July 16, 1963 A. M. BROWN 3,097,510

NEEDLE SELECTING MECHANISMS IN KNITTING MACHINES

Filed Dec. 8, 1960 7 Sheets-Sheet 1

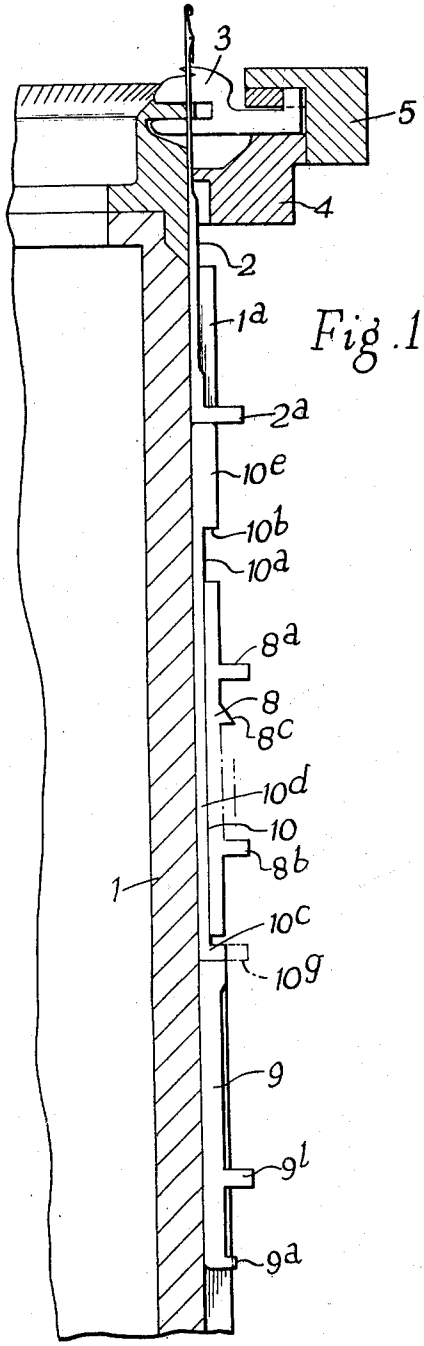


Fig. 1.

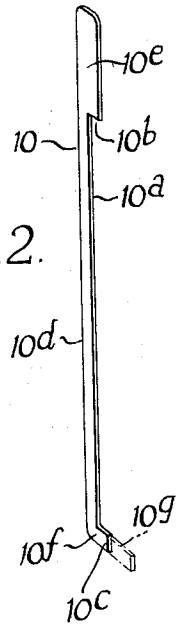


Fig. 2.

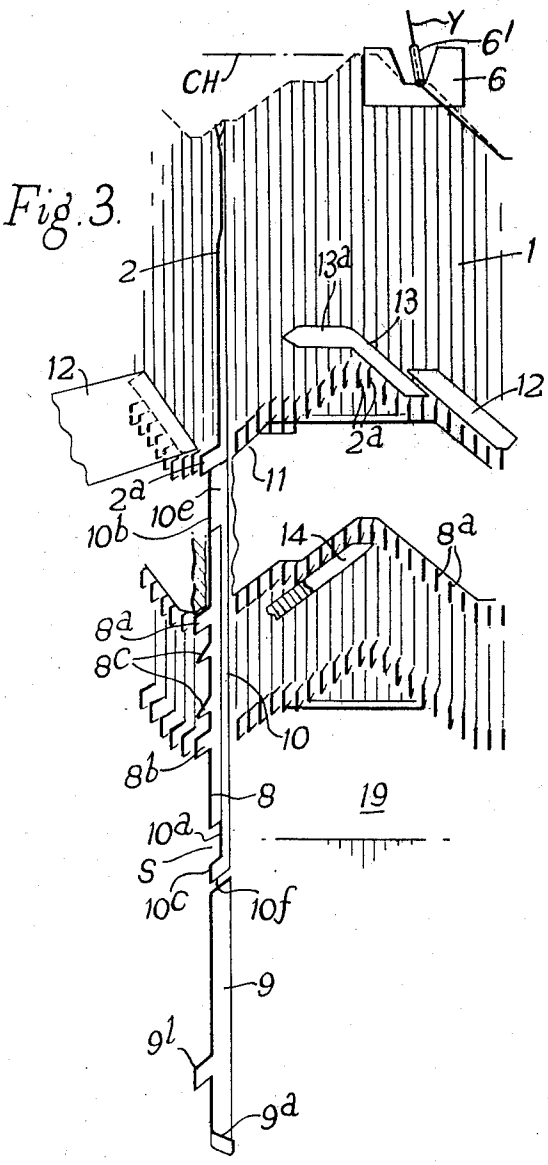
INVENTOR
Albert Matthews Brown
BY
Lawson and Taylor
ATTORNEY

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NEEDLE SELECTING MECHANISMS IN KNITTING MACHINES

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Fig. 3.



INVENTOR
Albert Matthews Brown
BY
Larson and Taylor
ATTORNEY

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Fig. 4.

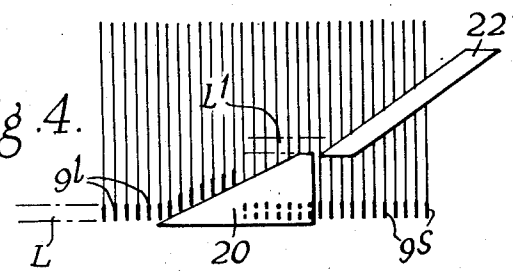
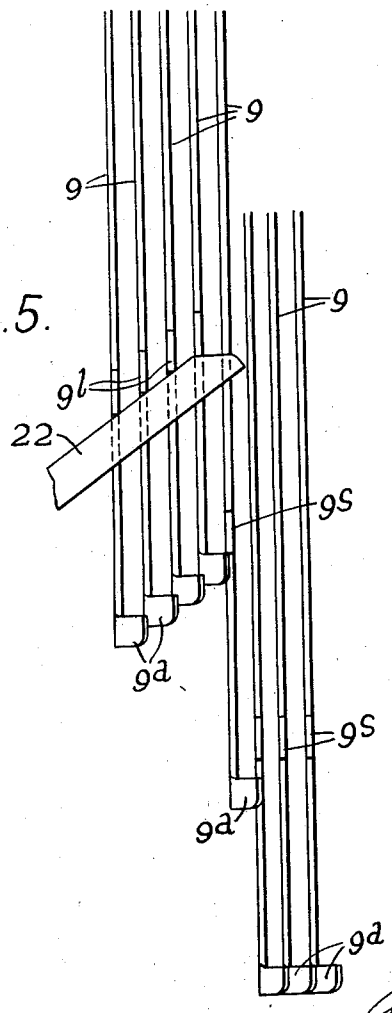


Fig. 5.



