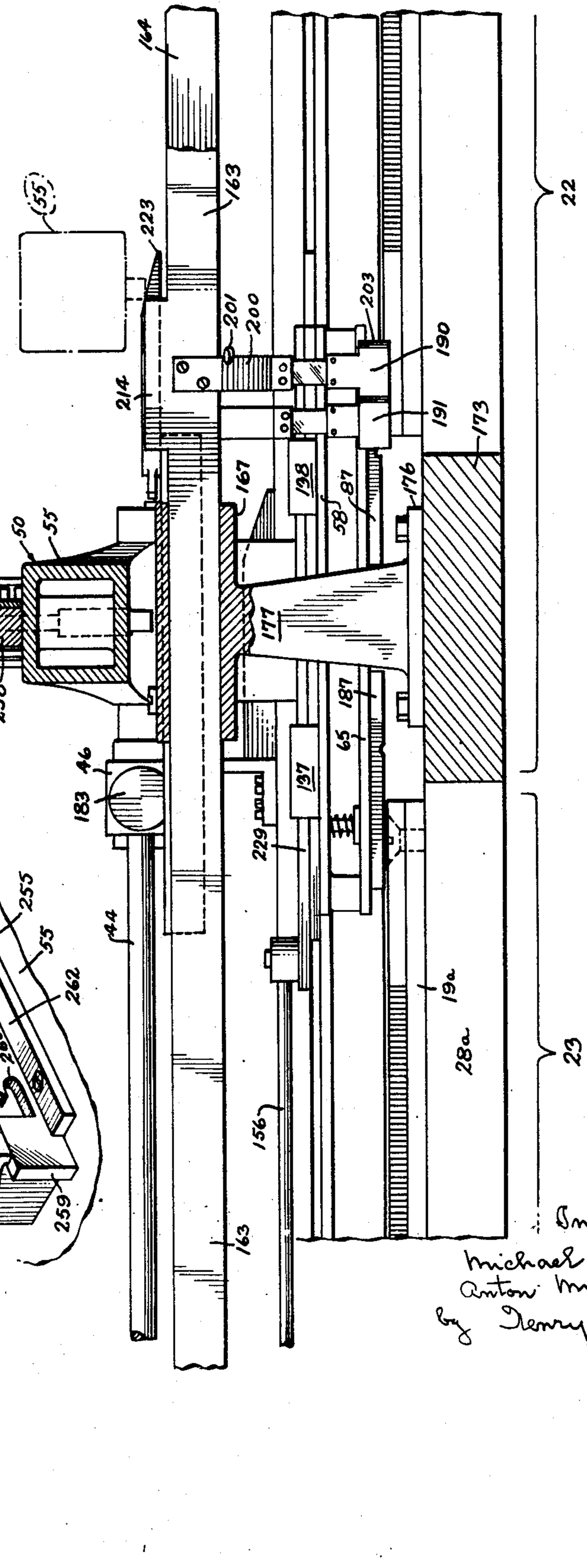


Fig. 5.

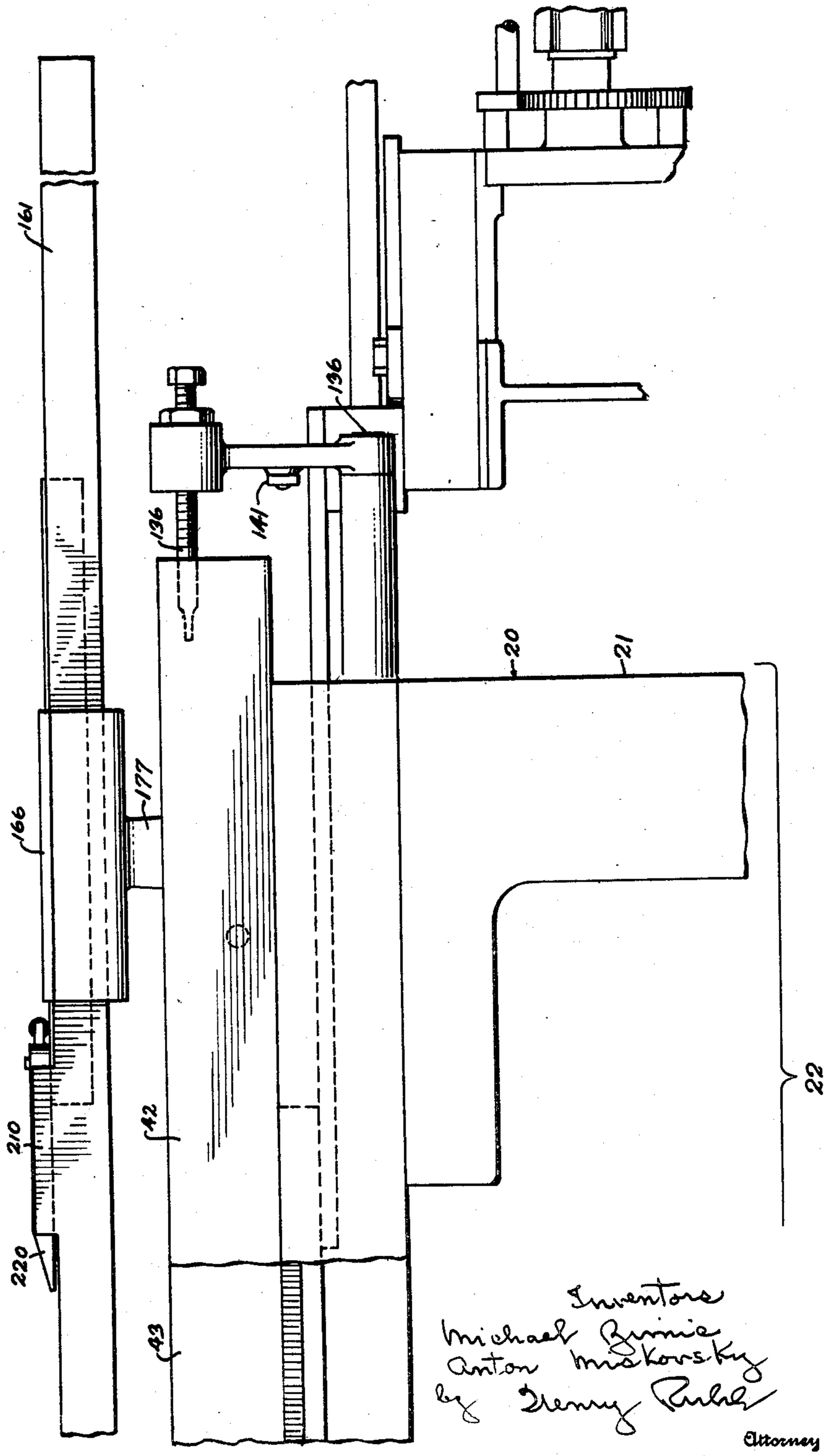
Inventors
Michael Zimic
Anton Miskovsky
by Henry Ruhe
Attorney

Sept. 29, 1953 M. ZIMIC ET AL 2,653,460

KNITTING MACHINE

Original Filed Sept. 13, 1945 9 Sheets-Sheet 5

Fig. 2B.



