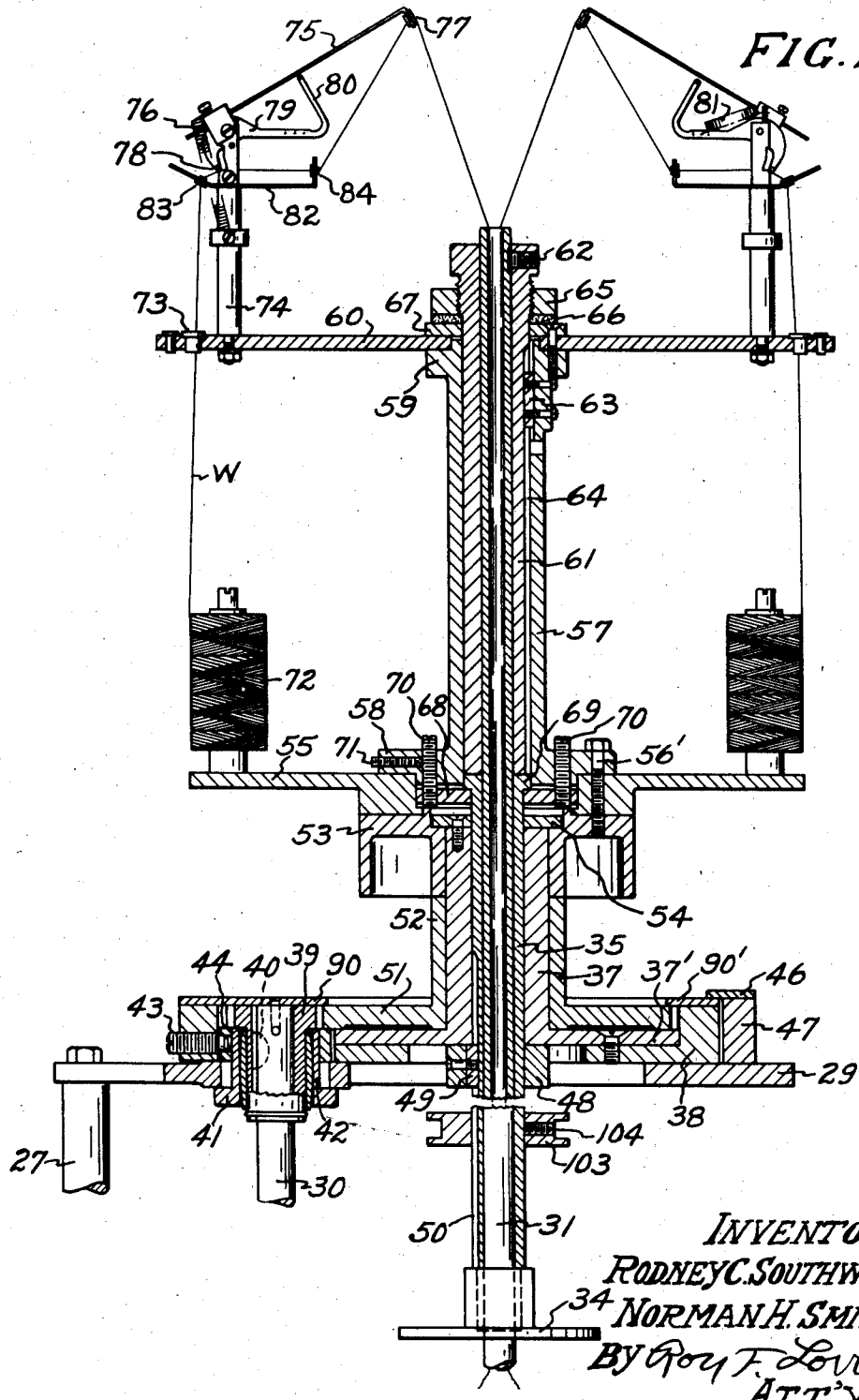
Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 1

FIG. 1.



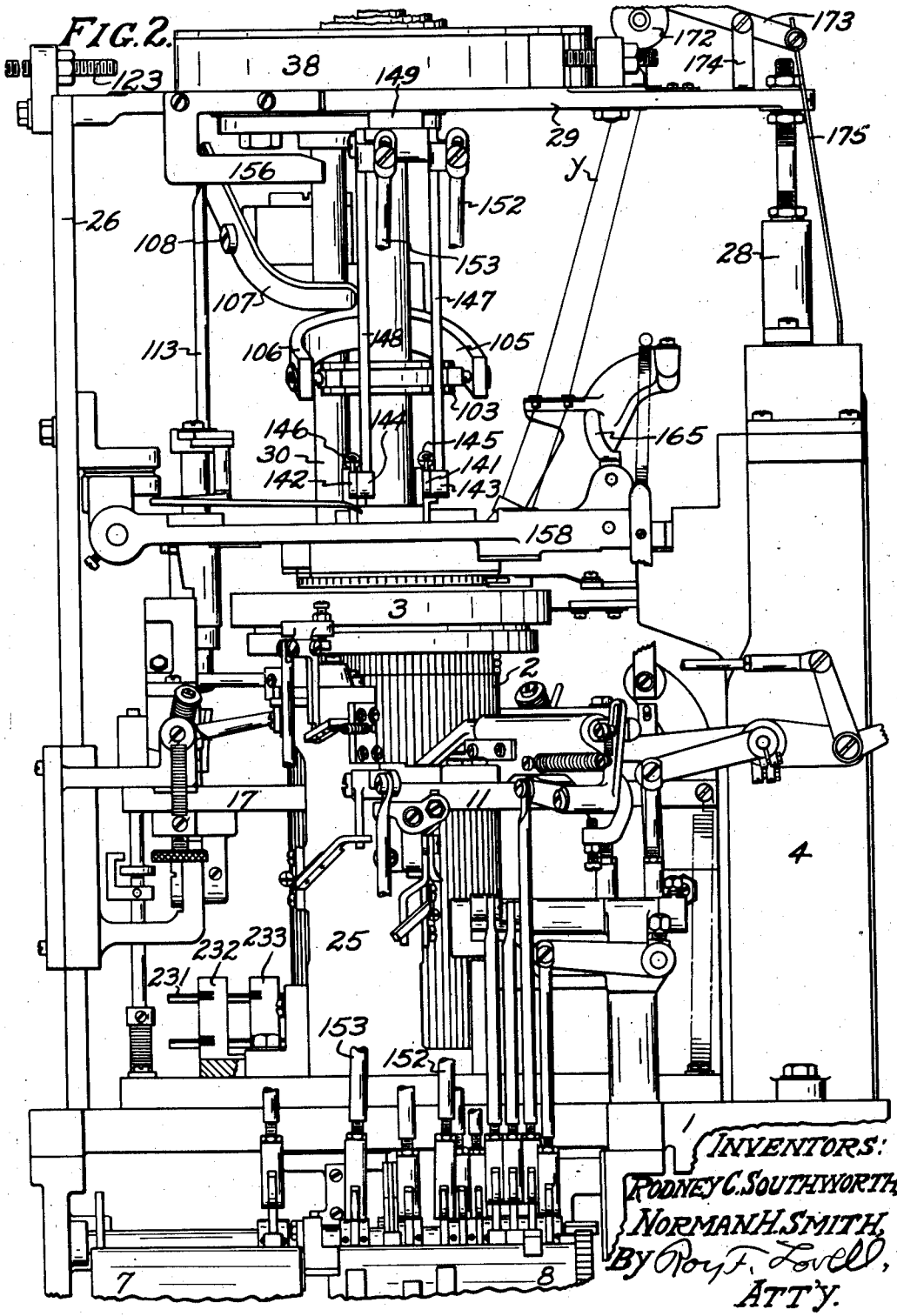
INVENTORS:
RODNEY C. SOUTHWORTH,
NORMAN H. SMITH,
BY Roy F. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 2

FIG. 2.



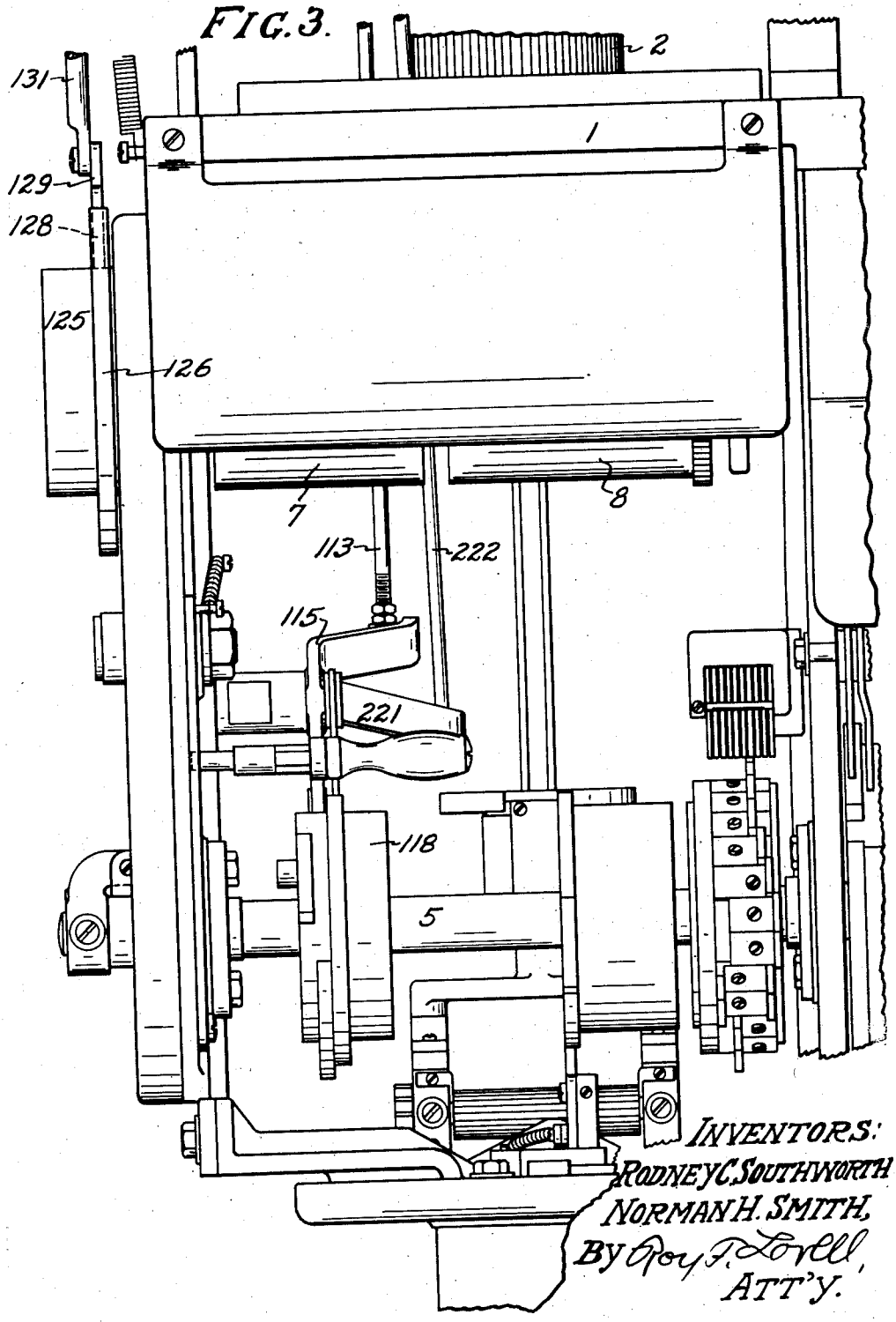
INVENTORS:
RODNEY C. SOUTHWORTH,
NORMAN H. SMITH,
BY Roy F. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 3

FIG. 3.