INVENTOR
Albert Matthews Brown
BY
Larson and Taylor
ATTORNEY

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NEEDLE SELECTING MECHANISMS IN KNITTING MACHINES

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Fig. 10.

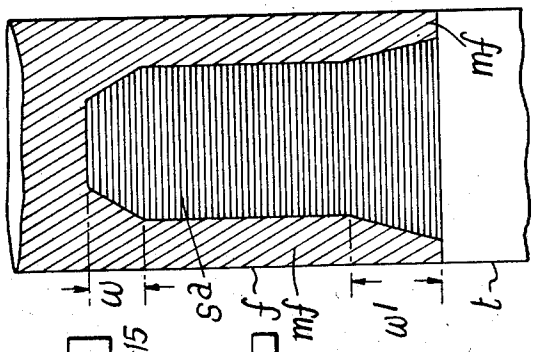
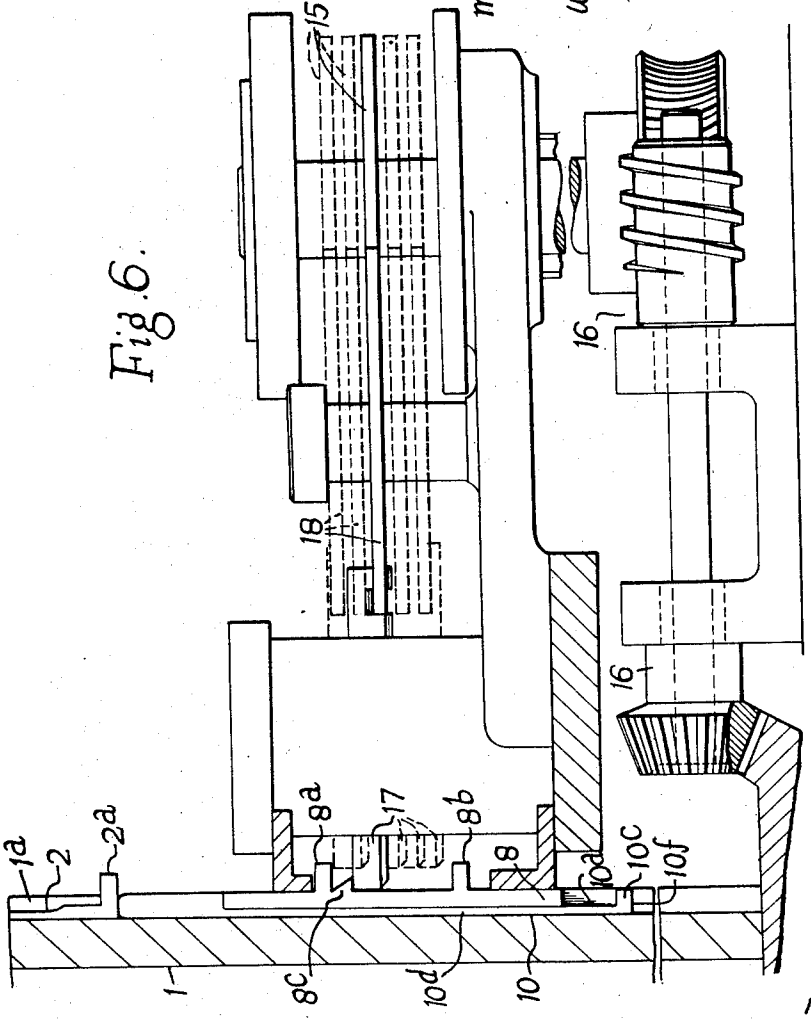


Fig. 6.



INVENTOR
Albert Matthews Brown
BY
Lawson and Taylor
ATTORNEY

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NEEDLE SELECTING MECHANISMS IN KNITTING MACHINES

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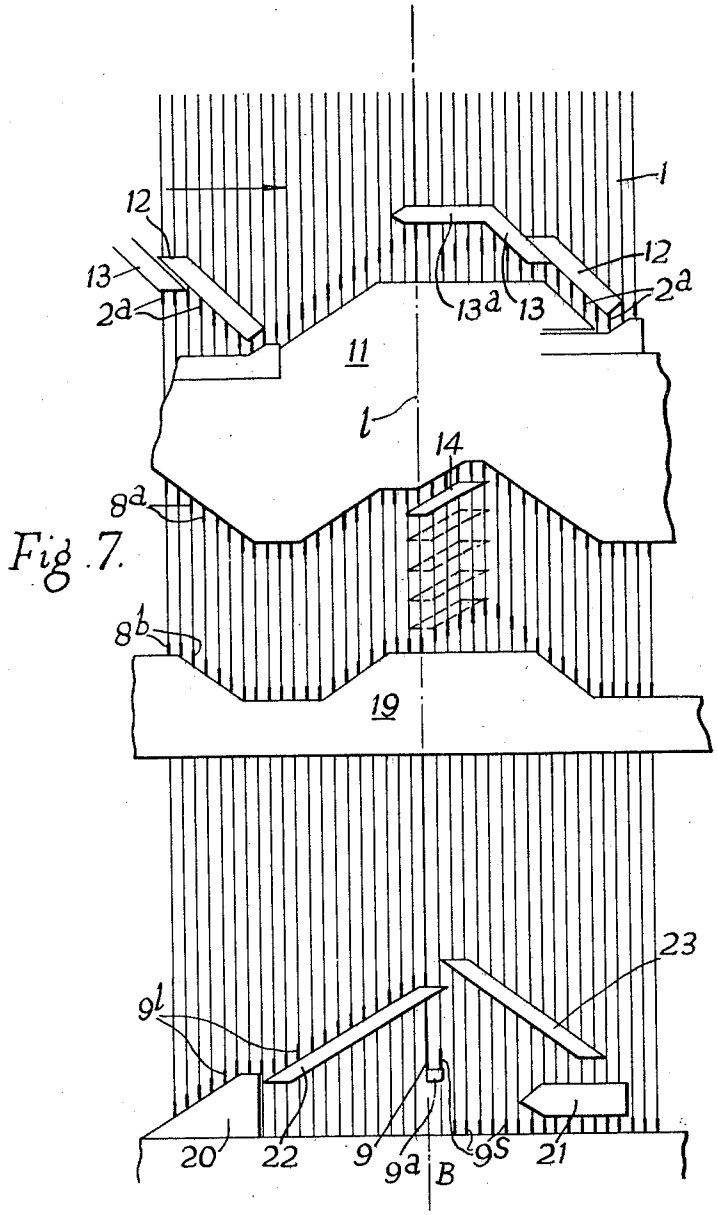