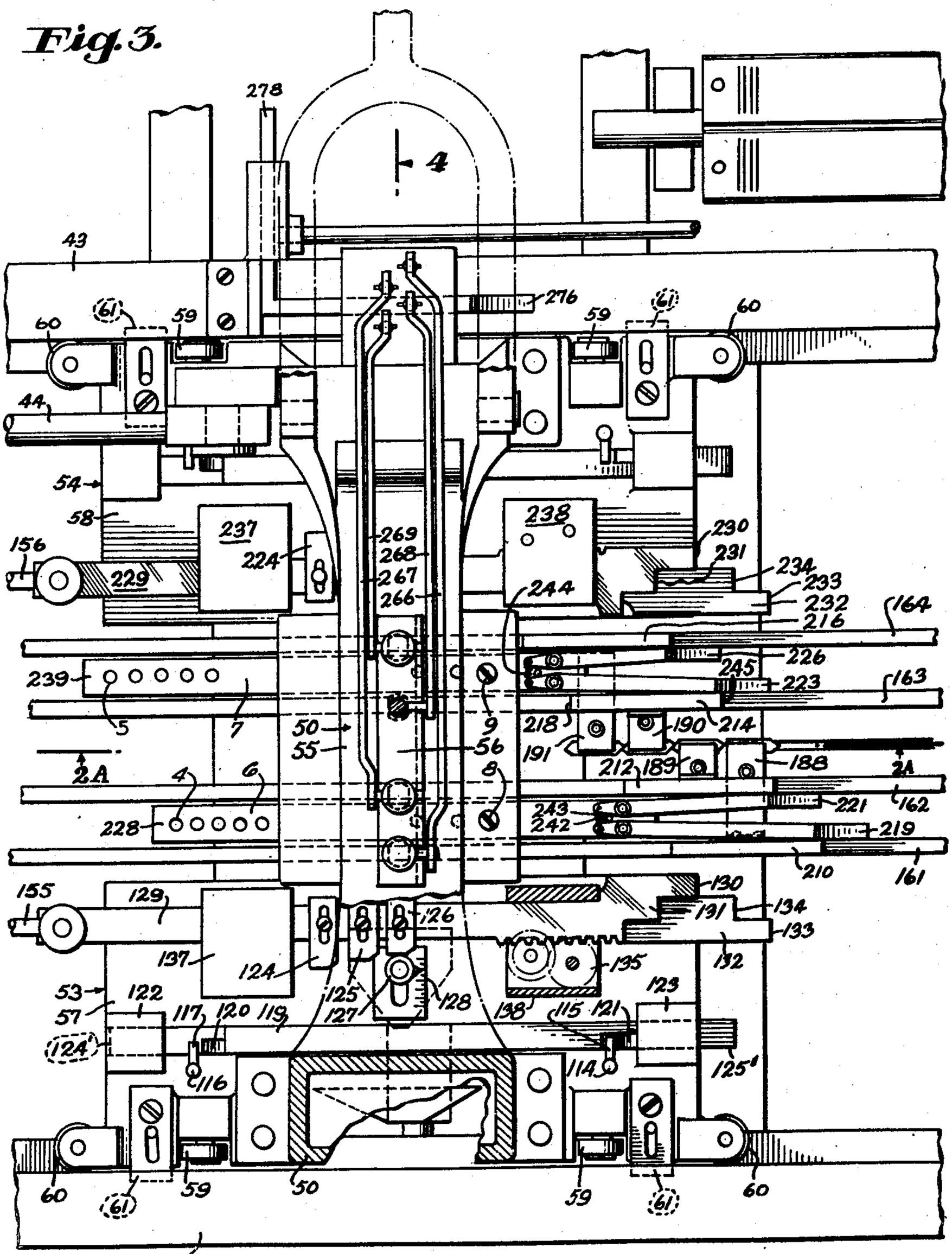
Inventors
Michael Zimic
Anton Mackorsky
by Henry Ruhl
Attorney

Sept. 29, 1953 M. ZIMIC ET AL 2,653,460

KNITTING MACHINE

Original Filed Sept. 13, 1945 9 Sheets-Sheet 6

Fig. 3.



Inventors
Michael Zimic
Anton Miskovsky
by Henry Ruhl
Attorney

Sept. 29, 1953 M. ZIMIC ET AL 2,653,460

KNITTING MACHINE

Original Filed Sept. 13, 1945 9 Sheets-Sheet 7

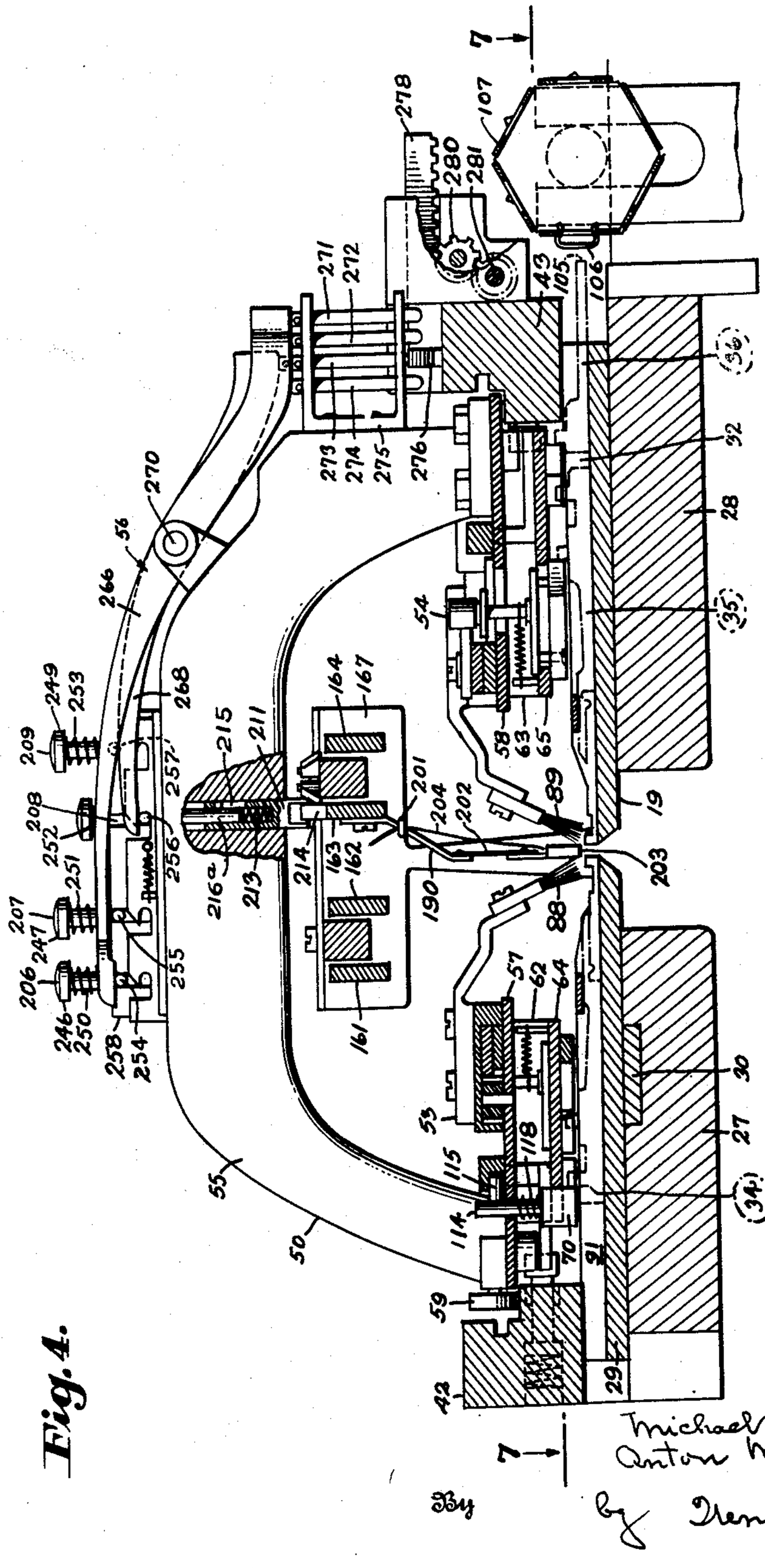


Fig. 4.