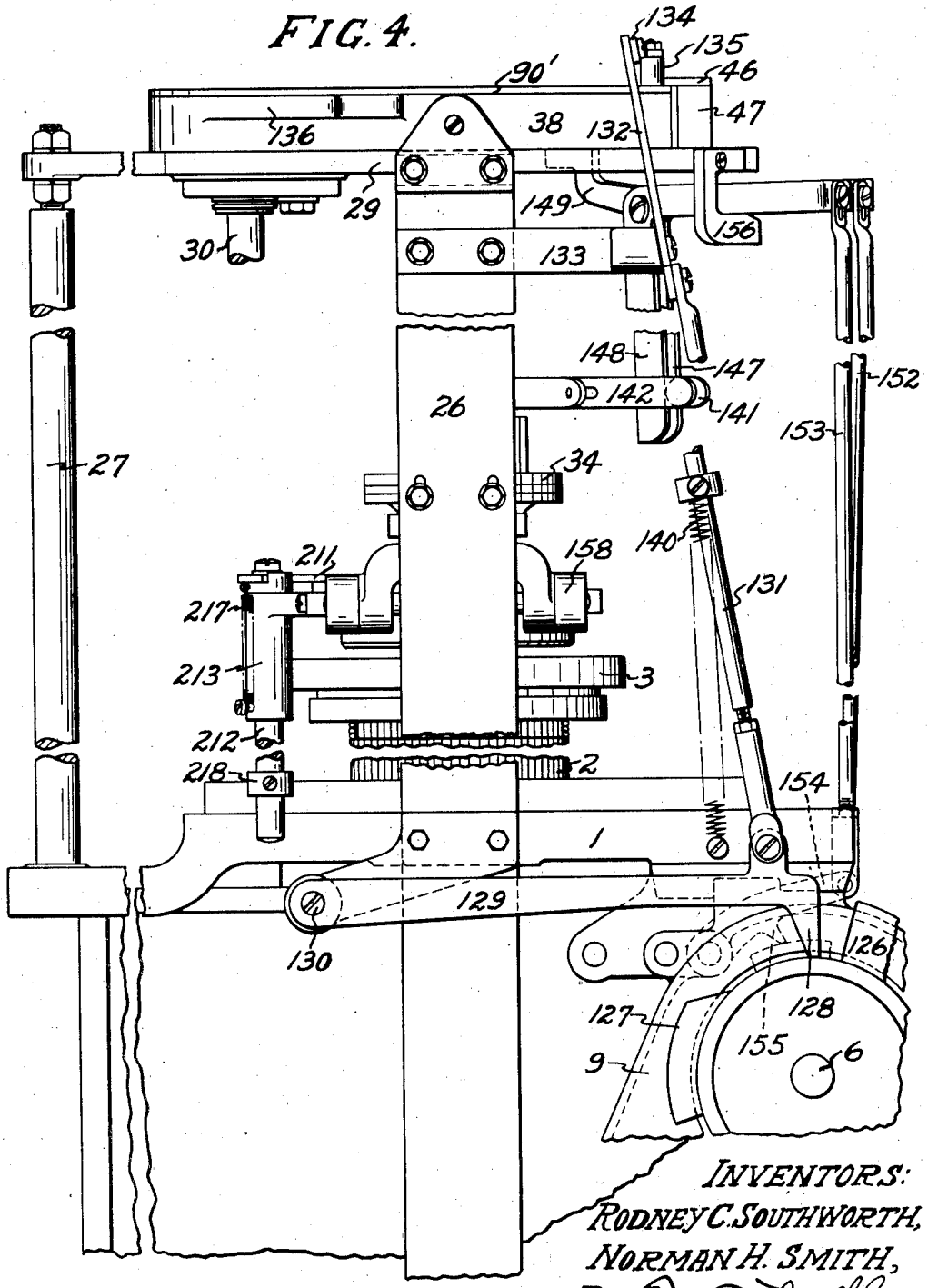
INVENTORS:
RODNEY C. SOUTHWORTH
NORMAN H. SMITH,
By Roy F. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 4

FIG. 4.



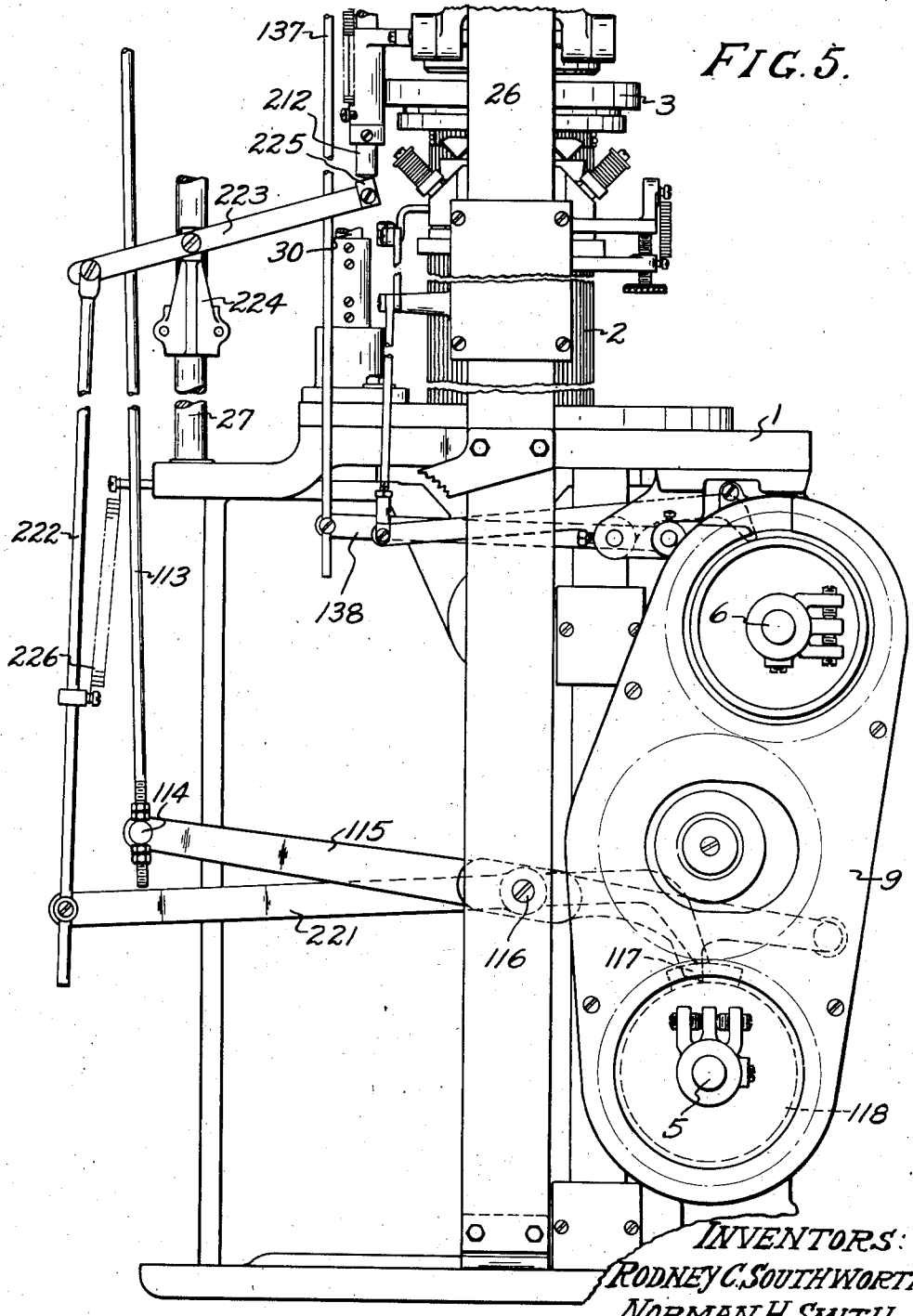
INVENTORS:
RODNEY C. SOUTHWORTH,
NORMAN H. SMITH,
BY Roy F. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 5

FIG. 5.



INVENTORS:
RODNEY C. SOUTHWORTH,
NORMAN H. SMITH,
BY Roy F. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 6

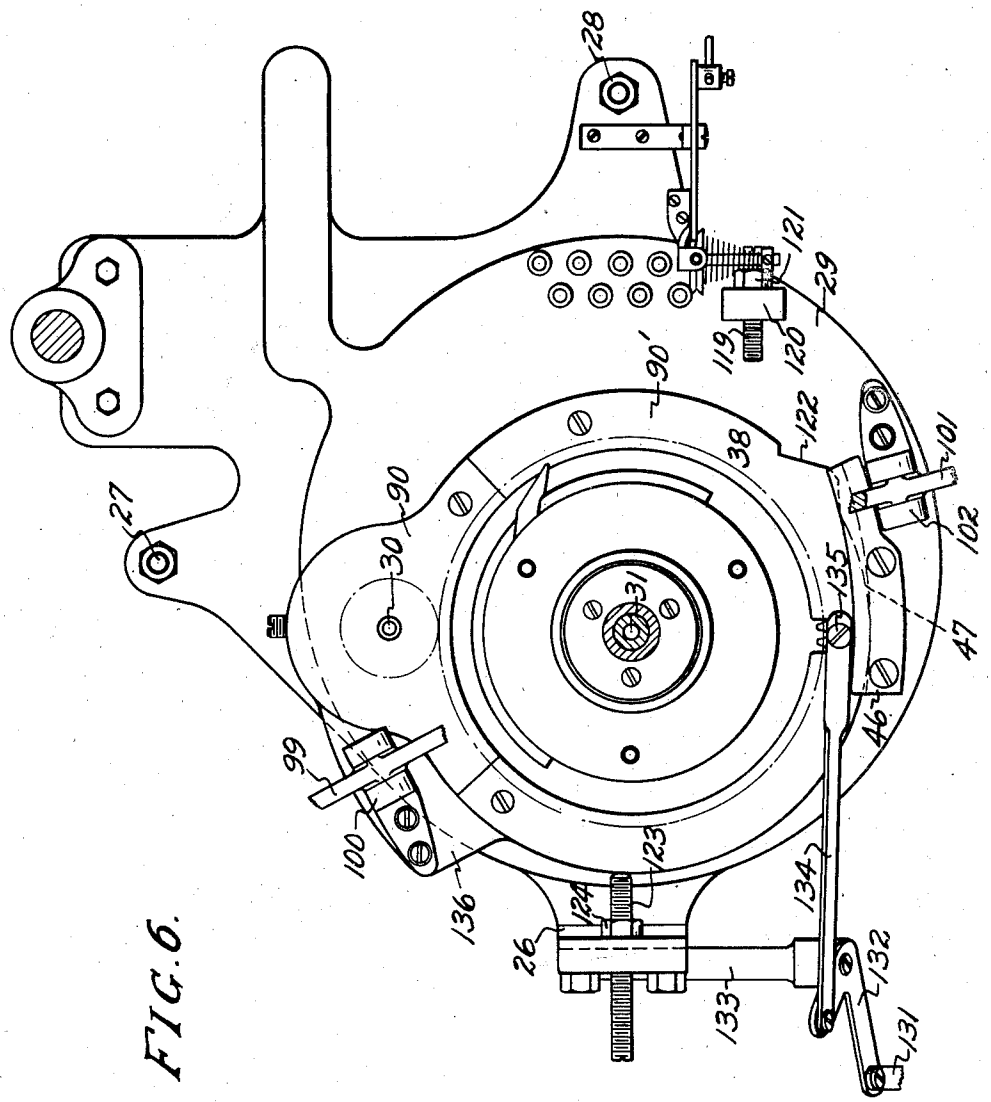


FIG. 6.

INVENTORS:
RODNEY C. SOUTHWORTH,
NORMAN H. SMITH,
BY Roy F. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 7

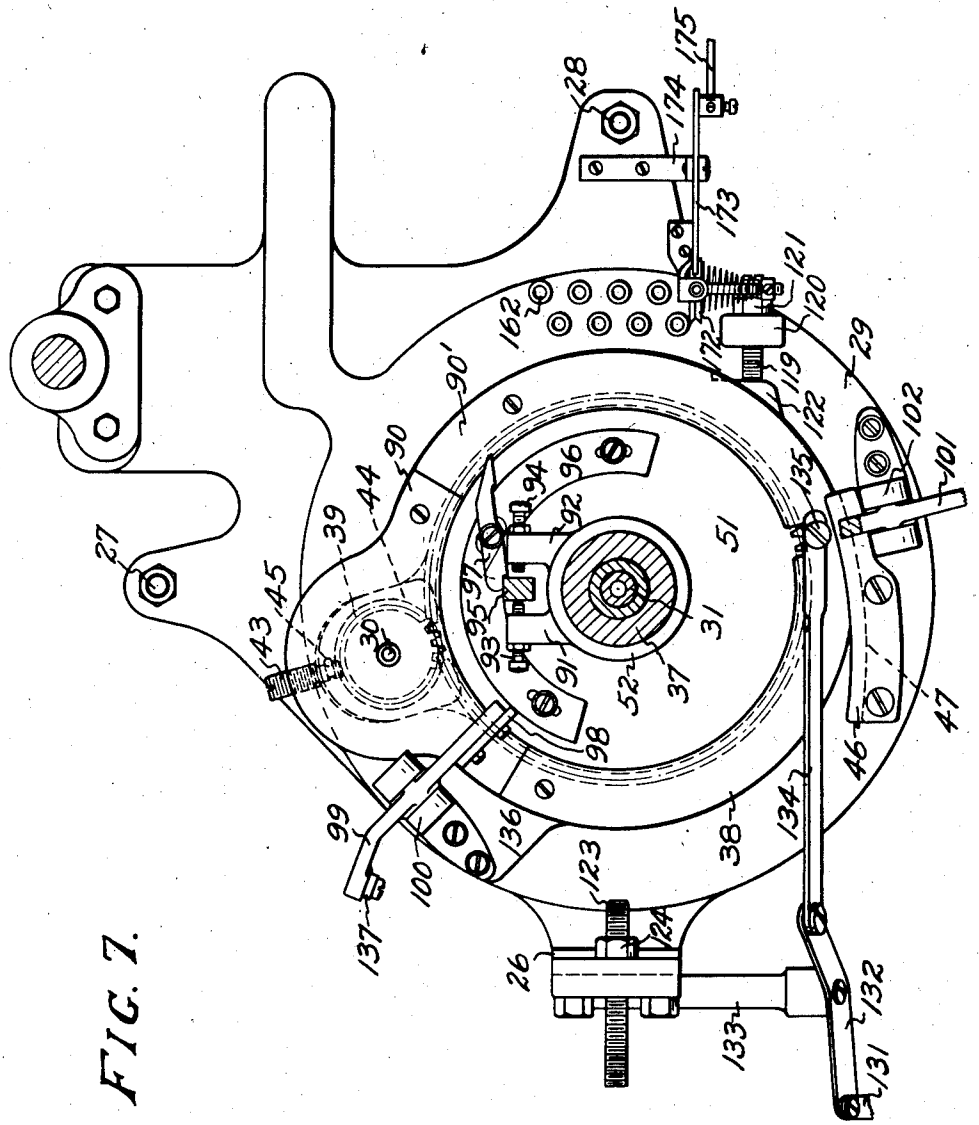


FIG. 7.