Fig. 7.

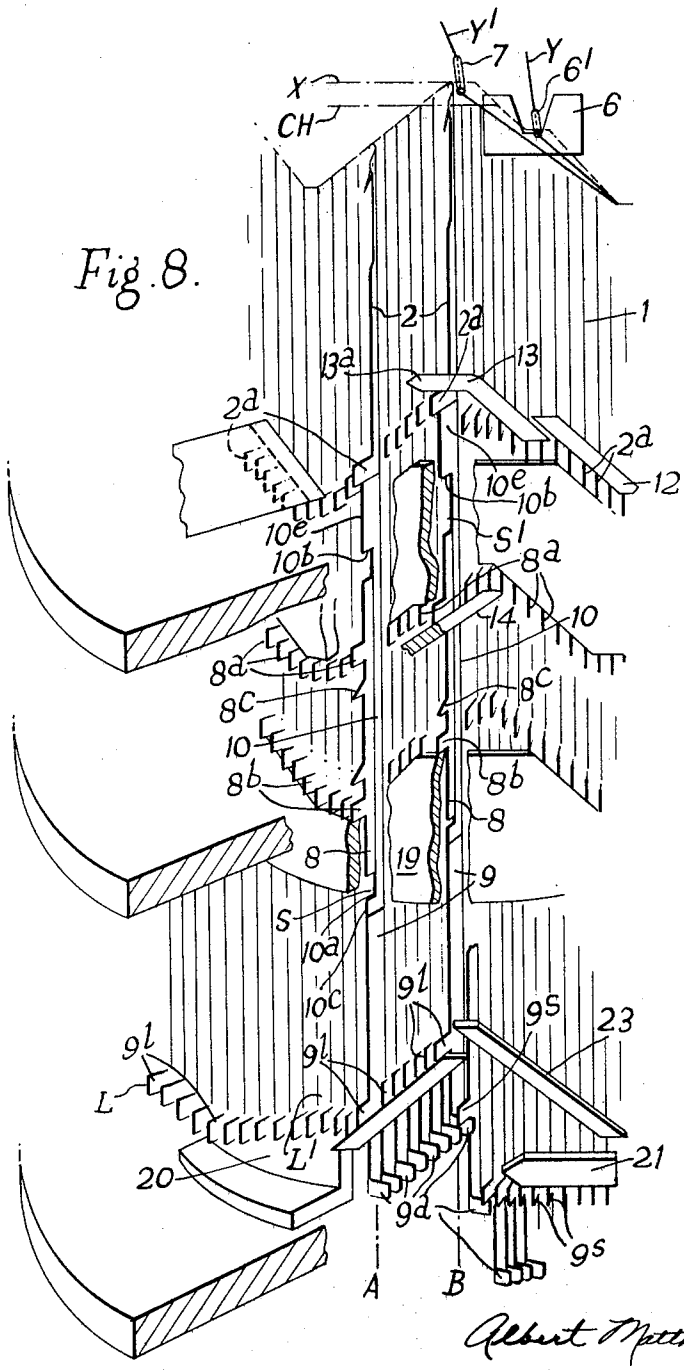
INVENTOR
Albert Matthews Brown
BY
Lawson and Taylor
ATTORNEY

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NEEDLE SELECTING MECHANISMS IN KNITTING MACHINES

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Fig. 8.