Inventors
Michael Zimic
Anton Miskovsky
By Henry Ruhl
Attorney

Sept. 29, 1953 M. ZIMIC ET AL 2,653,460

KNITTING MACHINE

Original Filed Sept. 13, 1945 9 Sheets-Sheet 8

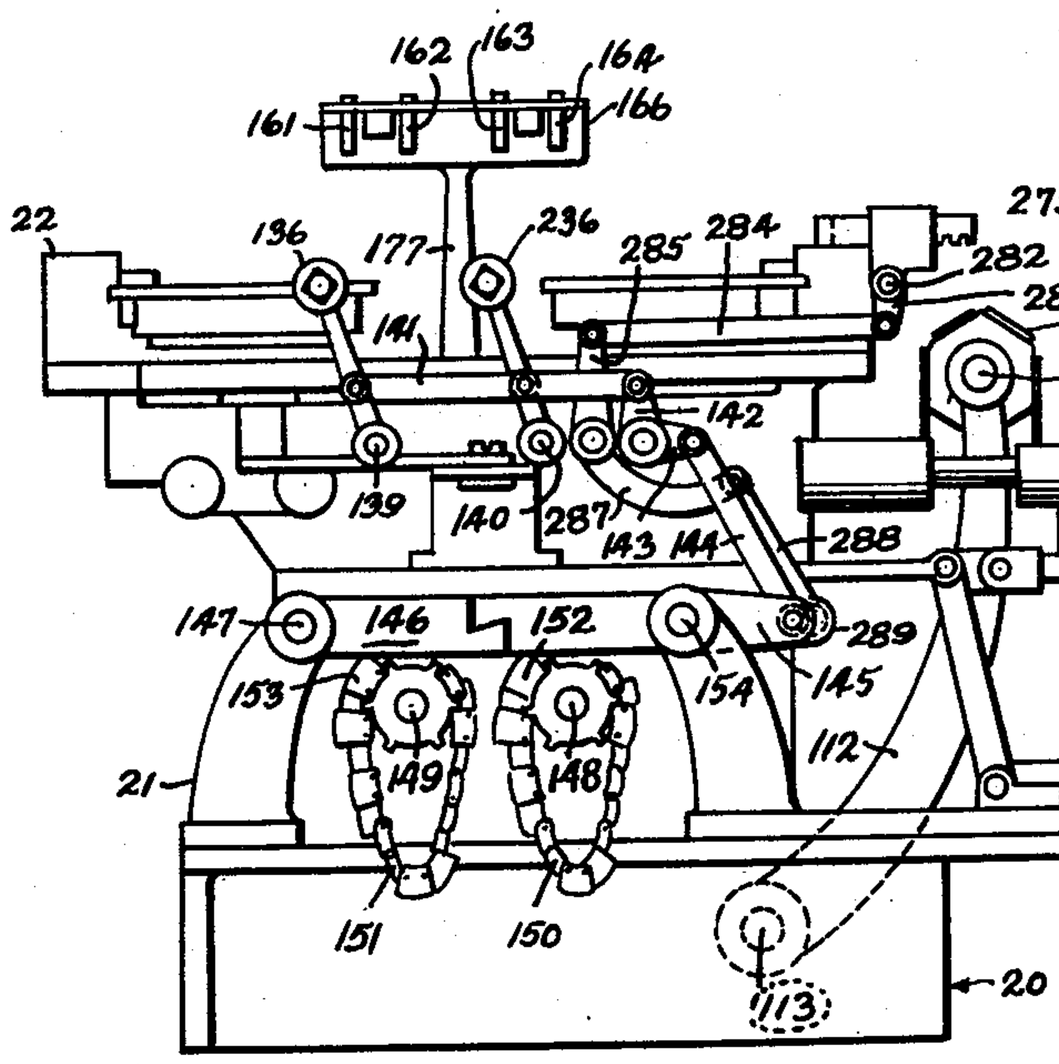


Fig. 6.

Inventors
Michael Zimic
Anton Miskovsky

By Denny Rubel
Attorney

Sept. 29, 1953 M. ZIMIC ET AL 2,653,460

KNITTING MACHINE

Original Filed Sept. 13, 1945 9 Sheets-Sheet 9

Fig. 7.

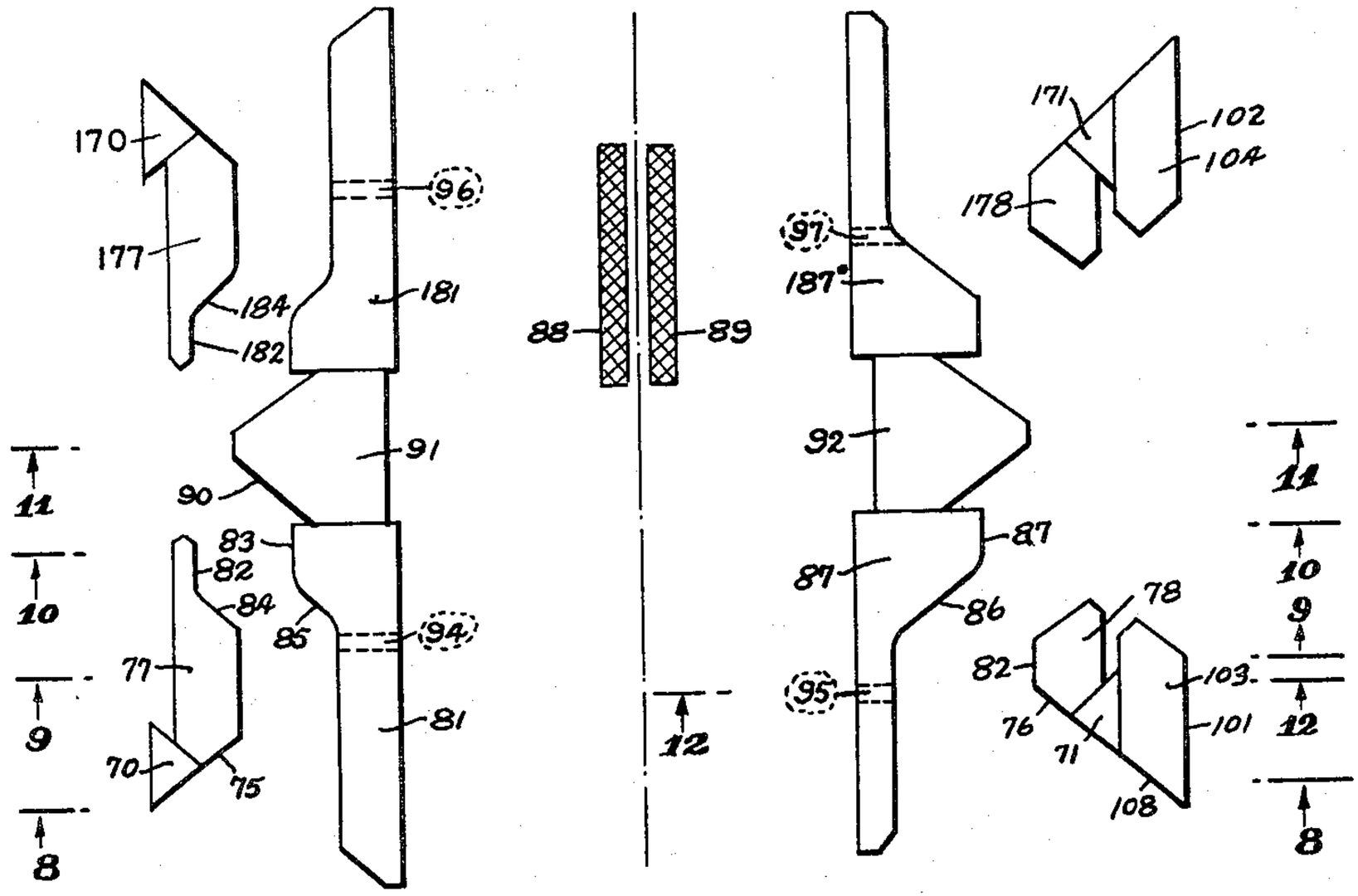


Fig. 8.