INVENTORS:
RODNEY C. SOUTHWORTH,
NORMAN H. SMITH,
By Roy F. Lovell,
ATT'Y.

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AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 8

FIG. 8.

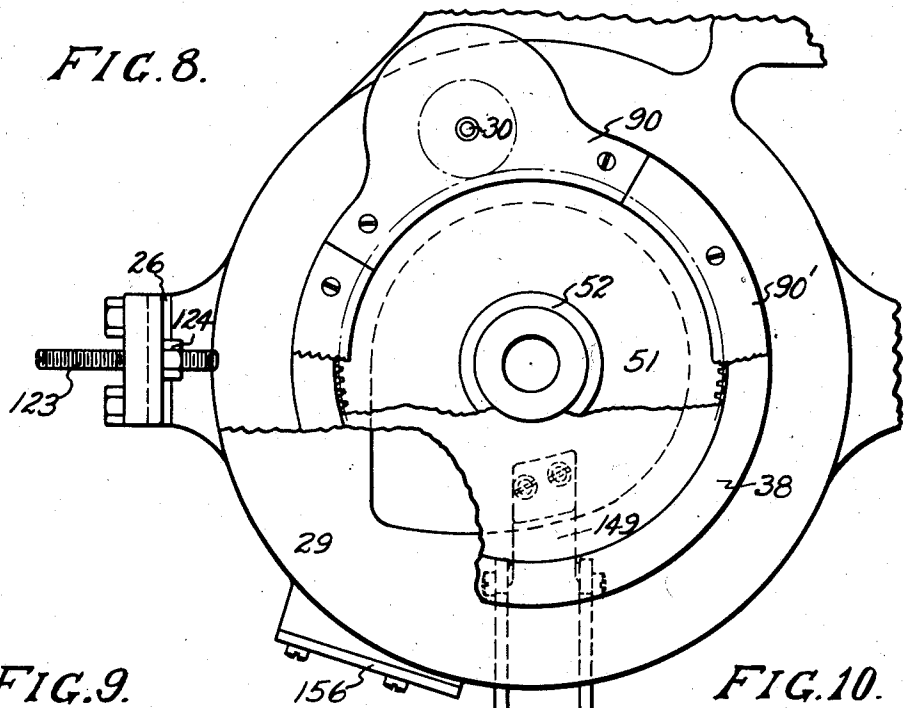


FIG. 9.

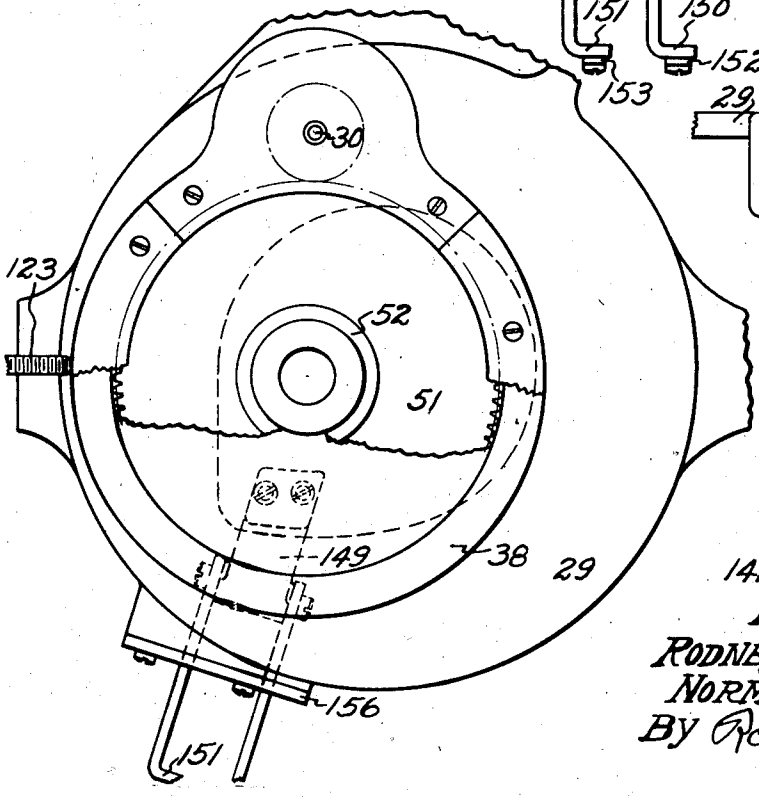
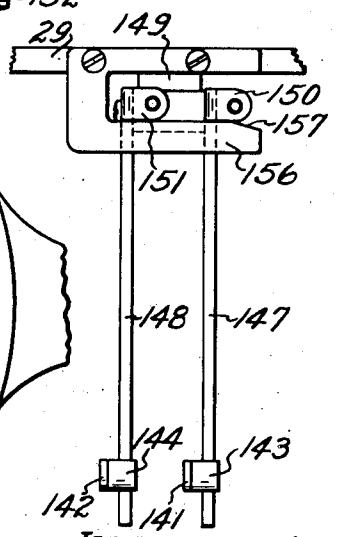


FIG. 10.



INVENTORS:
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ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 9

FIG. 11.

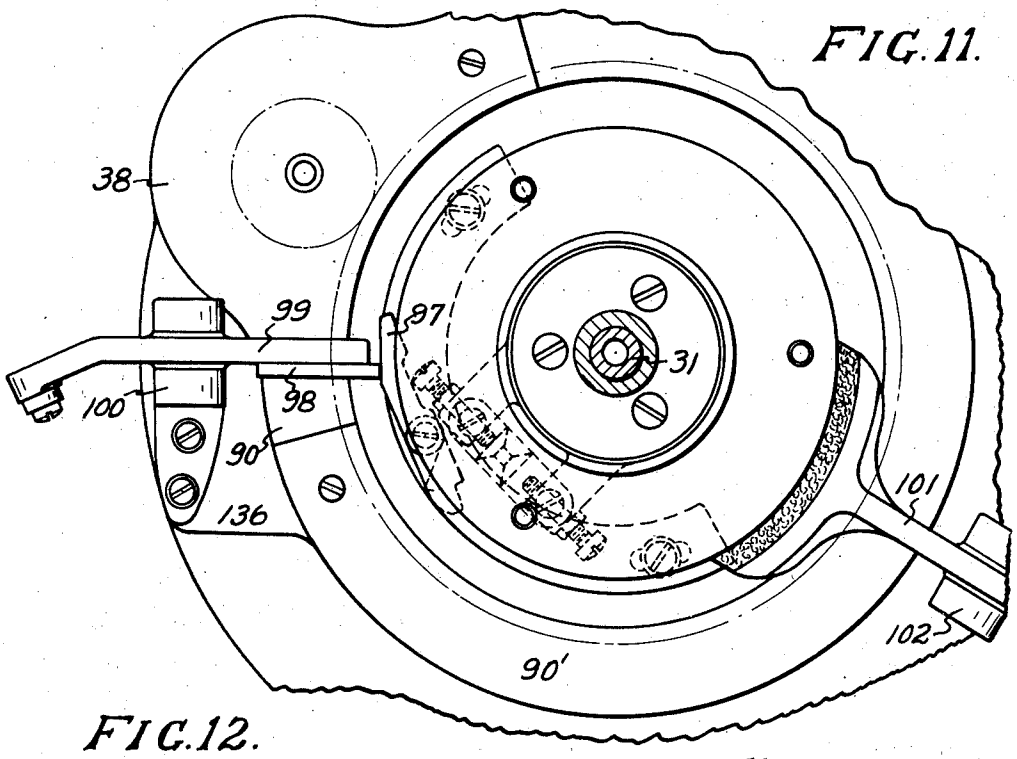
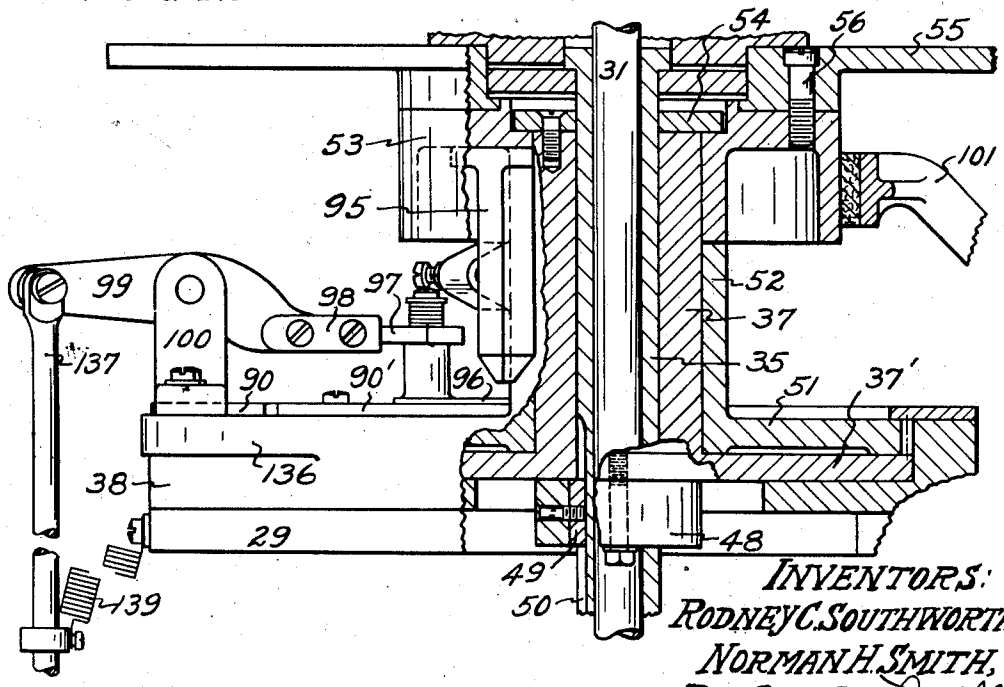


FIG. 12.



INVENTORS:
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NORMAN H. SMITH,
BY Roy F. Lovell,
ATT'Y.

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AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 10

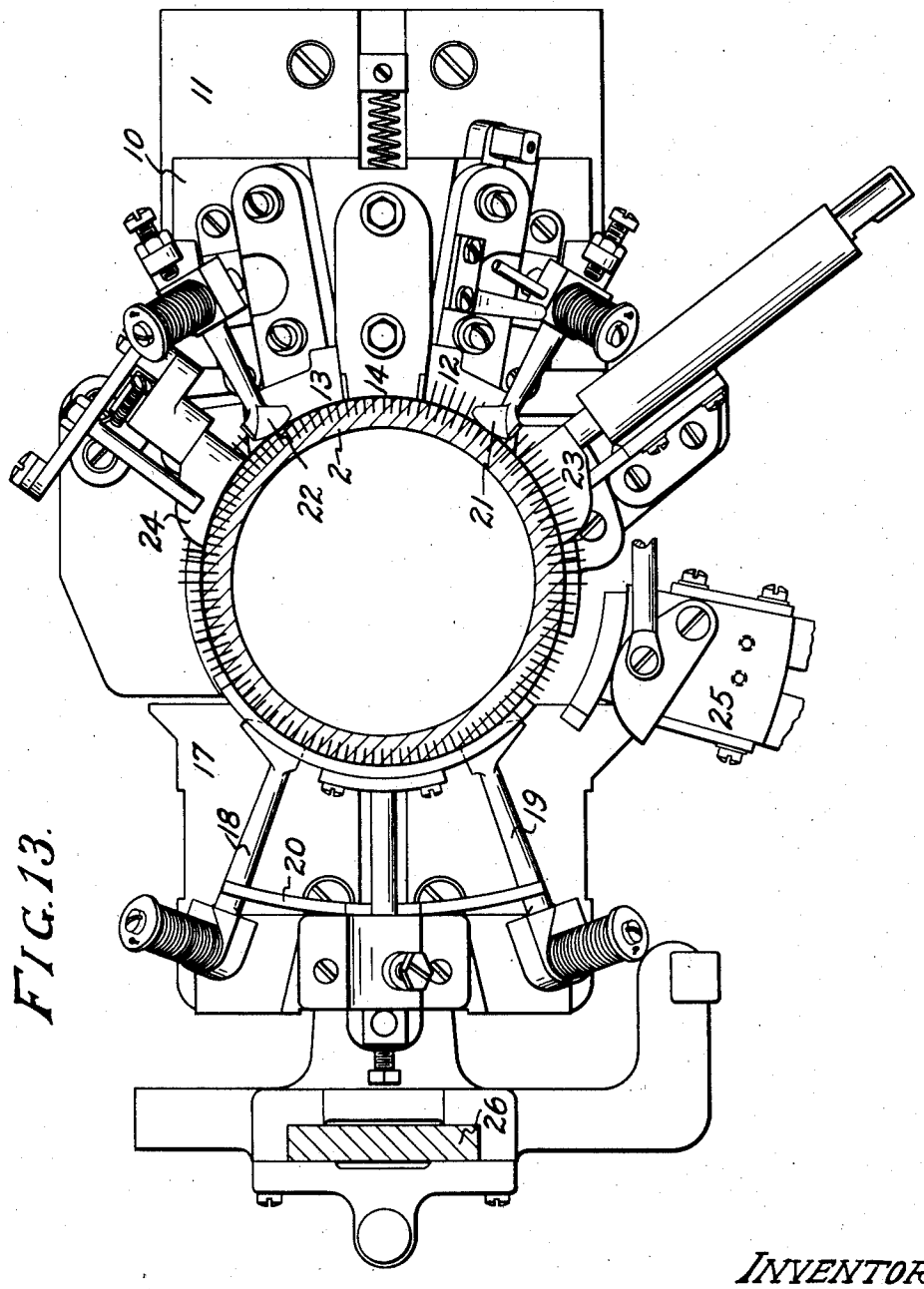


FIG. 13.