INVENTOR
Albert Matthews Brown
BY
Lawson and Taylor
ATTORNEY

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NEEDLE SELECTING MECHANISMS IN KNITTING MACHINES

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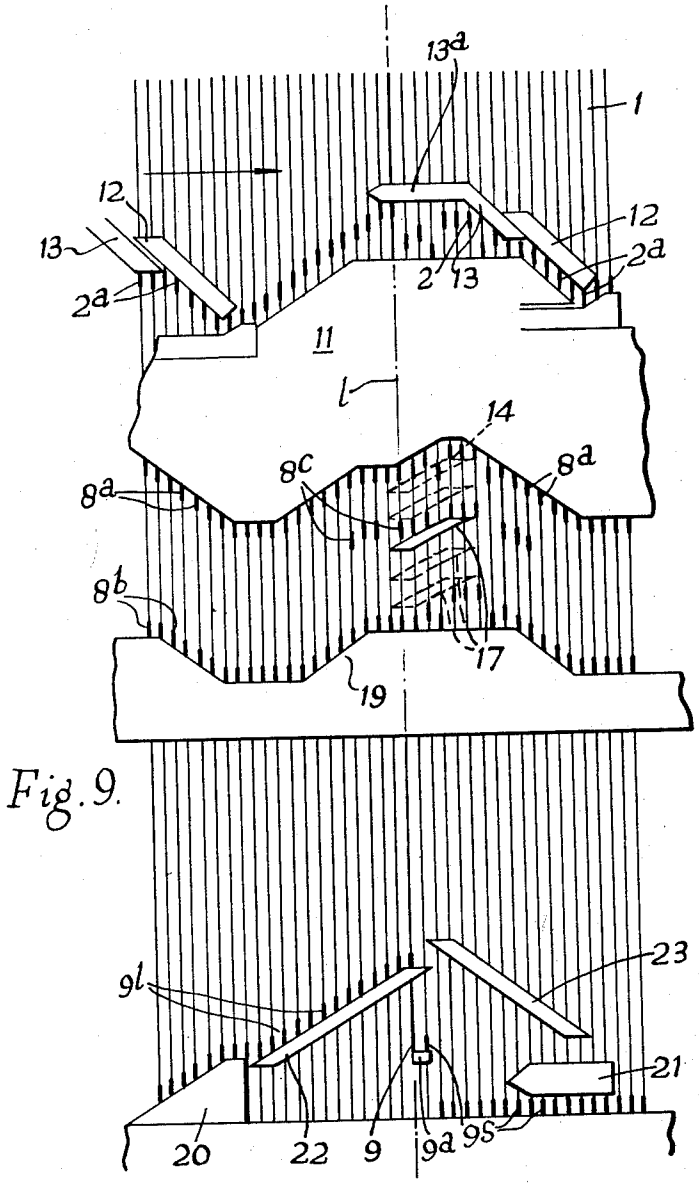


Fig. 9.

INVENTOR
Albert Matthews Brown
BY
Larson and Taylor
ATTORNEY

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NEEDLE SELECTING MECHANISMS IN KNITTING MACHINES

Albert M. Brown, Leicester, England, assignor to G. Stibbe & Co. Limited, Leicester, England, a British company

Filed Dec. 8, 1960, Ser. No. 74,538
Claims priority, application Great Britain Dec. 14, 1959
12 Claims. (Cl. 66—50)

This invention relates to needle selecting mechanism provided in knitting machines equipped with independent needles.

Although the invention is primarily applicable to circular knitting machines of the independent latch needle type such, for example, as multi-feed hose machines adapted to produce stockings either in the initial form of wholly circularly knitted blanks or with heels and toes formed by reciprocatory knitting, there is no limitation in this respect since, broadly, the invention may also be applied to, say, flat and straight-bar machines.

Now in certain knitting machines, especially multi-feed hose machines which have needle cylinders of small diameter, problems arise as a consequence of the small amount of space around the cylinders, and in cases where such machines are required to execute complicated patterning operations involving the employment of needle selecting mechanisms of different kinds, the restrictions in the space available for the accommodation of such mechanisms are particularly severe.

Accordingly, the object of the present invention is to provide, in a knitting machine equipped with independent needles, an improved arrangement of needle selecting mechanisms designed to assist in the solution of problems arising from the aforementioned space restrictions.

According to this invention there are provided at least two separate and distinct independently operable needle selecting mechanisms which are disposed at different heights and wherein there are, in association with each of the needles requiring to be influenced at predetermined times by the said two independently operable needle selecting mechanisms, two separate and independent needle-actuating jacks both arranged in the same needle trick or groove as, and in alignment with, the needle, and interposed between these two jacks, a spacer element which is also accommodated in the same trick or groove and aligned with the needle but is so formed as to enable it to be acted upon and moved longitudinally, to transmit a corresponding movement to the needle, by either of the two independent selectively actuated jacks without disturbing the other, whereby the aforesaid two independently operable needle selecting mechanisms are adapted to effect selections of needles for respectively different purposes and either of two such mechanisms can be operated without interfering with the other.

The spacer elements provided between the two sets of jacks are accordingly in the nature of longitudinally slidable movement transmitters.

The primary purpose of providing the spacer elements is to effect economy in space and to enable the said two separate and independently operable needle selecting mechanisms to be provided, if necessary, at one and the same needle selecting location and thereby to be disposed in alignment along a line perpendicular to the needle circle or the needle line, as the case may be.

In the preferred construction, each of the spacer elements is recessed at the front not only to receive one (for convenience hereinafter referred to as the "first") of the two associated needle-actuating jacks but also to provide (*a*) a shoulder against which the leading end of the said first jack can act, and (*b*) at appropriate times a free

space between the opposite end of the first jack and a tail portion of the spacer element against which portion the "second" of the two associated needle-actuating jacks can act.

In order that the invention may be more clearly understood and readily carried into practical effect, a specific constructional arrangement of two separate and independently operable needle-selecting mechanisms provided at a feed of a circular multi-feed hose knitting machine for the purposes of producing micro-mesh fabric and selective needle splicing respectively will now be described with reference to the accompanying drawings, wherein,

FIGURE 1 is a vertical sectional view through a portion of the knitting head of such a machine, showing the needle, the two independent needle-actuating jacks and the interposed spacer element in a single trick or groove in the needle cylinder,

FIGURE 2 is a perspective view of one of the spacer elements per se,

FIGURE 3 is a fragmentary perspective view, as seen from the outside of the machine, depicting a few of the knitting cams at two adjacent feeds of the machine, and showing the manner in which the first (upper) needle-actuating jacks are acted upon for the purpose of raising all needles to clearing height in the production of plain fabric,

FIGURE 4 is a detail view of cams included in the nib jack splicing system provided at each of desired feeds of the machine,

FIGURE 5 illustrates a few of the second or nib jacks included in the machine, and shows these in relation to the nib jack raising cam,

FIGURE 6 is a fragmentary vertical sectional view showing the micro-mesh needle selecting mechanism employed at each appropriate feed of the machine,

FIGURE 7 illustrates, in diagrammatic fashion, the layout of the butts and of the knitting cams at a feed when a nib jack splicing selecting of the needles is to be superimposed on normal clearing of the latter,

FIGURE 8 is a perspective view somewhat similar to FIGURE 3 depicting, in a more developed form, the manner in which the jacks, the spacer elements and the needles function whenever a nib jack splicing selection of such needles is superimposed on normal clearing of the latter,

FIGURE 9 is a view somewhat similar to FIGURE 7 showing how a splicing selection of the needles can also be superimposed on a further selection of the needles to produce micro-mesh fabric, and

FIGURE 10 is a diagram illustrating a plain spliced area within micro-mesh fabric in the foot of a stocking—this being one example of work which can be produced on the machine shown in the previous figures.