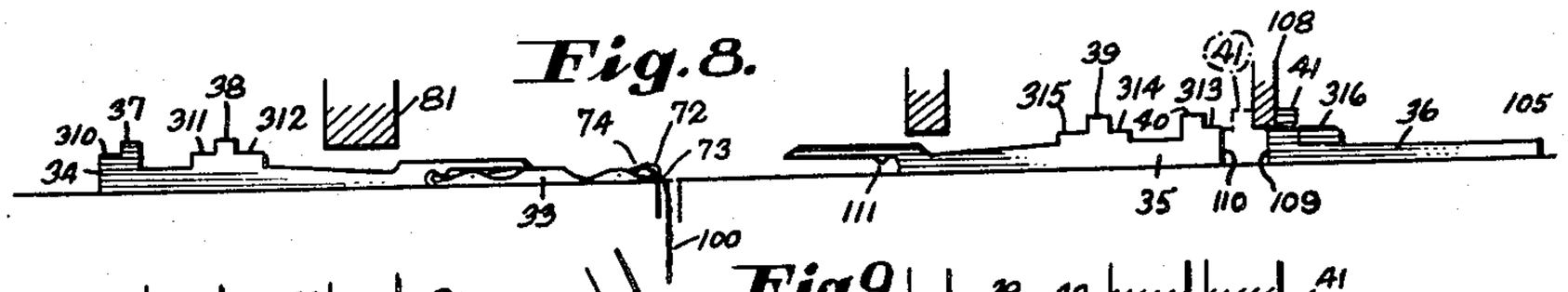


Fig. 9.

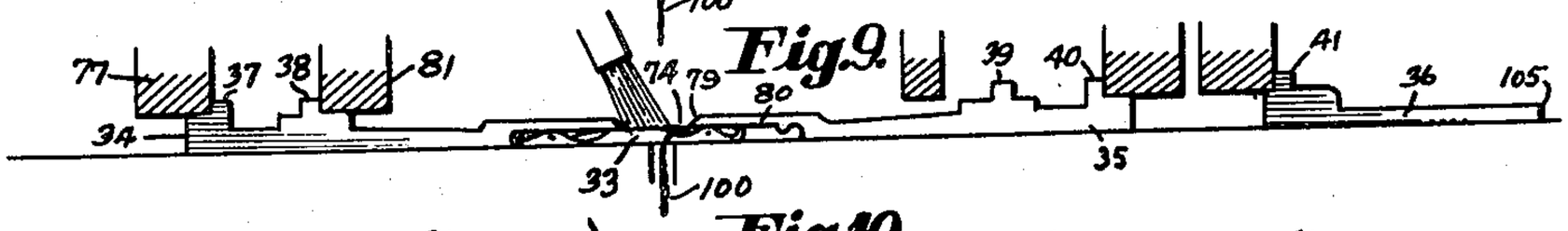


Fig. 10.

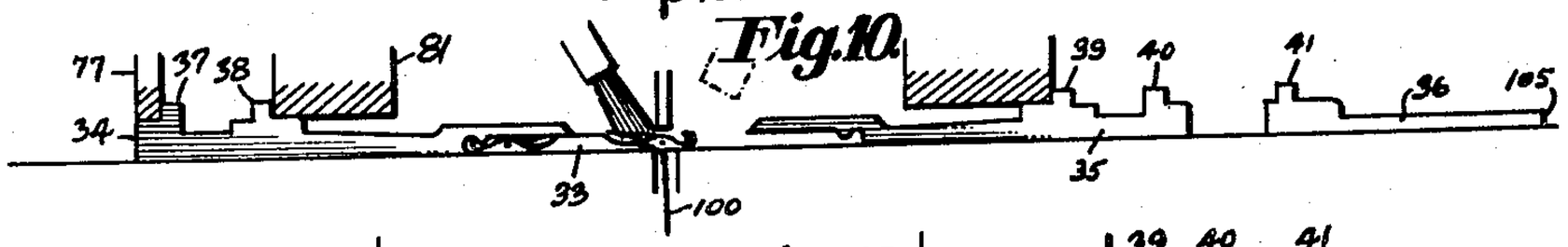


Fig. 11.

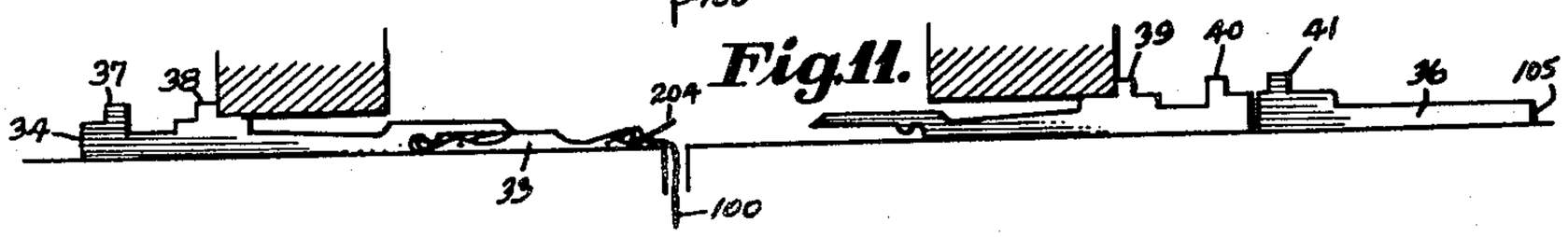
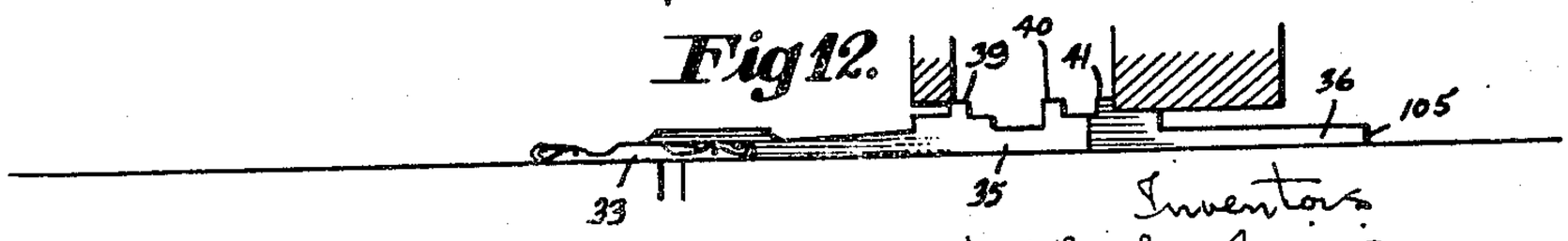


Fig 12.



Inventors
Michael Zimic
Anton Miskovsky
by Denny Rubel
Attorneys

Patented Sept. 29, 1953 2,653,460

UNITED STATES PATENT OFFICE

2,653,460

KNITTING MACHINE

Michael Zimic, New York, and Anton Miskovsky, Deer Park, N. Y.; said Miskovsky assignor to said Zimic

Original application September 13, 1945, Serial No. 615,936. Divided and this application September 19, 1949, Serial No. 116,487

5 Claims. (Cl. 66—63)

1

This invention relates generally to the field of machine knitting and more particularly, to a fully automatic links and links machine.

Among the objects of the present invention lies the provision of a novel and useful knitting machine of the links and links type wherein there is the simultaneous production of a plurality of knitted webs, and methods of knitting the same.

Another object herein lies in the provision of a machine of the character described which, by virtue of the organization of the parts and subassemblies thereof, provides a greater quantity of knitted fabric within the same space as would be occupied by a plurality of independent machines, or conversely, a substantially equal amount of knit goods in a corresponding or lesser amount of factory space.

Another object herein lies in the provision of a plural capacity links and links knitting machine wherein through a novel co-action of the parts thereof, controls of a master unit affect a series of controlled units. By virtue of the tandem operation and construction, certain control mechanisms need be only provided once for a given machine with a consequent saving in first cost and servicing.

A still further object of the present invention lies in the provision of improved jack construction, co-acting with split flat needle beds and needles, so that a superior knitting action is obtained.

Another object herein lies in the provision of improved carriage construction so that the shifting of the butts and hence the jacks may be accomplished in a superior manner with a consequent improvement in the action and knitting ability of the many needles in the beds. The present improved carriages also facilitate a new action of the yarn controls.

Another object herein lies in the provision of simple and substantially trouble-proof control means for producing co-action between the master unit and the controlled units.

Another object lies in the provision of an improved method of knitting of substantially continuous webs of knitted fabrics.

A feature of the present invention lies in the fact, that although increased production is obtained, various features of the automatic links and links construction, such as flexibility and adjustability, are retained, whereby the knitted fabrics may be varied as to the character of the stitches.