INVENTORS:
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NORMAN H. SMITH,
BY Roy T. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 11

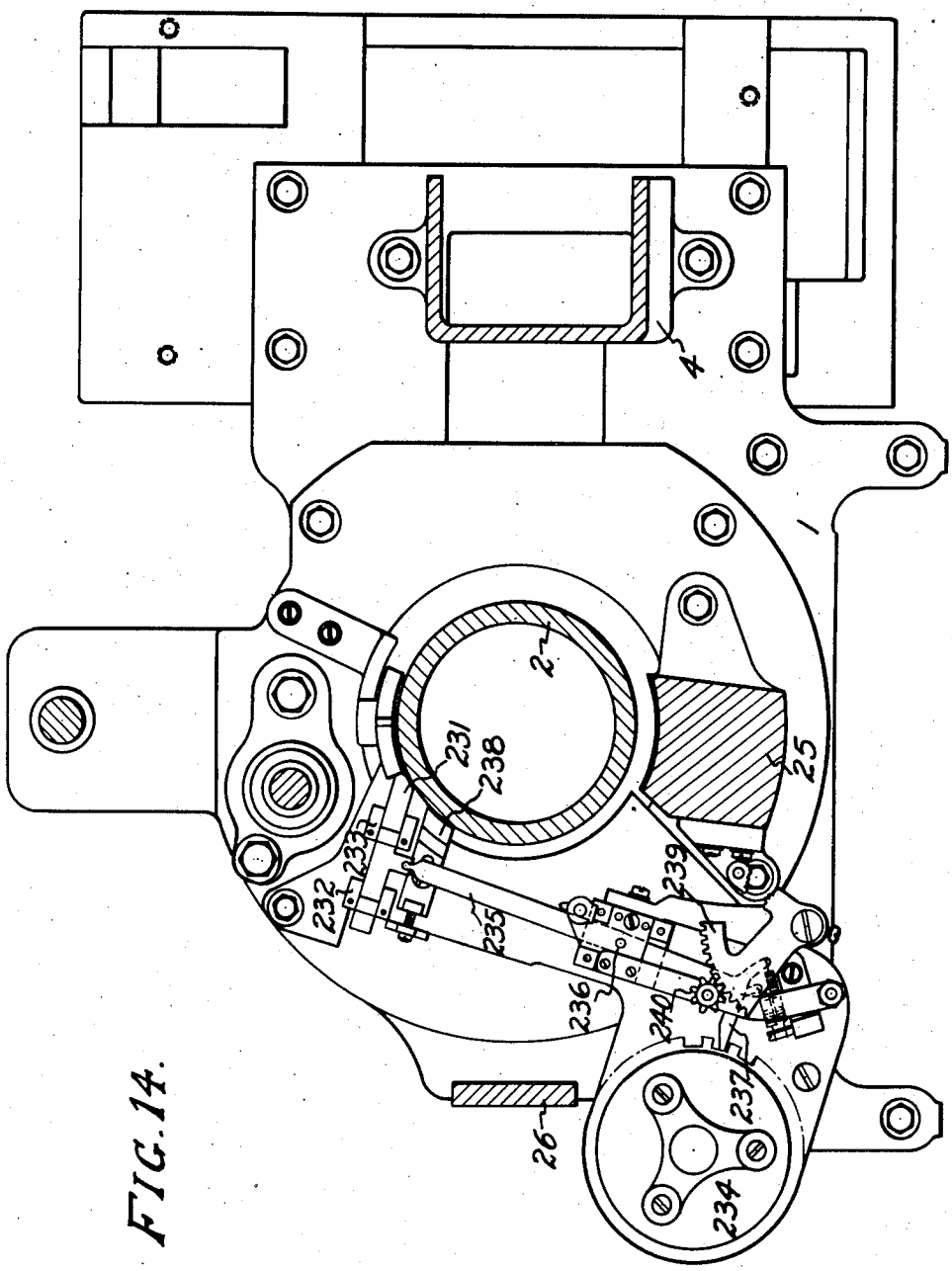


FIG. 14.

INVENTORS:
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BY Roy F. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 12

FIG. 17.

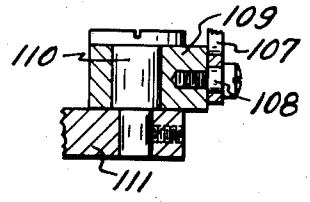
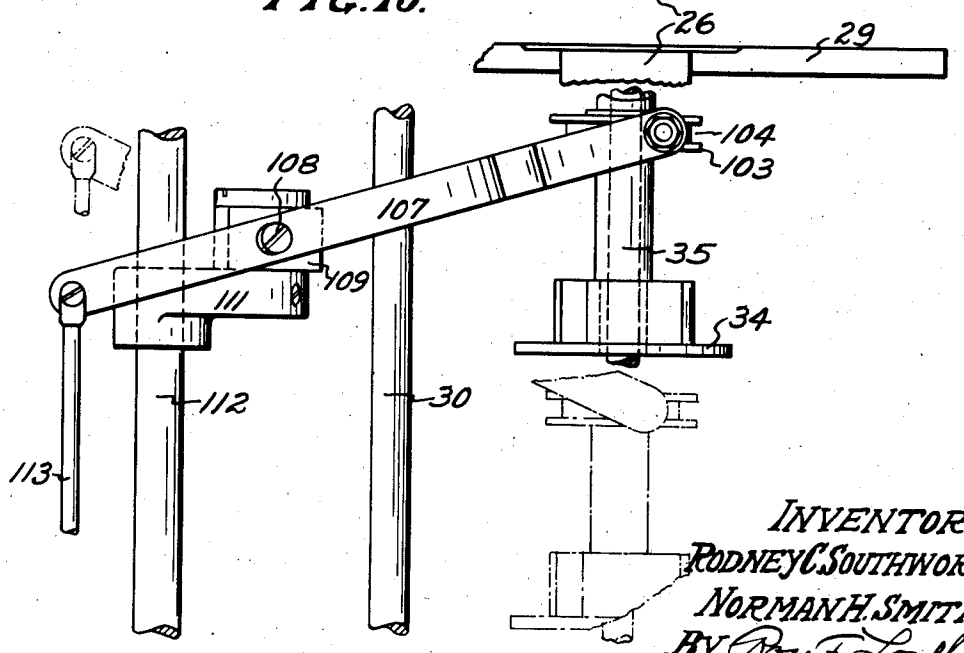


FIG. 16.

FIG. 15.



INVENTORS:
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NORMAN H. SMITH,
By Roy F. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 13

FIG. 18.

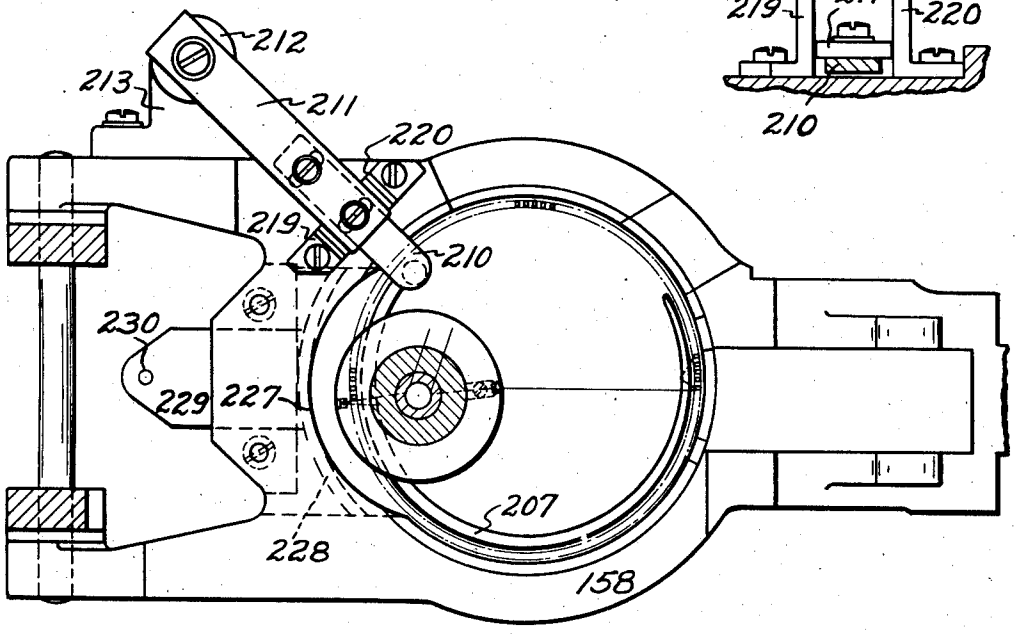
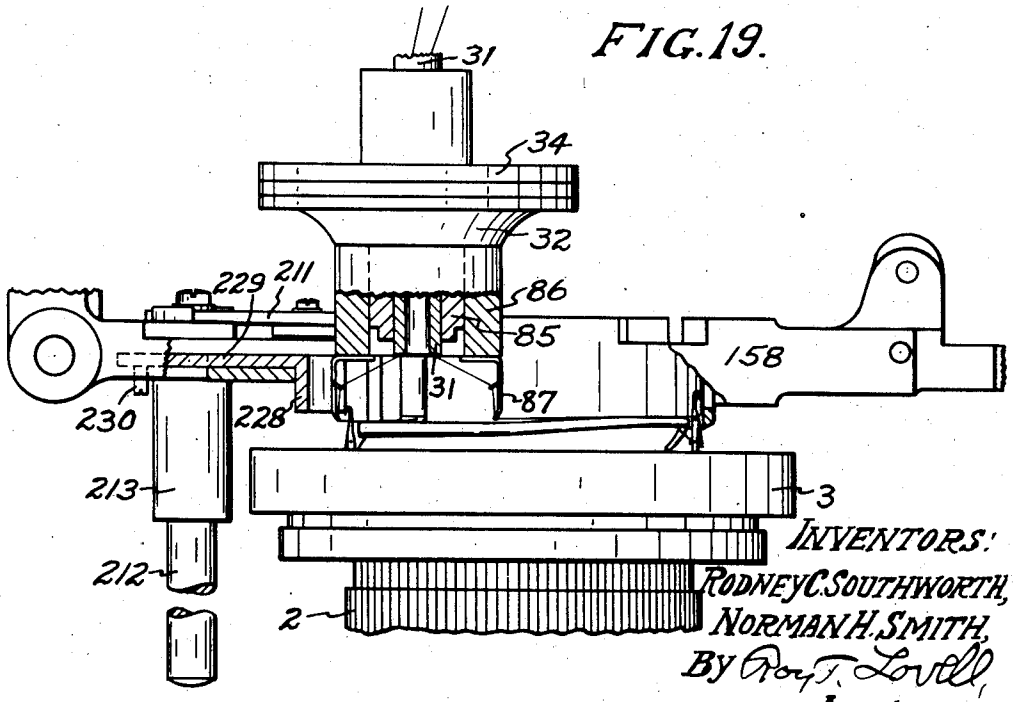


FIG. 20.

FIG. 19.



INVENTORS:
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NORMAN H. SMITH,
BY Roy T. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 14

FIG. 22.

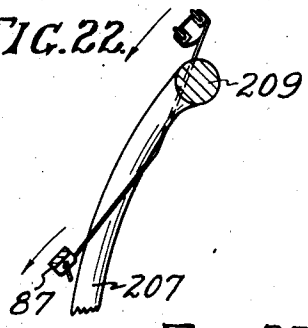


FIG. 21.

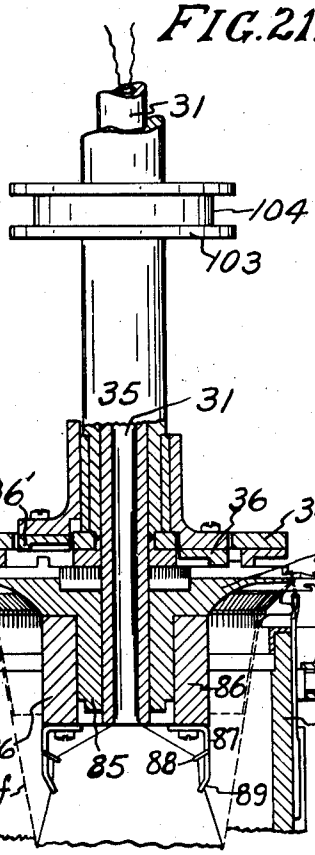


FIG. 28.

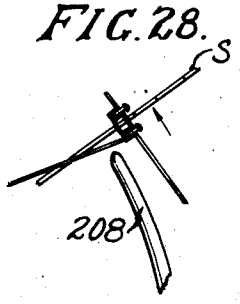


FIG. 23.

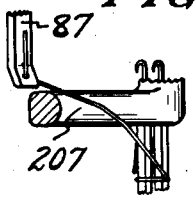


FIG. 29.

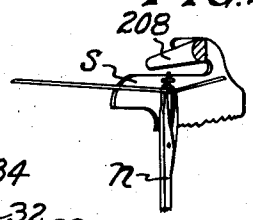


FIG. 24.

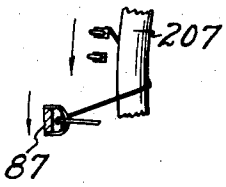


FIG. 26.