Like parts are designated by similar reference characters throughout the drawings.

Referring to FIGURE 1, it will be seen that the circular seamless hose machine to which the needle selecting arrangement now to be described is applied includes a needle cylinder 1 which has formed therein axially extending tricks or grooves 1*a* in the upper end of each of which is accommodated an independent latch needle 2. There is thus a circular set of needles each of which is furnished with an operating butt 2*a*. Co-operating with the said needles is a circular set of sinkers, such as that indicated at 3, these sinkers being mounted in an annular bed 4 and controlled by cams fitted to a sinker cam cap 5. The machine may be equipped with a conventional welting mechanism (not shown) comprising a dial mounted above the needle cylinder 1 and a circular set of welt instruments (transfer points) accommodated in this dial.

The machine has a plurality of feeds at each of which is provided a mouthpiece **6** (FIGURES 3 and 8) through which a main yarn Y from a yarn feeder **6'** is fed in at such a location as to enable it to be taken by needles **1** raised to clearing height CH at that feed. At each feed, or at each of desired feeds, moreover, there is also provided, a little above the mouthpiece **6**, a splicing feeder **7** for feeding in a splicing yarn Y' at the height indicated at X in FIGURE 8 to enable said yarn to be taken by needles raised to this height by a nib jack system at that feed.

In accordance with the present invention there is provided, in association with each of the needles **2** in the machine, a first needle-actuating jack **8** arranged below and in the same trick or groove **1***a* as the relevant needle. These first jacks **8** are primarily adapted to be selectively operated by a micro-mesh needle selecting mechanism provided at each feed, or at each of desired feeds, as the case may be. The jacks **8**, however, may also be used for actuating the needles selectively in the production of, say, a 1 x 1 welt. Associated with each of a group of the needles in the machine requiring to be influenced at predetermined times by a selective needle splicing mechanism at each feed, or at each of desired feeds as aforesaid, there is also a second needle-actuating jack **9** arranged below and in the same trick or groove **1***a* as the corresponding jack **8**. The two jacks **8** and **9** in each of the relevant tricks or grooves **1***a* are separate and independently operable. Interposed between, and arranged in alignment in the same trick or grooves as, these two jacks is a spacer element **10** which is so formed as to enable it to be acted upon and moved longitudinally, to transmit a similar movement to the corresponding needle **2**, by either of the two selectively actuated jacks without disturbing the other. For convenience the first jacks **8** will hereinafter be referred to as the "micro mesh selector jacks," albeit that they can be used for other purposes. Similarly, the second jacks **9** will hereinafter be referred to as "nib jacks."

As will be seen more clearly in FIGURES 1 and 6, each of the micro mesh jacks **8** is furnished near its upper end with a top master butt **8***a*, a bottom butt **8***b* for use, inter alia, when producing a 1 x 1 welt and, at a predetermined position between these top and bottom butts, a triangular patterning butt **8***c* of "saw tooth" form. The micro mesh selector jacks are, in fact, differentiated from one another by virtue of the positions heightwise thereon of these patterning butts **8***c*. Each jack **8** may be formed, initially, with a full complement of frangible butts **8***c* all or most of which, i.e. with the exception of one or two, are broken off.

As to the nib jacks **9**, each of these is furnished, as shown more clearly in FIGURES 1, 3 and 8, with an operating butt **9***l* or **9***s* and, at its lower extremity, with a laterally directed projection or "nib" **9***a*. A central panel of the nib jacks, corresponding to the minimum width of a spliced area to be produced have long operating butts **9***l* whilst the remainder of the nib jacks flanking opposite sides of the said central panel have, in this particular example, short operating butts **9***s*. As will be appreciated by those well acquainted with the art concerned, however, a set of nib jacks having only long and short butts can only produce a spliced area which widens from a minimum width to a predetermined maximum width. If two or more increases in width are required, then the operating butts of the nib jacks must be divided up into three or more groups having butts of respectively different lengths. For example, for two increases in width there must be a central panel of long butt nib jacks flanked on each side by nib jacks having medium and short butts. For simplicity, however, a system having nib jacks with long and short butts only will be considered in the following description.

Referring to FIGURES 1 and 2, it will be seen that each of the spacer elements **10** has formed in its front or outer longitudinal margin a long recess **10***a* not only

to receive a micro mesh selector jack **8**, but also to provide a shoulder **10***b* against which the leading or upper end of the said micro mesh selector jack can act, and the possibility at appropriate times of a free space *s* between the lower end of the jack **8** and a tail portion **10***c* of the spacer element **10** against which tail portion the upper end of the corresponding nib jack **9** can act. Such a free space *s* is shown in FIGURE 3. Thus, as will be appreciated, the actual recessed portion **10***d* of each spacer element **10** is relatively thin to enable it to extend along the back edge of the corresponding jack **8** and to be accommodated in the same needle trick or groove **1***a* as the latter. The combined widths of the major or stem portion **10***d* of the spacer element **10** and of the associated micro mesh selector jack **8** are approximately equivalent to, or do not substantially exceed, the depth of the trick or groove **1***a*. The shouldered leading portion **10***e* and the tail portion **10***c* of each spacer element **10**, however, project forwardly from the major stem portion **10***d* thereof and present transverse shoulders **10***b* and **10***f* to be acted upon by the jacks **8** and **9** respectively. It is the possibility of the aforementioned free space *s* between the tail portion **10***c* of the spacer element **10** and the lower end of the corresponding micro mesh selector jack accommodated within the said element which enables either of the two jacks **8** and **9** to be selectively actuated to advance the corresponding needle **2** to the appropriate extent without disturbing the other jack. Consequently, the nib jack **9** when selectively actuated can advance the spacer element **10** and hence also the needle **2** to an extent equivalent to the length of the free space *s* (but no more) without moving the corresponding micro mesh selector jack **8**. In these circumstances, the nib jack **9** can be said to by-pass the micro-mesh selector jack **8**. When, on the other hand, the jack **8** is selectively actuated, it engages the shoulder **10***b* on the leading portion **10***e* of the spacer element **10** and can advance this element, and hence also the associated needle **2**, to any desired extent without affecting the jack **9**, this is because the spacer element **10** is separated from the jack **9**.