A further feature of the present construction lies in the provision of safety devices by the use

2

of which imperfections in the yarn or knitting operations cause a stoppage of the machine and the construction is such that servicing may be done with a minimum of lost time by the operator or repairer.

These objects and other incidental ends and advantages will more fully appear in the progress of this disclosure and be pointed out in the appended claims.

The inventive ideas involved are capable of receiving a variety of expressions, one of which, for purposes of illustration, is shown in the accompanying drawings; but it will be expressly understood that said drawings are used merely for the purpose of facilitating the description of the invention as a whole, and not to define the limits thereof, reference being had to the appended claims for this purpose.

This application is a division of our copending application, Ser. No. 615,936, filed September 13, 1945, for Knitting Machines, now Patent No. 2,493,054.

In the drawings, in which similar reference characters designate corresponding parts throughout the several views:

Figure 1 and Figure 1–*a*, together form a general plan of view of an embodiment of the invention. It is intended that these two figures be consulted simultaneously by placing them in juxtaposition with Figure 1 on the left.

Figure 2 is an enlarged fragmentary front elevational view partly in section of one of the controlled carriages of Figure 1.

Figure 2–*a* is an enlarged fragmentary front elevational view partly in section of the master carriage shown at the left of Figure 1–*a*.

Figure 2–*b* is an enlarged fragmentary detail elevational view of the mechanism seen at the right end of Figure 1–*a*.

Figure 3 is an enlarged top plan view of the control carriage which is shown at the left of Figure 1–*a*.

Figure 4 is a fragmentary vertical sectional view as seen from the plane 4—4 on Figure 3.

Figure 5 is a fragmentary perspective view showing details of the yarn control mechanism.

Figure 6 is an end elevational view of the buck or right end of Figure 1–*a*.

Figure 7 is a schematic plan view of the stitch cams on the control carriage substantially at the level of the plane 7—7 on Figure 4.

Figure 8 is a schematic fragmentary vertical sectional view as seen from the plane 8—8 on Figure 7.

Figure 9 is a schematic fragmentary vertical

sectional view as seen from the plane 9—9 on Figure 7.

Figure 10 is a schematic fragmentary vertical sectional view as seen from the plane 10—10 on Figure 7.

Figure 11 is a schematic fragmentary vertical sectional view as seen from the plane 11—11 on Figure 7.

Figure 12 is a schematic fragmentary vertical sectional view as seen from the plane 12—12 on Figure 7.

Before entering upon a detailed description of the construction of the machine by means of which the various knitting steps are accomplished, it is believed that a better understanding of the entire mechanism and methods of operation will be obtained by first giving a synopsis.

As shown in Figures 1 and 1–*a*, a bank of individual knitting units is provided. As an example, three knitting units **22**, **23** and **24** are shown. Groups of needles in each of the units do the knitting and these needles are actuated by stitch cams carried by the carriages **50**, **51** and **52**. The carriage **50** is the master carriage and the carriages **51** and **52** are the controlled carriages. In some instances, for the purpose of avoiding unnecessary repetition, parts on the units **23** and **24** corresponding to the unit **22** are given the same reference character with the addition of a letter suffix, "*a*" in unit **23** and "*b*" in unit **24**. Each of the knitting units has a stationary needle bed and a movable needle bed, the latter being shifted in unison on all units. A yarn selecting mechanism in the master unit controls the feeding of the yarn in the controlled units. The size of the knitted stitches in the master unit is controlled by a selector for this purpose, which shifts stitch size cams in master unit, and this selection is transmitted to the controlled units. The width of the knitted fabric web is determined by shiftable cams in the master unit and this is transmitted to the controlled units. As to which ends of the double point needles in the links and links machine are used, this is controlled by novel structure and the control is effective in each of the knitting units **22**, **23**, and **24**.

In the general type of machine herein shown, the usual front and rear beds **29** and **19** are provided in which the needles **33** are controlled to form stitches through the medium of a separate lock mechanism supported by each of the carriages **50**, **51**, and **52**, which continuously reciprocate over the needle beds in each of the knitting units. The carriage **50** is connected to the carriage **51** by a connecting rod **44**, the carriage **51** is connected to the carriage **52** by the connecting rod **45**. Each of the connecting rods **44** and **45** as provided, at the ends **46**, **47**, **48**, and **49** is provided with a downwardly opening notch which is adapted for detachable engagement with the shanks of headed pins which project forwardly from the rear portions of the carriages. See, for example, the pins **185** and **186** on Figure 2 and **183** on Figure 2–*a*. The carriages in reciprocating over the needle beds control the needle jacks associated with the various needles to accomplish the regular knitting operations.

For the purposes of the description, it will be assumed that operation is initiated with the carriages at their left hand positions.

Turning to Figures 1 and 1–*a*, the machine generally is indicated by reference character **20** and includes, broadly, a base or frame **21** upon which are supported a plurality of knitting units

22, **23** and **24**. While, for the purpose of illustrating the invention, a machine has been shown having a master knitting unit **22** and controlled knitting units **23** and **24**, the number of controlled knitting units may be varied to produce, simultaneously, a different number of fabric webs than the three produced by the present machine.

As far as the general knitting structure is concerned, each of the controlled units **23** and **24** is substantially identical with the other and also with the master unit. This will more fully appear as the disclosure proceeds. As seen in Figure 4, there are stationary frame beds **27** and **28**. The front needle bed **29** is slidably mounted on the front stationary frame bed **27** for movement longitudinally of the machine **20** and said front needle bed may be shifted by actuation of the connecting bar **30** which joins the corresponding shiftable front needle beds of the controlled units. Shifting of the bar **30** to produce the desired type of stitches is accomplished in a well-known manner heretofore used on links and links machines of the present class. The bar **30** interconnects the three front needle beds so that they may be simultaneously shifted.

The front and rear needle beds are provided with a plurality of grooves **31** and **32** within which are located the needles **33**, as well as the front and rear, and auxiliary jacks **34**, **35** and **36**, respectively. Obviously, the number of the grooves **31** and **32** will depend upon the width and gauge of the fabric and the size of the machine. It may be noted here, however, that the carriages in their operational cycles make a complete traverse of the needle beds so that knitting may be carried on for the full width of the capacity of the machine. Where narrower fabrics are desired, the yarn controls feed the yarn for a lesser width, as will more fully appear herein.

The front jacks **34** are provided with a series of butts **37** and **38**, and the rear jacks **35** have corresponding butts **39** and **40**. The auxiliary jacks **36** have single butts **41**. These butts coact with the stitch cams on the carriages.

Disposed at the front and rear portions of the machine and supported above the beds **27** and **28** are the front and rear rails **42** and **43**. The cross-sectional configuration of these rails is seen in Figure 4 and they serve as tracks along which the main carriage **50** and the controlled carriages **51** and **52** ride.

The carriages are generally similar in construction with the master or main carriage **50**, the carriage **50** having additional mechanism for controlling carriages **51** and **52**. As seen in Figures 3 and 4, the carriage **50** has front and rear assemblies indicated generally by reference characters **53** and **54**. The assemblies **53** and **54** are connected by an arched bridge **55**. In the case of the master carriage **50**, the bridge **55** supports the yarn control **56**. The front and rear assemblies **53** and **54** are built about the front and rear carriage plates **57** and **58**. The front and rear base portions of the bridge **55** are secured to the upper surfaces of the plates **57** and **58** in any suitable manner, as by bolting.

The front and rear plates **57** and **58** are provided with a plurality of horizontally journalled rollers **59** and a plurality of vertically journalled rollers **60**. The rollers **59** and **60** are adjustable so that the carriage **50** may follow a substantially rectilinear oscillatory course. A plurality of reciprocatable latches **61** are shiftable inwardly and outwardly of the carriage to engage corre-

spondingly positioned grooves in the rails **42** and **43**. When in their extended position, these latches maintain the carriage in positive slidable engagement with the rails. When the latches **61** are retracted, they permit the vertical upward removal of the carriage from the rails.