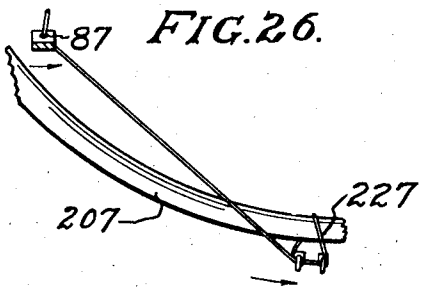


FIG. 25.

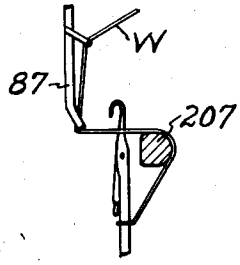
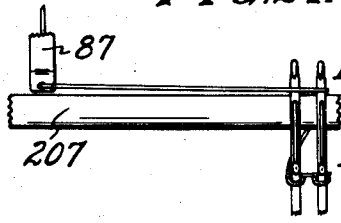


FIG. 27.



INVENTORS:
RODNEY C. SOUTHWORTH,
NORMAN H. SMITH,
BY Dorr F. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 15

FIG. 30.

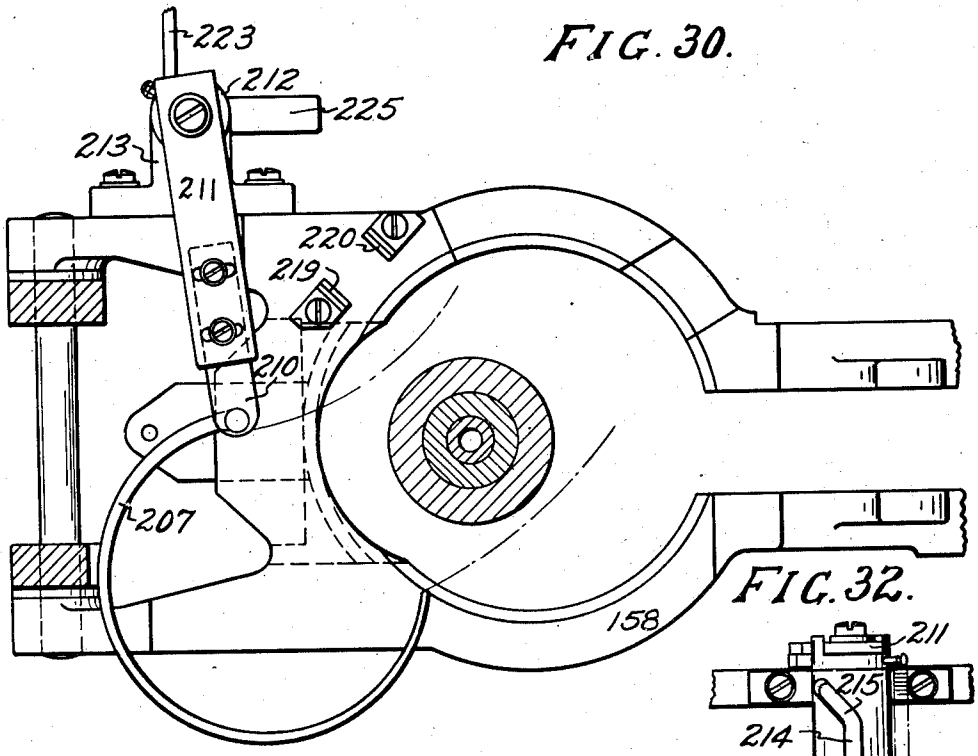


FIG. 31.

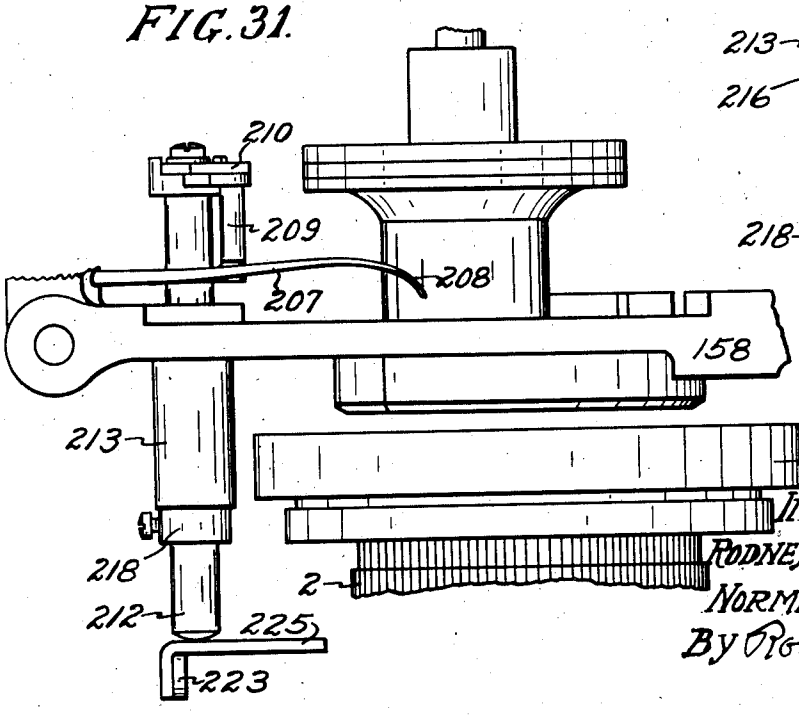
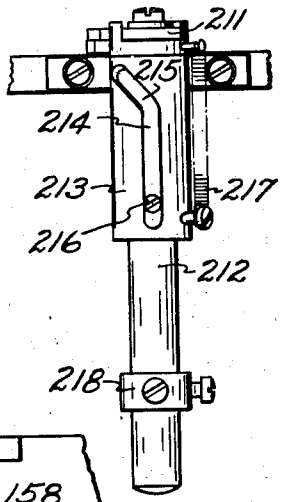


FIG. 32.



INVENTORS:
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NORMAN H. SMITH,
By Roy F. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 16

FIG. 33.

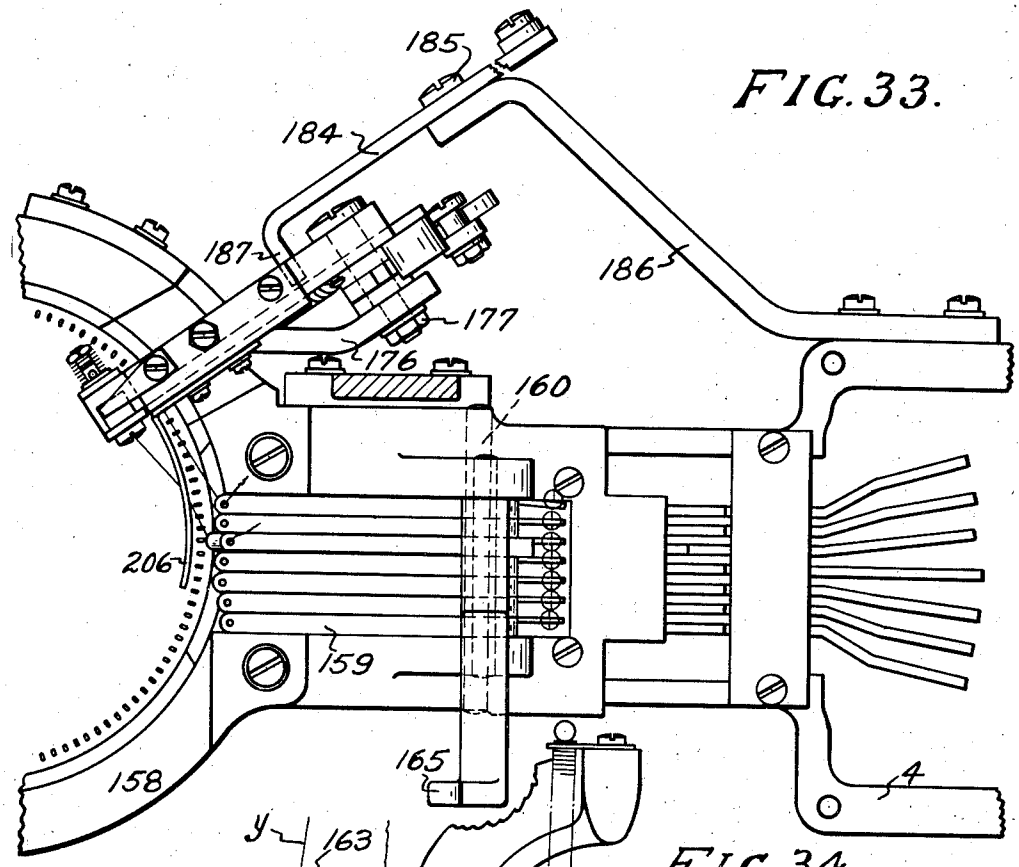
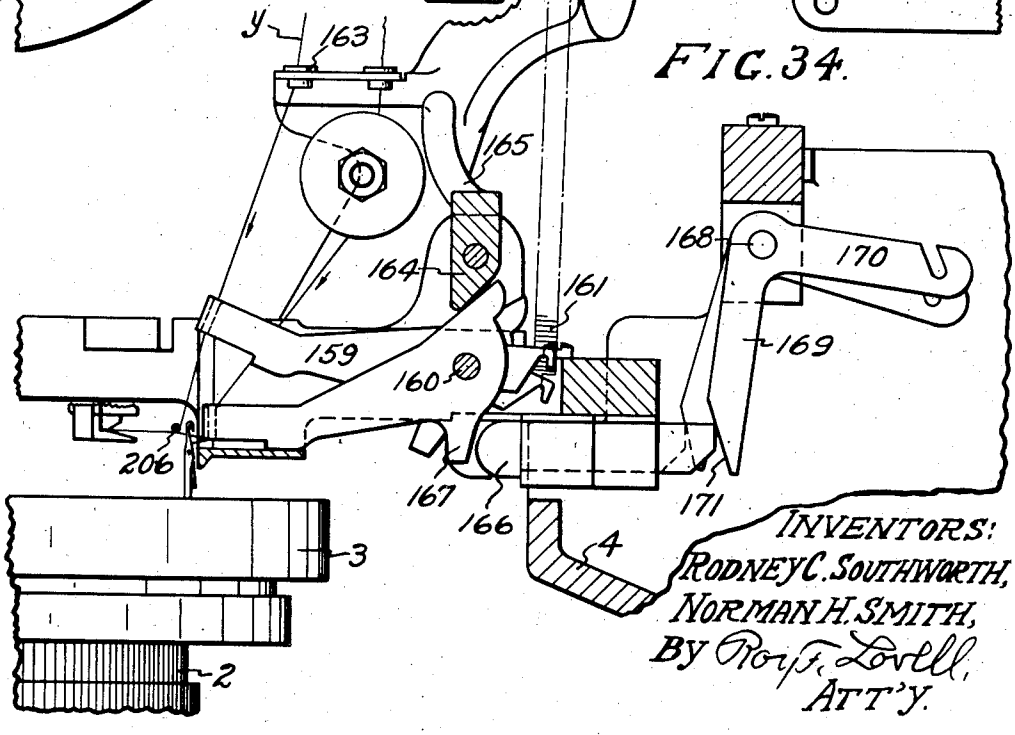


FIG. 34.



INVENTORS:
RODNEY C. SOUTHWORTH,
NORMAN H. SMITH,
By Ross F. Lovell,
ATT'Y.

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AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 17

FIG. 35.

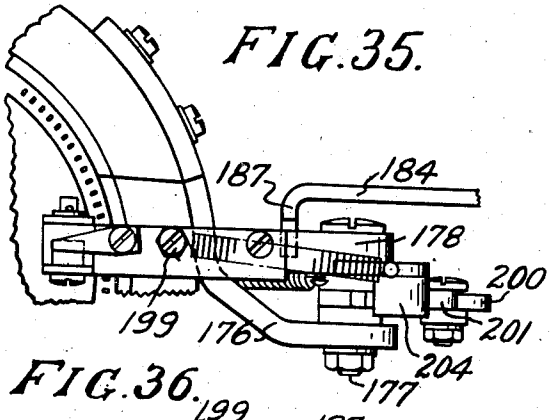


FIG. 38.

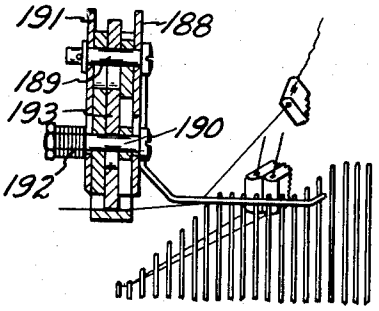


FIG. 36.

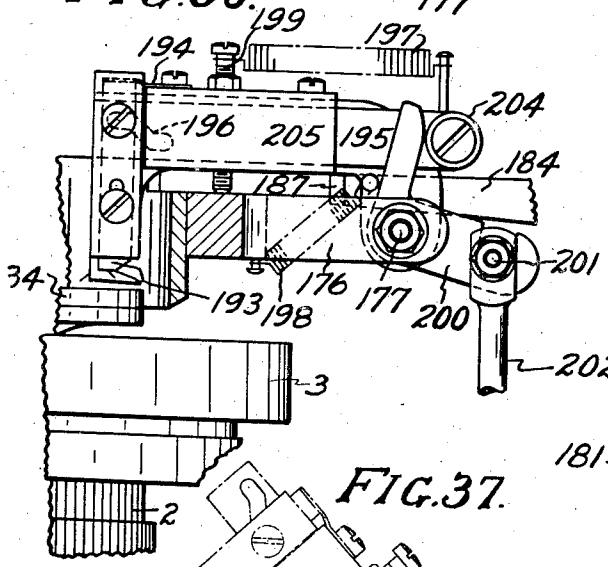


FIG. 39.