In accordance with an optional feature of the invention, each of the spacer elements **10** may, if desired, itself be furnished with a butt **10***g* (constituted by an outward extension of the tail portion **10***c*) to enable it to be selectively actuated independently of either the associated independent jack **8** or **9**. This feature accordingly enables the elements, in addition to being used simply as spacers and movement transmitters as hereinbefore described, also to be used on other occasions as intermediate needle-actuating jacks capable of being selectively actuated quite independently of the micro-mesh selector jacks and the nib jacks, thereby still further economising in space.

The arrangement of the two jacks **8** and **9** and an interposed spacer element **10**, all in alignment with a needle **2**, in each of the relevant cylinder tricks or grooves **1***a*, enables a micro mesh needle selecting mechanism and a quite separate and distinct independently operable selective needle splicing mechanism incorporating a nib jack system to be provided one above the other at the same feed of the machine. Thus, at each feed, or at each of a lesser number of pre-arranged feeds, two such independently operable needle selecting mechanisms are provided in the illustrated machine, these two mechanisms being disposed in alignment along a line *l* (FIGURES 7 and 9).

Before proceeding to briefly describe these needle selecting mechanisms, which are of conventional form, it should first be explained that there are provided, in the cam box at each feed, an upthrow cam **11** for action on the needle operating butts **2***a* to raise all of the needles to tucking height from a knocking-over position at the preceding feed, a stitch cam **12** and, immediately in advance of the latter, a guard cam **13**. There is also pro-

vided, below a horizontal portion 13*a* of this guard cam 13 at each feed, a jack raising cam 14 of the bolt type adapted, when moved into its operative position, to act on the top master butts 8*a* of all of the micro-mesh selector jacks 8, for the purpose of raising these jacks, and hence also elevating all of the needles 2 from the tucking height to the clearing height. As a consequence, these needles will have the old loops cleared from their latches, and will take into their hooks the main yarn Y fed in through the feeder 6' so that the needles will knit to produce plain fabric as they are retracted to knock-over by virtue of action of the relevant stitch cam 12 upon their operating butts 2*a*. All this is clearly shown in FIGURE 3 wherein the jack raising cam 14 is shown in action so that plain fabric will be produced at the illustrated feed. The needles 2 are, of course, raised to clearing height through the medium of the spacer elements 10, so that before this can happen, the micro-mesh selector jacks 8 have to be so moved relatively to the said elements that the upper ends of the jacks abut the shoulders 10*b* and free spaces *s* occur between the lower extremities of the said jacks and the tail portions 10*c* of the spacer elements.

Now micro mesh fabric is produced, as is well known, by a systematic and regular selection of a set of needles— some to tuck and the remainder to clear, the set out of the clearing and tucking needles being, for example 3 x 1 or some similar combination. In the specific example illustrated, the micro mesh needle selecting mechanism provided at the vertical line *l* at each feed, or at each appropriate feed, as the case may be, conveniently includes, in addition to the complete circular set of micro-mesh selector jacks 8 furnished with the patterning butts 8*c* differentiated from one another by virtue of their positions heightwise on the jacks, a bank of superimposed revolvable pattern drum discs 15 corresponding in number with the number of such patterning butt positions, the said discs being appropriately contoured peripherally and adapted to be driven from the needle cylinder 1 through the medium of gearing designated generally by the numeral 16, a corresponding bank of inclined and selectively operable cam slides 17 arranged for action selectively upon the butts 8*c* and provided between the pattern drum discs 15 and the cam slides 17, a corresponding group of superimposed operating levers 18. These levers are selectively actuated by the discs 15 and in turn act selectively upon the cam slides 17. A micro-mesh selection is effected in the illustrated example by first raising all of the micro-mesh selector jacks 8 to a height corresponding with tucking height of the needles 2, by means of a fixed cam 19 provided at the feed for action on the bottom butts 8*b* on the said jacks, and then selectively further raising predetermined ones of these partially raised jacks from the said height to a height corresponding with clearing height of the needles, by the selective action of the slides 17 upon the patterning butts 8*c*. Dispositions of butts 2*a*, 8*a*, 8*b* and 8*c*, during selective actuation of the micro-mesh selector jacks 8 for the production of micro-mesh fabric, are depicted in the upper part of FIGURE 9, the set out being such that the clearing and tucking needles are in a 3 x 1 relation.