Secured to the under-surface of the plates **57** and **58** by the bosses **62** and **63**, and generally spaced and parallel with respect thereto, are the stitch cam supporting plates **64** and **65**. The cams which co-act with the butts **37—41** are seen in Figure 7 in which the cams which depend from the front plate **64** are seen at the left of said figure and the cams which depend from the rear plate **65** are seen at the right of said figure. The arrangement of the stitch cams is such that when the carriage **50** (or the other carriages corresponding thereto) is moved to the right as the machine is faced from the front, said cams would move downwardly as illustrated on Figure 7.

Assuming the carriage to be moving downwardly as last described, and the particular jacks **34** and **35** to be at the position indicated by the plane **8—8** on Figure 7, the butt **37** is just about to be struck by the switch or gate cam **70** while the butt **40** is about to be struck by the switch or gate cam **71**. These cams at that time are in their lowered or active position. The effect of the cams **70** and **71** and the movement of the carriage is to move the jacks **34** and **35** toward each other. In the position shown in Figure 8, which may be referred to as a normal position of the jacks, they are at rest and may be considered to be at the end of one knitting cycle and at the beginning of another. In this position, the rear hook **72** of the needle **33** carries the last formed loop **73** and the rear hook latch **74** is closed. The carriage continuing its downward (as viewed in Figure 7) movement, brings the butts **37** and **40** into contact with the cam surfaces **75** and **76** of the cams **77** and **78**. The jacks **34** and **35** are brought closer together and appear as shown in Figure 9, at which position the tip **79** of the forward portion **80** of the jack **35** opens and maintains open the latch **74**.

As the carriage proceeds downward (as viewed in Figure 7), the butts **37** and **38** are disposed between the cams **77** and **81**. In the case of the rear jack **35**, the butt **40** engages the straight portion **82** of the cam **78**. The opening of the latch **74** makes way for the laying in of the yarn.

Further movement in the same direction of the carriage brings the parts to the position shown in Figure 10 in which the butts **37** and **38** are engaged between the cams **77** and **81** at the portions **82** and **83**, said butts having been retracted (in this case, moved to the left) by the cam portions **84** and **85**. At the same time, the portion **86** of the cam **87** has retracted from the knitting area the rear jack **35** so that the butt **39** now engages the cam portion **87**. In this position of the needle and the jacks, the yarn is laid in and the brushes **88** and **89** facilitate this operation.

Continued movement of the carriage in the same direction brings the butt **38** into contact with the portion **90** of the stitch size cam **91**, which is shiftable forwardly or rearwardly as further appears herein. The farther forward (or to the left as viewed in Figure 7) the stitch cam **91** is moved, the longer will be the stitch in the finished material. At this time, the rear jack **35** is further retracted by the rear stitch size cam **92**. The completion of the stitch occurs in

the position indicated by Figure 11 and the butt **37** is engaged by the cam portion **182** and then moved toward the knitting area between the front and rear needle beds **29** and **19**, respectively, by the cam portion **184** of the cam **177**. This brings the front jack **34** to the normal position (corresponding to Figure 9). The butts **39** and **40** on the rear jack **35** straddle the cam **178**, the gate cam **171** being in its elevated or open position. The cams **81** and **87** and **181** and **187** are provided passages **94, 95, 96** and **97** which permit the needles **33** to be shifted from the front to the rear needle bed plates **29** and **19**, respectively, or vice versa, for changing the character of the stitch. The shifting of the needles from one needle bed plate to another for this purpose is well known in the art and is controlled by the auxiliary jacks **36**. The jacks **36**, when in their normal or inactive position, are disposed in the rear-most portions of the grooves therefor in the rear needle beds **19**, the butt **41** being passed by the rear portions **101** and **102** of the needle transfer cams **103** and **104**.

The auxiliary jacks **36** are shifted to the active position thereof by the contact of the rear tip **105** with a clip **106** (see Figure 4) secured to th hexagonal jacquard drum **107**. The jacquard drum **107** is of a well-known type having orifices, into which the tips **105** may pass, and when it is desired to advance an auxiliary jack to an active position thereof, the particular orifice is blocked by a clip **106**. Where it is desired to expand the range of jacquard design cntrol, a relatively long annular chain, having a corresponding function (aligned orifices and clips) may be driven by a suitable polygonal drum. When the jacquard drum **107** advances the auxiliary jack, a relatively slight amount, the butt **41** thereon becomes engaged by the portion **108** of the cam **103**. This butt **41** then has the effect of displacing the butt **40** (see the dot-dash lines in Figure 8) and the forward edge **109** contacts the rear edge **110** of the rear jack **35** so as to advance said jack from its normal course of travel, a distance equal to the distance between the rear edges of the butts **40** and **41**. When the rear jack **35** is thus advanced, the downward projection **111** rides up over and is engaged by the rear hook **72** of the needle **33** and when in passing between the stitch cams the rear jack **35** is moved rearwardly, it pulls the needle **33** from the front needle bed **29** into the rear needle bed **19**.

The jacks are frictionally retained within the grooves of the beds by laterally extending springs at the sides thereof (not shown) as is well known in the art to which the present invention relates. The jacks rest in these grooves under gravity. When the jacks are shifted longitudinally of themselves, any tendency thereof to rise except when they are going through the slots **94, 95, 96,** and **97** is prevented by the shoulders **310, 311, 312, 313**, and **314, 315** and **316** which engage the under surfaces of the various cams which act upon the butts as followers. By this construction, independent needle latch openers and so-called wengels which overlie the forward portions **80** of the jacks **36** or the corresponding inner ends of the jacks **34** are eliminated. Since the jacks are thus supported against vertical movement in the area of the butts, the portions of the jacks which engage the needles may flex slightly upwardly, with a substantial reduction in damage of needles caused by jacks striking the needles, in such manner that jamming or damage to the needle or jack is materially reduced.

The jacquard drum 107 may be mounted upon a shaft 111 (Figure 6) which is engaged in the slotted upper ends of a plurality of radial arms 112 which are fixed to the longitudinal shaft 113. The shaft 111 slidably rests upon the supports 99 (Figure 1–*a*).

The gate cams 70 and 170 (Figure 7), as a co-acting pair, are so arranged that when one of them is down or in the closed or active position thereof, the other one is in the open, upper or inactive position. The gate cams 71 and 171 are substantially identical in structure and mode of operation with the cams 70 and 170. As seen in the lower portion of Figure 3, the cam 70 is secured to the lower end of a vertical pin 114, having a rearwardly projecting follower 115. Similarly, the cam 170 has a vertical pin 116 and a follower 117. The gate cams seek the lower or active position thereof under the action of gravity, aided by expansive coil springs. The spring 118 is seen in Figure 4. Slidably disposed upon the upper surface of plate 57 is a member 119, provided with a left cam surface 120 and a right cam surface 121. When the follower 117 or 115 is resting upon the upper surface of the member 119, the respective gate cam is elevated to its inactive position. The cam surfaces 120 and 121 are so arranged that the elevated portion of either one of the cams is mutually exclusive with regard to the other. The member 119 is maintained in an operative position by the guides 122 and 123. The member 119 is shifted in position by the ends thereof 124′ and 125′ (Figure 1–*a*), striking suitable relatively stationary projections arranged in their path of travel.

The stitch size cams 91 and 92 are substantially identical in construction and operation and are shifted in position by adjustable fingers such as the fingers 124, 125 and 126, which engage the follower 127, projecting upwardly from the cam 91, for example. The follower 127 may have associated therewith, suitable indicating means 128 to show the relative position of the cam 91 in its retracted positions. The fingers 124—126 are adjustably secured to a bar 129 by means of the screws, which penetrate slots in said fingers and threadedly engage said bar. The righthand end of the bar 129 is provided with stepped faces 130 and 131 and lying directly below the bar 129 is another bar 132, having the stepped faces 133 and 134. The bars 132 and 129 are interconnected by a well known rack and pinion device 135, so that any one of the three fingers, 124, 125 or 126 may be selectively engaged with the follower 127 by means of the dog 136 (Figure 2–*b*) which is movably mounted with respect to the frame 20 for movement forwardly or rearwardly of the machine, but is fixed longitudinally. The dog 136 is seen at the right end of Figure 1–*a*. The bars 132 and 129 are slidably mounted in the guides 137 and 138 which are secured to the top surface of the plate 57. A similar structure is utilized to shift the stitch cam 92 and includes the bars 229 and 232 in the guides 237 and 238, and fingers (only one 224 of which is seen). The stepped faces 230, 231, 233 and 234 co-act with the dog 236, while the bars 229 and 232 are oppositely moved by the rack and pinion device 235.