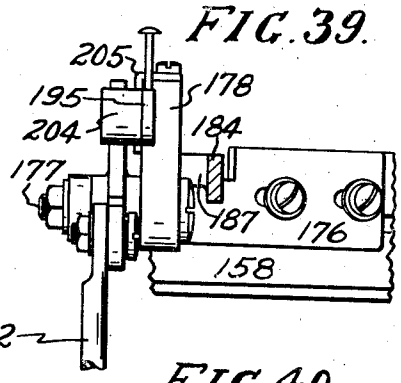


FIG. 40.

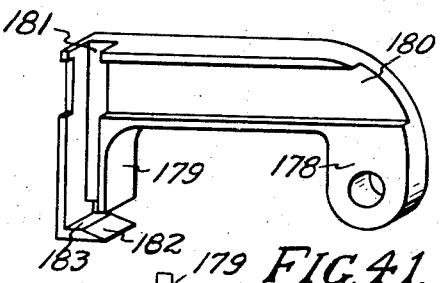


FIG. 37.

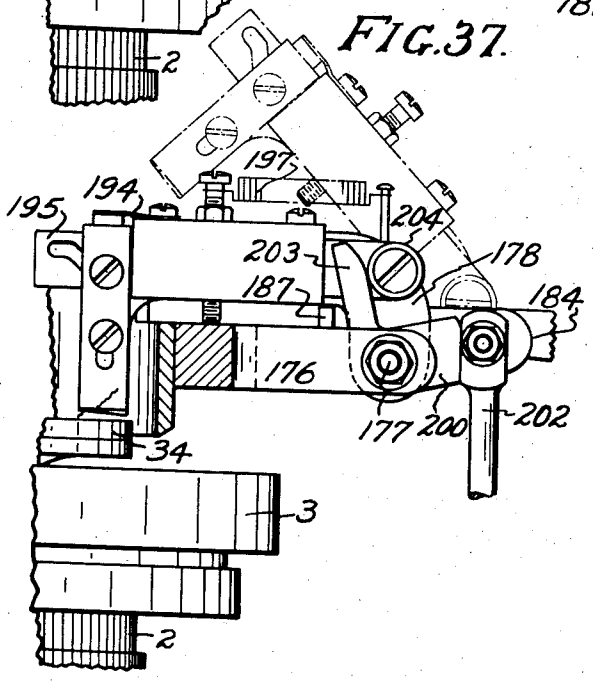
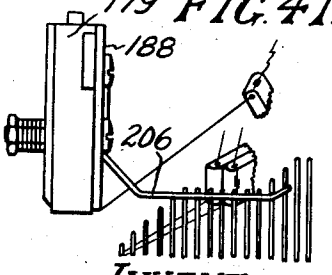


FIG. 41.



INVENTORS:
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NORMAN H. SMITH,
BY Roy F. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 18

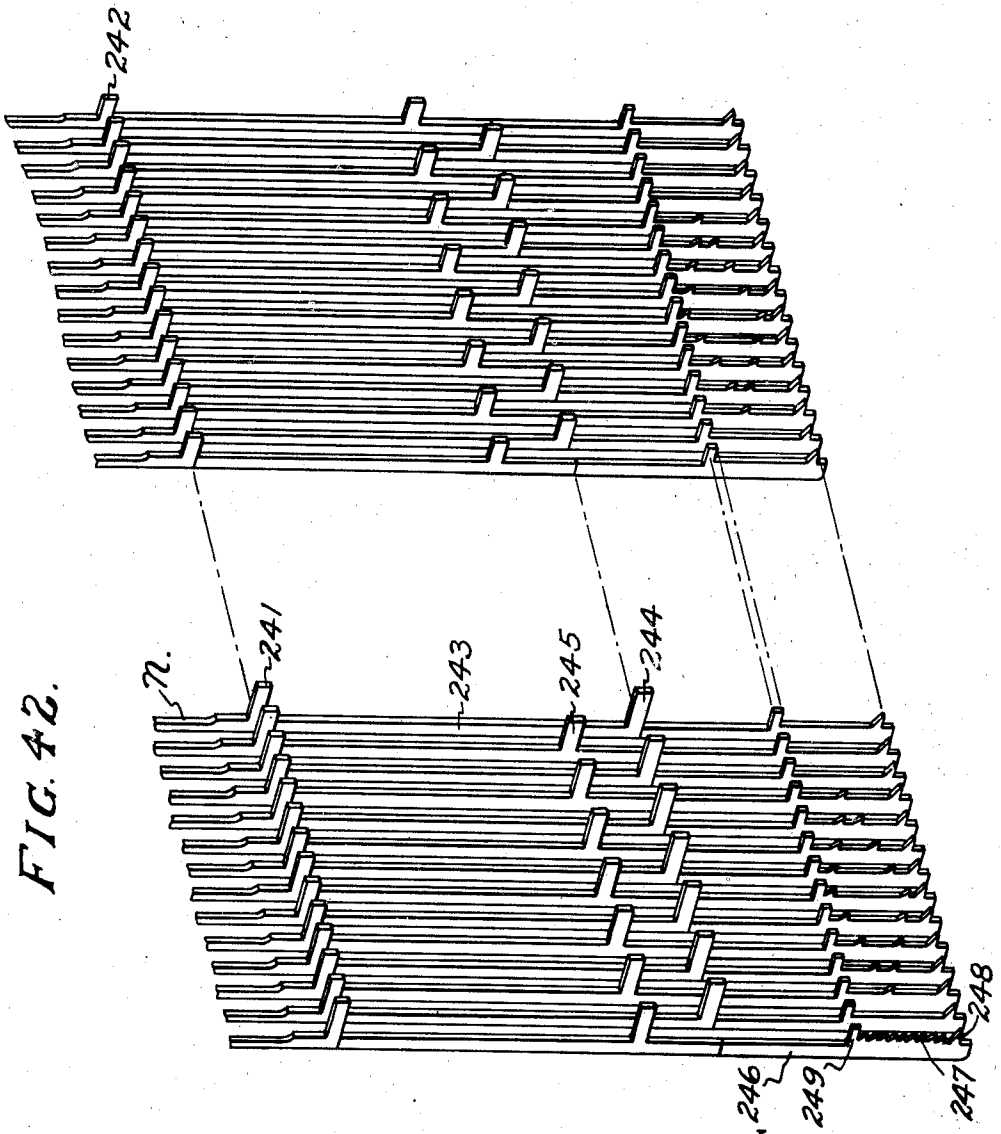


FIG. 42.

INVENTORS:
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BY Roy P. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 19

FIG. 43.

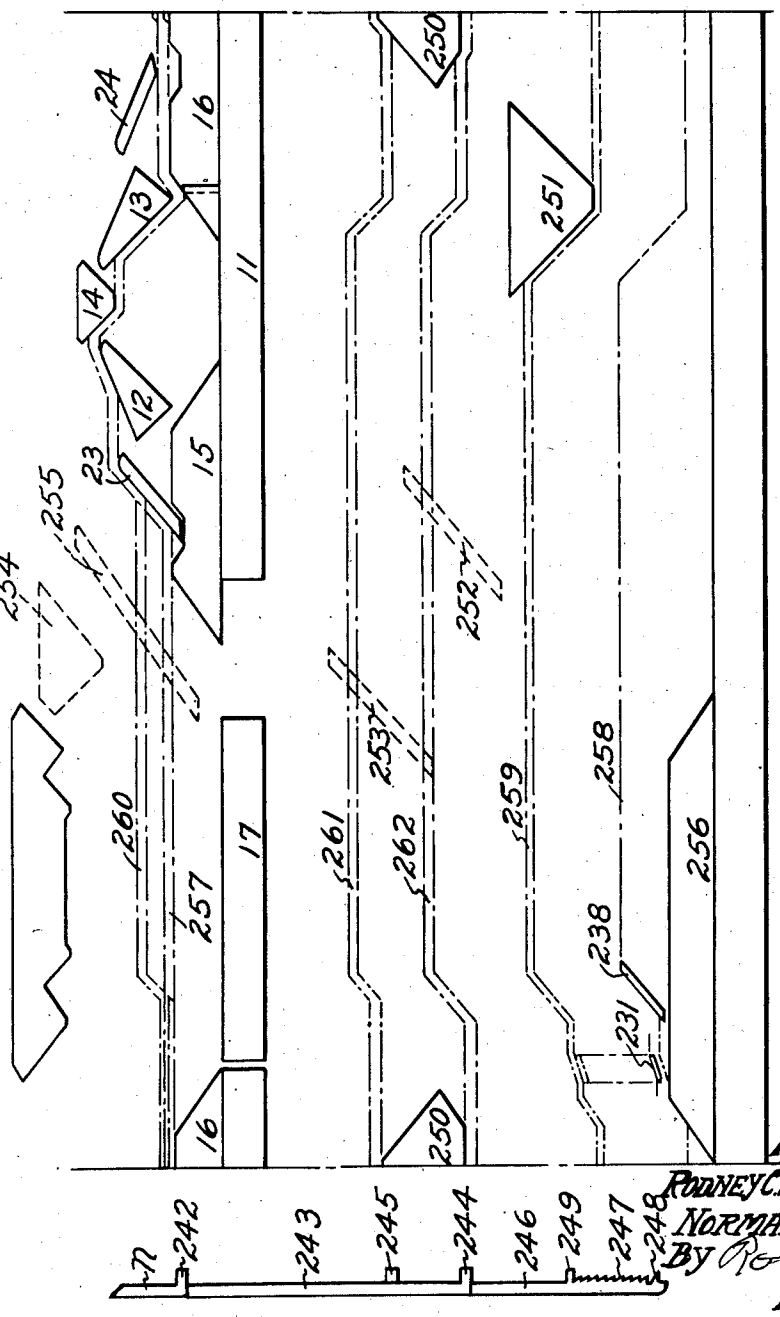


FIG. 44.

INVENTORS:
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NORMAN H. SMITH,
By Roy F. Lovell,
ATT'Y.

Jan. 12, 1943. R. C. SOUTHWORTH ET AL 2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Filed Feb. 25, 1941 20 Sheets-Sheet 20

FIG. 45.

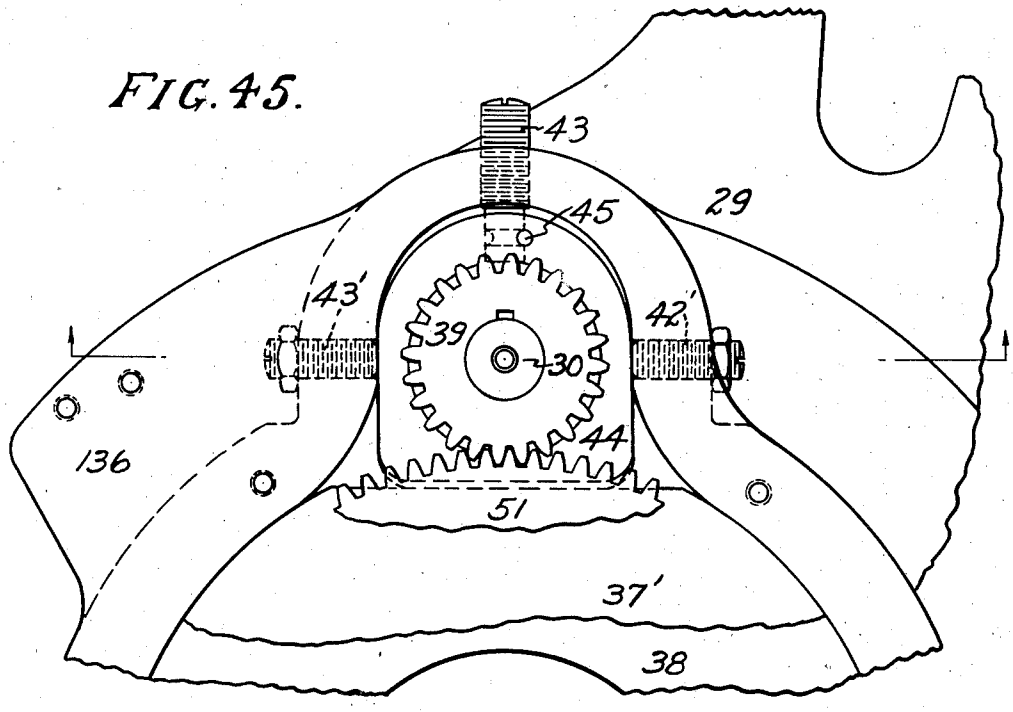
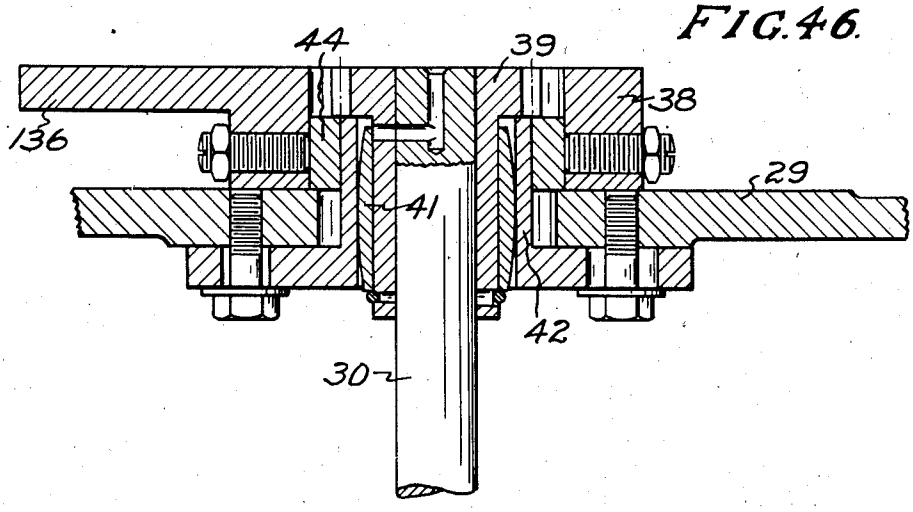


FIG. 46.