The "nib jack system" for producing selective needle splicing at each feed or each appropriate feed is of the known form comprising a group of the nib jacks 9 and a cam system distributed about the vertical line *l*, at the feed. This system includes a fixed starting cam 20 for action on all the long butts 9*l* on the central panel of nib jacks 9 for the purpose of raising the said panel of jacks from an idle position L to a working level L', whilst permitting those nib jacks with short butts 9*s* to pass by at the idle low position (see FIGURE 4). As will be seen in FIGURES 7, 8 and 9, the short butts 9*s* pass idly under a guard cam 21. The nib jack cam system also includes a further nib jack raising cam 22 which immediately follows the fixed starting cam 20 at the feed and is of the bolt type so that it can be withdrawn from, and projected into, its operative position at appropriate times. When the cam 22 is inoperative, long butts 9*l* raised to L' by the starting cam 20 will simply pass beneath a guard cam 23 and over the aforementioned guard cam 21. But when the raising cam 22 is projected into its operative position, the long butts 9*l* partially elevated by the fixed starting cam 20 will be landed on to the said raising cam and lifted by it to raise all of the central panel of long butt nib jacks to such a height as in turn to raise the corresponding needles 2, through the medium of the interposed spacer elements 10, to the splicing height X at which the needles take the splicing yarn Y' presented thereto by the feeder 7. At the position marked A in FIGURE 8 a long butt nib jack 9 is shown in the course of being raised by the cam 22 and lifting the associated spacer element 10 without disturbing the aligned micro-mesh selector jack 8; as previously mentioned this lack of disturbance of the jack 8 is made possible by virtue of the presence of the space S between the lower extremity of the said jack and the tail portion 10*c* of the element. But at position A the tail portion 10*c* is in the course of being closed up to the jack 8. However, by the time the nib jack under discussion has been raised to the position marked B in FIGURES 7 and 8 the space S has disappeared but the jack is fully raised so that a further space S' has opened up between the shouldered upper end 10*e* of the element 10 and the upper extremity of the micro-mesh selector jack 8. As the first and the last of the long butt nib jacks of the aforementioned central panel are raised by the raising cam 22, the rising nibs 9*a* of these two jacks will engage and elevate the short butts 9*s* of the immediately flanking short butt nib jacks at both of the opposite ends of the said central group, thereby raising these two short butt nib jacks to such a height as to land their butts on to a succeeding nib jack raising cam so that in turn these jacks will be fully raised to raise the corresponding needles to splicing height. This action will take place progressively, short butt nib jacks at opposite sides of the increasing central group being successively picked from the low position L until a desired widening of a spliced area has been effected. FIGURE 5 illustrates, in detail, the manner in which the nib 9*a* of the first of a group of long butt nib jacks acts on the butt 9*s* of a flanking short butt nib jack. In short, the nib jacks 9 are so operatively disposed in relation to a predetermined group of the needles 2 that when a cam 22 at a feed is rendered operative, it initiates splicing by raising the panel of long butt nib jacks, and the short butt nib jacks are then progressively raised, in conventional manner, to present the needles, correspondingly, to the splicing yarn whereby a shaped area of spliced fabric is produced.

According to yet another feature of the invention, provision may be made in the machine for simultaneously actuating both the first and the second jacks associated with each of desired needles so that the needle selection produced by one needle selecting mechanism is superimposed on the selection produced by the other needle selecting mechanism.

Thus where, as in the illustrated example, a micro-mesh needle selecting mechanism and also a nib jack splicing mechanism of the form already described herein are provided vertically in alignment at one and the same feed, the two mechanisms may, if desired, function together during the knitting of portions of a stocking having therein spliced areas. In such a case the nib jack selection is superimposed on the micro-mesh selection so that whilst the actual spliced areas are plain knitted, the fabric immediately adjoining such areas are knitted in micro mesh. That is to say, as selected needles are raised by the nib jack system beyond clearing height, for splicing, the micro-mesh selection of the needles is neutralised to produce plain knitting. This superimposition of a splicing selection on a micro-mesh selection is clearly illustrated in FIGURE 9.

Alternatively, a nib jack selection may be superimposed on normal clearing of the needles at one and the same feed so that both the spliced areas and the fabric immediately adjoining the same will be plain knitted. Such a superimposition of a splicing selection on normal clearing is shown in FIGURES 7 and 8.

In FIGURE 10 is shown a portion of a circularly knitted stocking blank of which *t* represents toe fabric whilst *f* represents the foot bottom having a plain knitted spliced area *sa* within micro-mesh foot fabric *mf*. The foot portion of such a blank is knitted by the superimposition on a micro-mesh selection of a splicing selection generally in the manner shown in FIGURE 9. However, since the illustrated spliced area *sa* includes two widenings *w* and *w'*, the nib jack system necessary to produce it would have to include nib jacks having three different lengths of butts, viz. long, medium and short, and each of the nib jack raising cams 22 would have to be capable of being moved in to appropriate different extents for suitable action upon such butts at the required times.

Now although the greatest advantage is derived from this invention when a micro-mesh selecting mechanism and a nib jack splicing mechanism are arranged in vertical alignment at one and the same feed, the invention is not necessarily limited in this respect. For example, in a multi-feed machine having an even number of feeds, micro-mesh needle selecting mechanisms provided at alternate feeds may be caused to function in conjunction with nib jack splicing mechanisms at the intervening feeds in which instance the areas which are reinforced by a splicing thread would be knitted on a micro-mesh basis.

I claim:

1. A knitting machine comprising, in combination, a needle bed having needle grooves formed therein, a set of independent knitting needles arranged to work in said grooves, two separate independently operable needle selection mechanisms which are disposed at different heights, said two needle selecting mechanisms being adapted to effect selections of needles for respectively different purposes, two separate and independent needle-actuating jacks to each needle requiring to be influenced by the said needle selecting mechanisms, said two jacks being both arranged in the same needle groove as, and thus in alignment with, the said needle and, interposed between said two jacks, a spacer element which is also accommodated in the same groove as the needle but is so formed as to enable it to be acted upon and moved longitudinally, to transmit a corresponding movement to the needle, by either of the two independent selectively actuated jacks without disturbing the other.

2. A knitting machine comprising, in combination, a needle bed having needle grooves formed therein, a set of independent knitting needles arranged to work in said grooves, two separate independently operable needle selecting mechanisms which are provided at one needle selecting location and are disposed in alignment along a line perpendicular to the set of needles, said two needle selecting mechanisms being adapted to effect selections of needles for respectively different purposes, two separate and independent needle-actuating jacks to each needle requiring to be influenced by the said needle selecting mechanisms, said two jacks being both arranged in the same needle groove as, and thus in alignment with, the said needle and, interposed between said two jacks, a spacer element which is also accommodated in the same groove as the needle but is so formed as to enable it to be acted upon and moved longitudinally, to transmit a corresponding movement to the needle, by either of the two independent selectively actuated jacks without disturbing the other.