As best seen in the right end of Figure 1–*a* and in Figure 6, the dogs 136 and 236 are pivotally mounted on the frame at 139 and 140 and are adapted to be partially rotated in a stepped manner by the link 141 which interconnects the dogs 136 and 236. The link 141 is pivotally connected to the upper arm 142 of a bell crank action. The

lower arm 143 is connected at its outer end to the link 144, the lower end of which is connected to the lever 145. The inner end of the lever 145 is interengaged with the adjacent end of an arm 146, the other end of which terminates and is pivotally mounted at 147 to the frame. Two sprocket shafts 148 and 149 of well known construction are utilized to control the sizes of the stitches of the knitted material by varying the position of the stitch size cams 91 and 92 by being stepped around to rotate a number of chains, such as the chains 150 and 151. Each of these chains carries the necessary number of lugs 152 and 153 arranged at intervals about the chain and brought into contact with the lever 145 or the arm 146 at the proper time and duration to accomplish the desired shift of the dogs 136 and 236. As shown in Figure 6, the link 141, and hence the dogs 136 and 236, may be shifted by a lug on either of the chains 150, 151, depending upon the positions of the lugs 152 and 153 thereon. If a lug on the chain 150 is engaged with the lever 145, the latter is rocked about its pivot 154 independently of the arm 146. On the other hand, if a lug on the chain 151 engages the arm 146, this raises the lever 145 to have a corresponding effect.

Each of the carriages 51 and 52, see Figure 1, is provided with stitch size cams corresponding to those on the master carriage 50 as described above and the bars 129–*a*, 229–*a*, 129–*b* and 229–*b* are interconnected by the stitch size cam links 155, 156, 157 and 158.

The yarn carrier changing structure, indicated generally by reference character 56, is best seen in Figures 1–*a*, 3 and 4. The structure 56 is mounted upon the carriage 50 and transmits through the elongated yarn carrier bars 161, 162, 163 and 164 its yarn shifting effect. The carrier bars are slidably mounted for reciprocation, longitudinally of the machine in the yarn bar supports 166, 167, 168 and 169. The bar supports 166—169 are substantially identical and extend upwardly from bridges 172, 173, 174 and a fourth one (not shown) below the carriage 52 in Figure 1, which are disposed at the level of the stationary frame beds 27 and 28. Each of the said yarn bar supports includes a base 176, a relatively narrow upright 177 and a slotted head with a retainer plate secured to the head to hold the bars in place.

Each of the bars 161—164 has three yarn guides secured thereto, one for each of the knitting units 22, 23 and 24 referred to hereinabove, so that in Figure 3 there are shown the guides 188, 189, 190 and 191 for the knitting unit 22; in Figure 1 there are shown the guides 192, 193, 194 and 195 for unit 23 and the guides 196, 197, 198 and 199 for unit 24. A detailed view of the guide 190 is seen in Figures 4 and 2–*a* and it comprises an offset bracket 200 carrying a yarn eye 201, a connector 202, and a yarn tube 203. The particular yarn 204 may be supplied from any well known yarn rack (not shown). Each of the other yarn guides is of substantially the same construction as the guide 190 the brackets varying in size and angularity to place the yarn over the open needle hooks during the knitting process.

Thus each knitting unit 22, 23 and 24 may be served with four different threads or yarns which may vary in character as desired. The yarn selected by the control is laid into the open needle hooks of the needles 33 by the yarn tube, such as the tube 203 being moved along the knitting area between the front and rear needle beds. The

brushes 88 and 89 keep the latches open and prevent the yarn from coming out of the hooks. The particular yarn carrier bar being activated is moved along by reason of its engagement with the master carriage 50. This is accomplished by a series of four pins 206, 207, 208 and 209. The pins are vertically reciprocatable and have inactive upper positions and active lower positions. Each of the said pins 206—209 has a slidably and resiliently mounted lower terminal. See Figure 4 in which the terminal 211 in the form of a sleeve as slidably mounted on the lower end of the pin 208 is seen. A spring 213 urges the terminal 211 to its lowermost position. The terminal 211 is provided with a slot 215 in which the projection 216–*a* from the pin 208 rides. This slot and projection limits the upper and lower travel of the terminal 211 with respect to the pin 208. The terminals of the pins 206—209 coact with upward projections 210, 212, 214 and 216 on the bars 161—164, respectively. For example, with the pin 208 lowered to its active position and the carriage 50 about to travel to the right as viewed in Figures 1–*a* and 3, the pin will engage the left end 218 of the projection 214. The carriage then travels to the right and the bar 163 goes along with it.

There are eight sets of cams, 219, 220, 221, 222, 223, 225, 226 and 227, which are adapted to stop the movement of the bars 161—164. These cams are pivotally mounted on extensions from the yarn bar supports. Thus, the cams 223 and 226 are mounted upon the extension 239. The extensions 228 and 239 are longitudinally adjustable in position with respect to the yarn bar support 167. The cams 220 and 222 are mounted upon the extension 240, and the cams 225 and 227 are mounted upon the extension 241. The extensions 240 and 241 are longitudinally adjustable in position with relation to the yarn bar support 166. While the carriages therefore make complete traverses of the entire needle bed lengths, the fabric need not be as wide as the needle bed is long but need be only as wide as the relative movement of a particular yarn guide. By the adjustment of the positions of the cams 219—223 and 225—227, the width of the finished material 100 can be determined. The cams last mentioned are urged in the directions of the yarn bars to which they relate by springs such as the spring 242 and preferably suitable stops are provided, such as the stop 243 to prevent contact of the cams against the sides of the yarn bars. It is desirable that the cams be in close proximity to the yarn bars but not that they rub.

Returning to the engagement of the terminal of the pin 208 with the end 218 of the projection 214, as described above, as the pin is carried to the right (see Figure 3) the long arm of the lever type cam 223 is deflected, against the tension of the spring 244, so as to allow the said pin to pass. When the carriage 50 reaches the right hand end of its travel (see Figure 1–*a*) said pin 208 will be elevated by the cam 225 to its inactive or upper position. Action of the yarn selector control 36 may reactivate the pin 208, or one of the other pins as will appear hereinbelow. On the return trip when the carriage 50 moves to the left, assuming that the pin 208 has again been selected, it engages the right end 245 of the projection 214, the cam 225 will deflect to allow said pin to pass and at the end of the return trip the cam 223 will elevate the pin 208 to its inactive position. The other pins 206, 207, and 209 have

a similar mode of operation with the cams and projections which they engage.

The selector 56 acts to lower the desired pin of the pins 206, 207, 208 and 209 to the active or yarn feeding position thereof. Each of these pins has (in addition to the movable terminals, corresponding to the terminal 211) a head 246, 247, 248 or 249, an expansive coil spring 250, 251, 242, and 253, and a laterally extending pintle 254, 255, 256 and 257, respectively. The shanks of the pins 206—209 are vertically reciprocable in cylindrical bores in the block 258 (see Figure 5) and there are slots laterally extending from said bores within which the pintles 254—257 may move. A reciprocable latch plate 259 is longitudinally slidable in the rabbet 260 in the surface 261 of the block 258. The block 258 is secured to the upper surface of the bridge 55. A guide 262 maintains the latch plate 259 in position. The latch plate 259 is urged forwardly by the coil spring 263, and has a plurality of cam surfaces 264 and notches 265. By virtue of the structure just described, the downward movement of any one of the pins 206—209 causes its respective pintle 254—257 to engage one of the cam surfaces 264 in turn shifting the latch plate 259 rearwardly. This releases any previously engaged pintle from a notch 265. As the pintle being lowered travels farther downwardly, it in turn becomes engaged by a notch 265, as the latch plate 259 is urged forward with a snap action.