INVENTORS:
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NORMAN H. SMITH,
By Roy F. Lovell
ATT'Y.

Patented Jan. 12, 1943 2,307,969

UNITED STATES PATENT OFFICE

2,307,969

AUTOMATIC WRAP STRIPE KNITTING MACHINE

Rodney C. Southworth, Providence, and Norman H. Smith, Pawtucket, R. I., assignors to Hemphill Company, Central Falls, R. I., a corporation of Massachusetts

Application February 25, 1941, Serial No. 380,522
In Great Britain April 3, 1940

24 Claims. (Cl. 66—25)

This invention relates to certain improvements in knitting machines and is specially concerned with, though not limited to, automatic hosiery machines adapted to produce an entire stocking including a ribbed top and to ornament the same with a true wrap stripe pattern, automatically and on a single machine.

According to the present invention there is provided a knitting machine comprising dial mechanism having needles which in one position of said mechanism co-operate with other needles to knit rib fabric, and having wrap yarn feeding means located below the dial itself, the said dial mechanism being movable bodily to another position (e. g. laterally and above that at which the rib knitting is effected), to act as an eccentric wrap yarn feeding device.

One way of carrying out the invention is described with reference to that type of wrap mechanism more specifically described and shown in United States Patent #1,702,608 and to an automatic hosiery knitting machine described and claimed in United States application Serial #86,814, now Patent #2,255,068. This automatic hosiery machine is adapted to knit a rib top (1 x 1) or other rib), then to transfer rib stitches to needles which are to continue knitting plain or jersey fabric. The leg and continuing parts of the stocking are thereafter knitted on one bank of needles only, that is, the usual cylinder needles. A heel and toe are knitted in a reciprocatory manner as is the common practice.

Such machines are necessarily rather complicated and that type of machine to which reference is herein made embodies in its construction a dial having therein dial needles which must be driven in synchronism with a cylinder. During the knitting of rib work dial needles alternate between cylinder needles and rib fabric is produced, whereupon at the transfer, stitches on dial needles must be conveyed on to cylinder needles, preferably those cylinder needles which had hitherto been inactive. According to the particular type of machine herein used by way of example, this transfer is accompanied by a shogging movement of the dial itself and in cooperation therewith a retarding and gaining movement of one set of needles with respect to the other whereby actual engagement of stitches is facilitated. According to Patent #2,255,068 a brake and latch device are employed by the use of which the position of the dial is shogged to a requisite angular extent whenever transfer is to be accomplished. At the same time the brake becomes effective, the drive for the dial is released and allowed to move back a few degrees so that the same may be shogged as above indicated. The retarding and gaining which is to accompany the more or less instantaneous shogging at a desired time is accomplished by means of offsetting the center of the dial relative to the center of the cylinder. This offsetting is but slight in amount and permanently established once the machine is adjusted for proper operation.

Automatic hosiery machines are known wherein true wrap patterns may be knitted in the plain portions of the knitted article. Insofar as is known, these wrap devices are entirely of the concentric type in contrast to eccentric wrapping mechanism functioning as illustrated and disclosed in United States Patent #1,702,608. Therein the wrap yarns are fed to selected needles by means of a disc or equivalent structure rotatable on a vertically moved spindle which is itself rotatable and situated quite a bit to one side of the center line of the rotating needle cylinder. The eccentricity is such that the wrap yarn feeding means overlaps the needle cylinder at one part of its rotation, the actual diameter of the feeding means for the wrap yarns or of the elements through which they are threaded being quite a bit less than the diameter of the needle cylinder for any particular machine. Angular speeds are the same, but the eccentricity makes it possible for wrapping action to occur due to the fact that the wrap means has considerably less lineal velocity than that of passing needles.

This type of wrapping mechanism has certain inherent advantages which recommend its use in all types of hosiery machines, and it is especially desirable that the same be employed in an automatic hosiery machine, that being one of the purposes of the present invention. According to the invention, the rotating dial mechanism is used at the appropriate times primarily as a dial and needles therein will be controlled to participate in the production of rib fabric. At other times the dial structure which, preferably, is mounted on a hollow shaft and has a wrap yarn feeding means located below the dial itself, is bodily moved to an eccentric position and elevated to a sufficient extent so that it may act as an eccentric wrap yarn feeding device. The drive is preferably through a single gear train having a pinion rotated by a ring gear at the base of the machine. A vertical driving spindle extending upwardly from said pinion and carrying a second and similar pinion adjacent the upper part of the machine frame meshes with a similar ring gear by means of which the dial spindle,

which is incidentally the wrap spindle, rotates at a 1 x 1 relation to the needle cylinder. Such a drive is illustrated in Patent #2,255,068.

In one construction according to the invention, the driving means is operable to rotate the dial spindle through a latch mechanism which may be tripped when transfer is to be accomplished, that is, when the dial is to be shogged. A brake, all as illustrated in Patent #2,255,068, functions at that time to make certain that the shogging is positively accomplished. The spindle itself, as before stated, is hollow so that the wrap yarns may be threaded down through the center. This spindle, also, is extended upwardly to a considerable extent, carrying a creel on which the supplies of wrap threads are to be mounted and having the necessary, or at least desirable, tension and yarn take-up devices. At the lower end of the dial is connected a disc or cup shaped element having depending wrap yarn feeding fingers or other means for presenting the wrap yarns to selected needles. This means is of such diameter that wrap yarn presenting means are swung in an arc of appropriate radius for the particular needle cylinder or needle circle diameter in any individual machine.

In the simple type of automatic machine as shown in Patent #2,255,068 the dial spindle is more or less fixedly mounted, although the said spindle is slightly eccentric to bring about the retarding and gaining referred to above. A mounting is provided for this rotating dial spindle which may be movable laterally of the machine and preferably swung about the center of the driving spindle which is more or less at the back of the machine. This mounting takes the form of a movable plate rather than a fixed plate as shown in Patent #2,255,068, although the movable plate is supported and laterally slidable on a stationary plate very much like that now employed. Proper guiding means for the movable plate is provided and is of such a nature that in either of its positions the movable plate will be held quite rigidly and, to all intents and purposes, maintains the rotating structure in definite alignment and properly positioned either at what may be called the dial knitting position or the wrap yarn feeding position. Of course, these positions are maintained by movement of the plate against suitable stops to be readily adjustable. The brake mechanism which is in combination a brake and a latch tripping means is mounted on the movable plate so that it will always be disposed in proper relationship to the brake drum and latch. Certain other controlling means may be mounted on the fixed plate for affecting certain of the dial cams and these are mounted on the movable plate according to the present construction. Links leading to both the brake and the mechanism for controlling dial cams are of considerable length and extend more or less vertically of the machine, so that the swinging of the movable plate will bring about a certain change of this vertical relationship in the said links, but this is of no consequence, since the links are long enough and loosely connected at their ends. Furthermore, the brake and latch tripping mechanism as well as the cam controlling means for the dial are operated, that is, change position, only when the dial is in its central or dial knitting position. The swinging of the movable plate as above described is controlled by certain cams on the machine, and preferably, it will be desirable to swing the combined dial and wrapping means from its so-called central portion after transfer and prior to starting the wrap pattern in the leg of a stocking or other article of hosiery. When knitting in the heel, wrapping is discontinued and two systems may be employed, either of which will remove the wrap mechanism out of engagement or out of a position in which interference might occur between the raised instep needles and the wrap means, or at least the wrap threads themselves. It is preferable at such time that the wrapping means be moved inwardly to its central position. Then both the wrap means and the threads themselves would not interfere in any way with instep needles or with the reciprocatory knitting. Normally the wrapping level is higher than the dial knitting level and since the wrap means is below the dial the spindle and all attached mechanism is elevated considerably after transfer and prior to needle wrapping. During the knitting of a heel or toe the dial and wrap spindle may be elevated still further. This is similar to the movement described in United States Patent #1,702,608 incidental to the same function. After the heel has been knitted and if wrapping is to continue throughout more of the foot, the mechanism will be returned to its wrapping position, whereupon the pattern will be continued. As the toe is knitted, it is preferable to move the spindle inwardly to its central position as during knitting in the heel. Certain manipulation of the brake and shogging means is effected at this time and will be described in more detail in a later paragraph.

The dial shaft and all attached parts must be raised at times as when starting the wrap pattern after transfer, or at other appropriate times, and, if desired, the shaft is maintained in a raised position during knitting of a heel and toe. Provision is also made for lifting these parts upwardly to a considerable extent so that access may be obtained to the space within the needle cylinder or to the parts below the dial as when working upon dial needles or threading up the wrap yarn feeding means which is lowermost beneath the dial. For this latter movement it is not necessary to employ automatic means, as the dial may merely be raised to an additional extent and latched upwardly as is now the practice on these machines in which wrap stripe patterning is not a feature. The automatic raising of the dial is accomplished by a lever having a forked end engageable with a collar on the dial shaft and being pattern controlled to accomplish its function at the appropriate times. This forked lever is similar to that employed on Banner wrap machines of ordinary construction, but is also provided with means for movement laterally without affecting the vertical raising function. This means consists of a support for the forked lever which is preferably rotatable about the driving spindle at the rear of the machine and guided by certain retaining means working within a slot in this support. The construction thus allows swinging of the dial and wrap assembly to the side and permits the same to be raised as desired either in its innermost position or in the wrap position.

The creel on which wrap striping thread supplies are to be mounted consists of a plate rotatable with the dial spindle and having a suitable number of pins arranged at its upper surface for carrying the small tubes or spools upon which wrap threads are commonly wound. At the upper end of the spindle structure is another plate carrying the tensions and take-ups, one of which

normally applies to each wrap thread, these tensions and take-ups being of any satisfactory type, but preferably so arranged that they move inwardly towards the center and guide the yarns towards the upper entrance to the hollow shaft or spindle.

While the supplies of yarn and the take-ups may move upwardly with the hollow spindle, it is preferred that they be mounted on a tubular member outside the hollow spindle, but capable of being driven with that spindle. Suitable splines or sliding keys are employed for the driving of these elements but at the same time allowing the spindle to move freely upward at desired times. It is thus not necessary to lift the weight of the creel mechanism each time the spindle, its dial and wrap thread feeding means are raised.

Selection of needles for determining those needles which are to be raised and thus the ultimate pattern may consist of any satisfactory means for the purpose. Normally jacks are to be employed having a plurality of removable butts and by means of which needles may be raised to an additional height prior to their passing the wrap feeding mechanism so that wrap threads will be presented to any desired needle or group of needles. It is contemplated to employ color within color or color side of color selecting devices if desired, and one example of such selecting means is disclosed in United States Patent #2,167,390, special reference being made to Fig. 31 where a double selection is illustrated operable on jacks beneath needles for raising them to different heights whereby these more intricate patterns may be knitted.. Of course, in such instance the wrap yarn feeding means would have fingers or other elements through which the wrap threads were fed with eyelets at different elevations. The usual mechanism for blocking out the pattern in the sole is to be employed whereby patterns are carried down through the instep but the sole knitted plain.

Wrap mechanism of the present type is commonly used in conjunction with a so-called crescent shaped hook mounted within the needle circle and closely adjacent the latter and at a height so that wrap yarns are held above passing needles except those needles which are selected and raised to a greater height. This hook has the additional function of holding the wrap yarn more or less open or in a loop until said loop or loops of the wrap yarn slide from the point of the hook at which time the wrap yarn plated stitches are practically completed. This avoids tightness in the wrap stitches and is conducive of better wrap patterns and eliminates cutting of the wrap yarns or failure to cast the same over the needle latches if stitches thereof are drawn too tightly. An example of this crescent shaped hook is found in Fig. 24 of United States Patent #1,872,760 and in United States Patent #2,146,750.

A similar hook is employed in the present case but is provided with additional means whereby it may be raised or retracted radially when the dial is moved down within the needle circle, or to dial knitting position. For this purpose the hook is mounted within the carrier ring which extends much higher in this type of machine than in other machines and is recessed especially for the purpose. The hook is supported above passing needles, but the support therefor will project downwardly so that as the hook is first moved inwardly to a position within the needle circle, selected needles may be passed beneath the support although they are raised higher than the upper surface of the hook itself. The support for this hook is also at a higher elevation than that to which needles are raised during heel and toe knitting, namely, the instep needles. When the dial is to be lowered as for knitting a rib top, the hook will be retracted into a recess within the carrier ring, or alternately, may be moved upwardly and outwardly above that ring. In addition to the outward movement, the point of the hook may be retracted so as to avoid interference at the mouthpiece at which main yarns would be fed.

In Patent #2,255,068 in which the automatic type machine is illustrated but does not have provision for feeding wrap patterning yarns, a centrally located binder is employed, this binder being mounted on the dial. The fact that the dial is raised considerably so that the wrap mechanism at the end of the dial spindle may come into use at the appropriate time, makes it preferable to use a binder and cutter located outside the needle circle. These binders and cutters are quite commonly employed and their construction so well known that further discussion is not necessary at this point. The fact that the main yarn feeding means and the binder and cutter for these yarn are located without the needle circle allows the dial to be raised and swung to the side, as for wrapping, without interference with the main yarn feeding function.