3. A knitting machine comprising, in combination, a needle bed having needle grooves formed therein, a set of independent knitting needles arranged to work in said grooves, two separate independently operable needle selecting mechanisms which are disposed at different heights, said two needle selecting mechanisms being adapted to effect selections of needles for respectively different purposes, a first and a second needle-actuating jack to each needle requiring to be influenced by the said needle selecting mechanisms, said two jacks being both arranged in the same needle groove as the said needle, with the first jack disposed above the second jack and, interposed between said two jacks, a spacer element which is also accommodated in the same groove as the needle and has a stem portion recessed not only to receive the first jack but also to provide a shoulder against which the upper end of the said first jack can act and a tail portion against which the upper end of the second jack can act, there being a space between this tail portion and the lower end of the first jack, whereby the spacer element can be moved longitudinally, to transmit a corresponding movement to the needle, by either of the two independent selectively actuated jacks without disturbing the other.

4. A knitting machine according to claim 3, wherein the width of the stem portion of each spacer element combined with the width of the associated first jack is substantially equivalent to the depth of the relevant needle groove, and the shouldered upper end and the tail portion of the said spacer element project forwardly from the stem portion thereof so as to present transverse shoulders to be acted upon by the first and second jacks respectively.

5. A knitting machine according to claim 3, wherein each of the spacer elements is itself furnished with a butt to enable it to be selectively actuated independently of the associated first and second jacks.

6. A knitting machine according to claim 3, wherein both the first and the second jacks associated with desired needles are adapted to be simultaneously actuated so that the needle selection produced by one needle selecting mechanism is superimposed on the selection produced by the other needle selecting mechanism.

7. A circular knitting machine comprising, in combination, a needle cylinder having needle grooves therein, a circle of independent knitting needles arranged to work in said grooves, at each of desired feeds of the machine two separate independently operable needle selecting mechanisms which are disposed in alignment along a vertical line perpendicular to the needle circle, said two needle selecting mechanisms being adapted to effect selections of needles for respectively different purposes, two separate and independent needle-actuating jacks to each needle requiring to be influenced by the said needle selecting mechanisms, said two jacks being both arranged in the same needle groove as, and thus in alignment with, the said needle and, interposed between said two jacks, a spacer element which is also accommodated in the same groove as the needle but is so formed as to enable it to be acted upon and moved longitudinally, to transmit a corresponding movement to the needle, by either of the two independent selectively actuated jacks without disturbing the other.

8. A circular knitting machine according to claim 7, wherein the two needle selecting mechanisms at each feed are for the purposes of producing micro-mesh fabric and selective needle splicing respectively.

9. A circular knitting machine comprising, in combination, a needle cylinder having needle grooves therein, a circle of independent knitting needles arranged to work in said grooves, at each of desired feeds of the machine a micro-mesh needle selecting mechanism and an independently operable selective needle splicing mechanism, these two mechanisms being disposed one above the other along a vertical line perpendicular to the needle circle, said micro-mesh needle selecting mechanism comprising jacks of a circular set of first selector jacks, one in alignment with and in the same groove as each needle, and furnished with patterning butts differentiated from one another by virtue of their positions heightwise on said jacks,

a bank of superimposed rotary drum discs at each feed corresponding in number with the number of such patterning butt positions, said discs being peripherally contoured, gearing for driving the drum discs from the needle cylinder, and at each feed a corresponding bank of selectively operable slides arranged to be acted upon by the discs and for action selectively in turn upon the butts of the first selector jacks, and said selective needle splicing mechanism being in the form of a nib jack system comprising second jacks formed with nibs in addition to operating butts, there being one of these nib jacks in alignment with and in the same groove as each of a group of the needles, and a cam system at each feed for controlling the second jacks for splicing, and, interposed between the said first selector jack and the second jack associated with each of the appropriate needles, a spacer element which is also accommodated in the same groove as said needle but is so formed as to enable it to be acted upon and moved longitudinally, to transmit a corresponding movement to the needle, by either of the two jacks without disturbing the other.

10. A circular knitting machine according to claim 8, wherein there is provided at each feed a cam for action on predetermined patterning butts on said first selector jacks for raising all of the latter to tucking height whereby predetermined ones of these partially raised jacks can then be raised from the tucking height to clearing height by the selective action of the slides upon the patterning butts.

11. A circular knitting machine comprising, in combination, a needle cylinder having needle grooves therein, a circle of independent knitting needles arranged to work in said grooves, at each of desired feeds of the machine a micro-mesh needle selecting mechanism and an independently operable selective needle splicing mechanism, these two mechanisms being disposed one above the other along a vertical line perpendicular to the needle circle, said micro-mesh needle selecting mechanism comprising jacks of a circular set of first selector jacks, one in alignment with and in the same groove as each needle, and furnished with differentiated patterning butts and means for selectively acting upon said butts, and said selective needle splicing mechanism being in the form of a nib jack system comprising a group of second jacks formed with laterally directed nibs in addition to operating butts and predetermined ones of the second jacks having long operating butts while the remainder of such jacks have shorter operating butts there being one of these second jacks in alignment with and in the same groove as each of a corresponding group of the needles, and a cam system at each feed including a cam movable to active and inactive positions for contact, when operative, with the operating butts and so operatively disposed in relation to the said group of needles and to a prearrangement of the operating butts and nibs that when said cam is rendered operative it initiates the operation of the long butt jacks and the remaining second jacks are then operated to present the needles, correspondingly, to a splicing yarn and, interposed between the said first selector jack and the second jack associated with each of the appropriate needles, a spacer element which is also accommodated in the same groove as said needle but is so formed as to enable it to be acted upon and moved longitudinally, to transmit a corresponding movement to the needle, by either of the two jacks without disturbing the other.

12. For use in a knitting machine, a spacer element adapted to be interposed between aligned first and second needle-actuating jacks, said element comprising a straight stem which is recessed at one edge to receive one of said jacks, the recessing of said element being such as to provide at one end thereof a shoulder against which the leading end of the first jack can act and a protuberant tail portion against which the second jack can act, and the length of the recessing in relation to the length of the first jack being such as to provide a space between the tail end of said jack and the tail portion of the spacer element.

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