The pins 206—209 are pressed to the lower or active position thereof by the long levers 266—269, inclusive, respectively, which engage the pintles on said pins.

All of the levers 266—269 are pivotally mounted on the axle 270. The outer or rear ends of the levers 266—269 are adapted to be selectively elevated by a plurality of vertically reciprocable rods 271–274, inclusive, said rods being mounted within pairs of aligned orifices in the U-shaped support 275. Suitable projections in the upper portions of the rods prevent them from dropping down excessively when they are not engaged by the cam 276. The U-shaped support 275 is secured to the rear vertical surface of the bridge 55. The cam 277 is similar to the cam 276 just noted, cam 277 being seen in Figure 1–*a*. Cams 276 and 277 have rearwardly directed racks 278 and 279, respectively, which engage a pair of gear trains, only one of which, the train 280 is seen, in Figure 4, and these gear trains are actuated by the shaft 281. The right end 282 (see Figure 6) of the shaft 281 has a crank 283 which is pivotally connected by the link 284 to the crank 285, which is fixed upon countershaft 286. Another crank 287 is connected through a link 288 to a lever 289 which is similar to the lever 145. The lever 145 is actuated by a chain control (not shown) similar to the chain 150. Thus, actuation of the lever 289 results in the simultaneous shifting in position of the cams 276 and 277, so that they engage the desired rods 271—274. These in turn shift the levers 266—269 to lower the desired pins 206—209, thereby moving the desired yarn carrier bars 161—164.

The main carriage 50 has pivotally connected thereto, at the rear of said carriage, a yoke 291 which is detachably engageable with the slider 292. This connection, which is provided with a ball handle 302 may be such that upon overload the same will automatically disengage and preferably simultaneously break the circuit to the source of power for the machine. The slider 292 is slidably engaged upon the track 293 which is

fixed to the frame of the machine and may be maintained in position by the supports 99. A bracket 294 may be supported by the track 293 and the supports 99 and upon the bracket are journalled a pair of sprockets 295 and 296. An annular sprocket chain 297 is carried by the sprockets 295 and 296, and said chain has a forwardly extending pin 298 which is vertically reciprocable within a vertically arranged slot 299 in the block 300, the latter being fixed to the slider 292. The sprocket 296 is fixed to a shaft (not shown) which carries the gear 301, and this gear may be driven by any suitable source of power, in timed correlation to the yarn selecting, jacquard needle shifting, and bed shifting mechanisms in a well known manner.

It may thus be seen that we have provided a novel and highly useful knitting machine and method of knitting. With a master unit, a plurality of controlled units duplicate the product of the master unit. By virtue of our means for controlling the shifting in position of the needles from the front to the rear needle beds or vice versa, the third, jacquard or rearmost jacks are guided in substantially the same groove or raceway by which the rear jacks are shifted. This reduces the number of cams and locks required and hence the size and weight of the carriage, making a more compact machine which, because of less friction, may be run at higher speed. By our novel double butt jacks, wear on the parts is materially reduced, with a consequent reduction in servicing and replacement and unproductive machine time. Only one yarn selector mechanism is required to control all of the knitting units. In accordance with our invention, a single stitch cam element is used for knitting in both directions of movement of a carriage, the cam element having two cam surfaces. This permits a smaller lighter carriage to be used. Undesirable pressure and wear on the needles is reduced owning to the positioning and support of the jacks obtained by the coaction of the shoulders beneath the butts on the jacks with the undersurfaces of the cams on the carriages.

We claim:

1. In a links and links knitting machine: a needle bed; a needle movably disposed on said bed; a jack having a pair of spaced butts projecting therefrom, said jack being movably supported by the bed and adapted to shift said needle; a carriage movable along said bed, said carriage having cam surfaces and an independently movable gate cam, adapted in an active position thereof to engage one of said butts and in an inactive position thereof to clear said butt; said gate cam being positioned in the line of motion of said cam surfaces; whereby when the gate cam is in the inactive position thereof said cam surfaces may pass between said butts, the jack remaining stationary.

2. In a links and links knitting machine: a needle bed; a needle movably disposed on said bed; a jack having a pair of spaced butts projecting therefrom, said jack being slidably supported by the bed and adapted to shift said needle in position; a carriage movable along said bed, said carriage having first and second groups of cam surfaces adapted to cause the needle to move in a direction toward making a stitch when the carriage is going in first and second directions, respectively; first and second gate cams on said carriage adapted in their active positions to guide the jack into knitting positions and in their inactive positions to clear the jack, said gate cams being mutually exclusive in the active positions thereof; said gate cams being positioned in the line of motion of said groups of cam surfaces; whereby when the first gate cam is active and the carriage is moving in a first direction it guides the jack to engage the outer edges of the pair of butts with the first group of cam surfaces and the inner edges of the butts to engage the second group of cam surfaces, and when the second gate cam is active and the carriage is moving in a second opposite direction it guides the jack to engage the outer edges of the pair of butts with the second group of cam surfaces and the inner edges of the butts to engage the first group of cam surfaces.

3. In a links and links knitting machine: a needle bed; a needle movably disposed on said bed; a jack having a pair of spaced butts projecting therefrom, said jack being slidably supported by the bed and adapted to shift said needle in position; a carriage movable along said bed, said carriage having a stitch size cam and first and second groups of cam surfaces disposed on opposite sides of said stitch cam and adapted to cause the needle to move in a direction toward making a stitch when the carriage is going in first and second directions, respectively; first and second gate cams on said carriage located outwardly of the said groups of cam surfaces and adapted in their active positions to guide the jack into knitting positions and in the inactive positions to clear the jack, said gate cams being mutually exclusive in the active positions thereof; said gate cams being positioned in the line of motion of said groups of cam surfaces; whereby when the first gate cam is active and the carriage is moving in a first direction it guides the jack to engage the outer edges of the pair of butts with the first group of cam surfaces and the inner edges of the butts to engage the second group of cam surfaces, and when the second gate cam is active and the carriage is moving in a second opposite direction it guides the jack to engage the outer edges of the pair of butts with the second group of cam surfaces and the inner edges of the butts to engage the first group of cam surfaces; said stitch cam having first and second oppositely disposed stitch size cam surfaces, the last mentioned first surface being engageable with the outer edge of one of said butts when the carriage is moving in a first direction and the last mentioned second surface being engageable with the last mentioned outer edge of the butt when the carriage is moving in a second direction.

4. In a links and links knitting machine: a needle bed; a needle movably disposed on said bed; a jack having a butt projecting therefrom, said jack being movably supported by the bed and adapted to shift said needle; and means in the form of a carriage movable along said bed and adapted to shift said jack in position, said carriage having a pair of cam surfaces spaced longitudinally of the bed and a stitch size cam disposed therebetween; said stitch size cam being movable and having two oppositely disposed size cam surfaces, one engageable with said butt when the carriage is moving in one direction and the other engageable with said butt when the carriage is moving in the opposite direction; and means to move said size cam so as to equally affect the size of the stitch produced by the needle irrespective of the direction of motion of the carriage.

5. In a links and links knitting machine, a

needle bed with a jack and needle groove; a needle; a jack in said groove and adapted for detachable engagement with said needle, said jack having a raised shoulder and a butt projecting from said shoulder; a carriage movable over said bed and having cams with edge cam surfaces and bottom relatively planar surfaces; said edge cam surfaces, as said carriage is moved, engaging the vertical edges of said butts to shift them along; and said relatively planar surfaces of the cams engaging the upper surfaces of the shoulder to maintain said jack in said groove.

MICHAEL ZIMIC.
ANTON MISKOVSKY.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,940,520	Zimic	Dec. 19, 1933
2,165,424	Eichner	July 11, 1939
2,316,822	Thurston	Apr. 20, 1943
2,362,041	Wildt	Nov. 7, 1944
2,395,814	Hayhurst	Mar. 5, 1946
2,464,126	Fregeolle	Mar. 8, 1949

FOREIGN PATENTS

Number	Country	Date
753,690	France	Oct. 21, 1933