At the start of knitting in the heel, it is common practice to raise instep needles, and if a pattern has been knitted to that point, to discontinue the pattern as reciprocatory work is started. The needle selecting devices are temporarily rendered inactive and the wrap yarn feeding means, which incidentally includes the hollow spindle and the dial mounted thereon, are either raised to a height at which they would not interfere with the elevated instep needles, or better still, are swung to a central position, it being quite evident that a swinging movement requires less effort than a raising movement, and for the particular purpose is rather more effective.

After transfer at the top of the stocking and before any wrap patterning is started, the dial will have been shogged by releasing the latch above mentioned. The wrapping mechanism is so timed or so disposed on the dial shaft that it will cooperate to present the wrap threads to the proper needles in this retarded or shogged position if it is also in the position to which it is laterally moved before wrapping starts. Theoretically the wrap yarns would not be fed to proper needles when the wrap mechanism is in any other position, although that matters little since the dial is always shogged and the entire mechanism moved to the wrap position before wrapping commences. However, in the first reverse stroke in the heel, the dial is automatically shogged back to its original position and latched at that position. If left there and a pattern is to be continued down through the instep or further in the foot, the wrap yarn feeding means would not register with the proper needles but would run ahead through an angular distance equal to the angle of shogging. To avoid this the latch operating means and brake, which in the plain machine are employed only prior to transfer, again function so that the dial is shogged back to the same position it occupied throughout wrapping the leg. Thus the pattern is continued in the foot after knitting the

heel and will align properly with the pattern in the leg. Of course, retiming means is to be employed so that the pattern in the foot will be in proper continuation of that in the leg.

The invention is hereinafter described in detail with respect to the accompanying figures of drawings which are illustrative of a preferred embodiment.

In the figures of drawings:

Fig. 1 is a vertical section showing the wrap yarn spindle, driving means therefor and other appurtenant parts;

Fig. 2 is a front elevation of a part of the machine showing controlling means for various cams and other devices;

Fig. 3 is a front elevation showing a portion of the machine and cam control operable during certain of the functions of the machine;

Fig. 4 is a side elevation showing parts of the controlling means which have been illustrated in Fig. 2;

Fig. 5 is a side elevation similar to that in Fig. 4 but showing controlling means at the back of the machine such as has been illustrated from a different point of view in Fig. 3;

Fig. 6 is a sectional view showing certain parts of the machine above the mounting plate and driving mechanism for the dial and wrap spindle;

Fig. 7 is a view similar to that of Fig. 6 but wherein the section has been taken at a slightly lower point illustrating certain mechanism not shown in Fig. 6;

Fig. 8 is a view similar to Figs. 6 and 7, but having parts cut away to show the mounting or bearing for the driving spindle for the dial and wrap head;

Fig. 9 is a view similar to Fig. 8 but wherein the movable part of the mechanism is shown in a different position;

Fig. 10 is a detail of certain of the control mechanism for dial cams;

Fig. 11 is a section taken above the supporting and driving mechanism for the dial and wrap spindle showing driving connections, shogging means and the brake;

Fig. 12 is a sectional view of the mechanism illustrated in Fig. 11;

Fig. 13 is a sectional view taken through the needle cylinder just above the knitting cams, picks, etc.;

Fig. 14 is a sectional view through the cylinder, but taken below the cam plate and illustrating selecting means operable for determining wrap yarn patterns;

Fig. 15 is an elevation showing in more or less detail the connections for raising and lowering the dial and wrap spindle;

Fig. 16 is a section through the part of the machine shown in Fig. 15 and illustrating how the dial and wrap spindle raising means functions when the spindle is moved to either of its positions;

Fig. 17 is a section showing details of a swivel mounting for the raising means of Figs. 15 and 16;

Fig. 18 is a section through the wrap spindle taken just below the dial and showing wrap means in operative position, also such other mechanism as is evident at the carrier ring level;

Fig. 19 is a fragmentary section taken through Fig. 18 and showing the manner in which wrapping is accomplished;

Fig. 20 is a detail view of a means for maintaining the movable wrap yarn controlling hook in position;

Fig. 21 is a section through the needle cylinder and dial structure showing the relative position of parts as rib knitting is accomplished;

Figs. 22–29 are detail views showing wrapping of needles and the control of the wrap stitch by the so-called hook, also some of the details of that hook and its relative position to needles and sinkers;

Fig. 30 is a section taken just above the carrier ring and showing the wrap yarn controlling hook swung to inactive position;

Fig. 31 is an elevation of the same parts shown in Fig. 30;

Fig. 32 is a detail of the wrap yarn controlling hook actuating means;

Fig. 33 is a plan view showing part of the carrier ring, some of the needles, yarn feeding levers, controlling means therefor and the binder and cutter;

Fig. 34 is a sectional view of main yarn feeding means and control therefor such as illustrated in Fig. 33;

Figs. 35–41 are views showing the binder and cutter, controlling means therefor, details of the same and the manner in which it functions to bind and cut a main yarn or yarns;

Fig. 42 is an isometric view showing a butt arrangement for needles, rib knitting, transfer jacks and pattern jacks;

Fig. 43 is a diagrammatic view showing the pathways of needles, rib knitting, transfer jacks and pattern jack butts during wrap yarn knitting;

Fig. 44 is a detail of part of a needle and jack associated therewith;

Fig. 45 is a plan showing a fragmentary part of the driving mechanism for the combined dial and wrap spindle;

Fig. 46 is a section taken horizontally through the spindle in Fig. 45.

General machine characteristics

Now referring to Figs. 1, 2, 3, 4, 5 and 13, the invention is described as applied to a circular, hosiery machine of the independent needle type. This machine will preferably, although not necessarily, have latch needles in both a cylinder and dial, and the construction is such that transfer of dial stitches to cylinder needles may be effected. The machine is built up about the usual frame and circular base 1, has a cylinder 2 and sinker assembly generally indicated by numeral 3. The cylinder is slotted for the reception of needles and jacks, two of which are to be employed beneath each of the needles. The sinker assembly includes the usual sinker head, sinker cam cap and sinker cams therein which function upon sinkers so that they may act in holding the web down upon needles and in casting off loops in a normal fashion. As shown in Fig. 2, a yarn lever control box 4 is supported on circular base 1 and encloses certain controlling mechanism functioning from pattern control on a main pattern drum on the shaft 5, Fig. 3. This control is well-known and need not be illustrated except for certain details with respect to parts at the main yarn feeding levers as will be described in a later paragraph. The cam shaft 5 has many other cams thereon which govern the operation of the machine at certain phases in its cycle, but herein, only those functions which intermittently affect the present invention will be discussed. A second

or auxiliary cam shaft 6, Figs. 2, 4 and 5, carries drums 7 and 8, each of which is provided with several cams serving to control other phases of the cycle of knitting not governed by those cams on the main cam shaft. This second or auxiliary shaft 6 is driven by gearing diagrammatically illustrated within a closure 9, Fig. 5.

Many cams function upon both needles and jacks, but most of these have been described in the original disclosure of the basic machine herein involved, that disclosure being evident in Patent #2,255,068 and it is not considered essential or appropriate to go into detail in this particular case. A main cam block 10 is supported upon cam plate 11, Figs. 2 and 13, and stitch cams 12 and 13 perform the usual function of actuating needles during rotary and reciprocatory knitting. A center cam 14 serves in conjunction with raise cams 15 and 16, Fig. 43, in leveling and further affecting movement of needles throughout the knitting cycle. At the opposite side of the machine a second plate 17 supports widening picks 18 and 19 and controlling mechanism therefor including a wing cam 20, the construction and function of which are well-known to those skilled in the art. Likewise, at the main yarn feeding side of the machine, narrowing picks 21 and 22 serve their intended function.

Cams 23 and 24 act to control needles, all as described in said Patent #2,255,068. A so-called instep cam bracket 25 is mounted at the base of the machine and carries many cams including the instep cams for raising long butt needles prior to heel and toe knitting and lowering them at the termination thereof, also other cams which function during rib knitting and transfer. All these cams and the precise operation of the same are thoroughly described in the above-mentioned application.

The machine has a dial assembly including the usual slotted dial member for the rib needles, a driving spindle for this dial and supporting means for the same. In addition to serving as a dial during rib knitting, the same spindle is so controlled and provided at its lower end with wrap yarn feeding means that it serves during plain (not rib) knitting to feed wrap yarns to certain selected needles. The support, Figs. 1, 2, 4, 5, 13, includes an upright bar 26, posts 27 and 28 and a plate 29 adjustably fixed at the upper ends of the said bar and posts. This plate 29 has a central opening therein through which the wrap yarn spindle passes and also has a bearing for the upper end of a shaft 30 which is a dial drive shaft having a pinion at its lower end driven by a ring gear beneath the cylinder.

Combined dial and wrap spindle

Referring to Figs. 1, 2, 4, 6, 7, 8, 9, 11, 12, 18, 19 and 21, a rotatable spindle carrying a dial and combined wrap yarn feeding means are illustrated. A central spindle 31 formed as a hollow tube is mounted vertically of the machine and is to be rotated at a 1 x 1 relationship to the needle cylinder. A mounting for this spindle is provided which allows the same to rotate as above explained, also provides for swinging the same to and from a position centrally of the needle cylinder in which position rib knitting is done and a second position eccentrically of the needle cylinder in which wrapping is accomplished by a method similar to that of United States Patent #1,702,608. At such times as neither rib knitting nor wrapping are to be done, the said spindle is preferably moved toward central position while being maintained elevated as will hereinafter be described in detail. This spindle 31 has adjacent its lower end, Figs. 19 and 21, a dial 32 having therein dial needles 33 divided into the usual long and short butt series. These needles are of the latch type and have shoulders on them for assisting in the transfer of stitches, and are otherwise constructed, as in Patent #2,255,068, that construction and method of transfer not being necessary of description here. A dial cap 34 is stationarily supported by a tube or sleeve 35 so that cams such as the cams 36 and 36' may perform their intended functions of guiding needles in rib knitting, transfer or may maintain said needles in a retracted position after transfer has been completed.

This sleeve 35 in which the spindle 31 turns has a bearing within a hub 37, Figs. 1 and 12. Hub 37 is flanged as at 37' and that flange is in turn attached by bolts or screws to a movable plate 38. This movable plate is to be swung about a pivot determined by the drive spindle or shaft 30 so that no matter what position the wrap spindle 31 takes, the dial will be permanently maintained and is, in fact, the center about which the whole dial and wrap assembly is swung.

Details of a bearing for the swinging of this plate 38 and for the drive spindle 30 are shown in Figs. 1, 4, 45 and 46. The spindle 30 has a pinion 39 keyed thereto by key 40, this pinion having an elongated hub about which is placed a self-aligning bushing 41. A second flanged bushing 42 is maintained in position by bolts passing through enlarged holes which attach it to plate 29. The bushing 42 may be adjusted by loosening these bolts and moving the bushing until spindle 30 is properly positioned. Set screw 43 is threaded into plate 38 and also passes into a block 44 (Figs. 1, 7, 45 and 46) within which the upper end of bushing 42 projects. A pin 45 is driven down through block 44 and maintains the end of set screw 43 within block 44 by engagement of a recess in the set screw. From this construction it can be seen that the spindle 30 and pinion 39 may rotate freely within bushing 42 while the plate 38 may be swung to and fro about the spindle 30 as a center since the same bearing within which the spindle 30 and its attached parts turns also allows the plate to be swung about those first mentioned elements as a center. The top of plate 29 is machined off and the lower end of plate 38 makes a fine working fit thereon so that these elements serve to support the central spindle 31 steadily and in true vertical alignment. The bushing 42 flanged at its lower end in combination with block 44 provides an adjustment so that plate 38 is maintained tightly downward against the plate 29 although the same is freely slidable thereon.

As shown in Figs. 45 and 46, the block 44, adjustable by means of a screw 43, is held in adjusted position by means of locking screws 42' and 43'. Since pinion 39 is keyed to shaft 30 and that pinion contacts the upper edge of block 44, and the block is locked by screw 42' and 43' within the plate 38, the plate is maintained downwardly against the upper surface supporting plate 29. In Fig. 46 the adjustable connection for the bushing 42 is illustrated. The left hand flange of the said bushing is slotted in one direction while the upright flange is slotted in the other direction. The attaching bolts may be loosened and by means of these slots, position of the shaft 30 varied in such a way so as prop-

erly to center the combined dial and wrap spindle 31.

The front end of plate 38 is maintained in position and is guided by a flange 46 attached above an arcuate guide 47. As shown in Fig. 7, the inner curvature of guide 47 is such that as the plate 38 swings about spindle 30, guiding and restraining relationship will be maintained.

The sleeve 35, Figs. 1 and 12, is to be restrained from turning although the same is to be moved vertically at desired times. A collar 48 is bolted to the flange 37 and has a key 49 fixed within a keyway but which has a sliding fit in an elongated keyway 50 in the sleeve itself. Since flange 37 is permanently attached to plate 38 and collar 48 is in turn attached to the flange, the said key will prevent rotation of sleeve 35 and its attached parts although the same may be moved up or down due to the sliding provision afforded by the elongated keyway 50.

A gear 51 meshes with the pinion 39 and has a hub 52 upon which said gear rotates on the outside of the sleeve or hub 37. Above this hub 52 a combined driving and brake drum 53 is also rotatable on the element 37. There is a connection for driving between the gear 51 and the combined driving and brake drum 53 which will be described in detail in a later paragraph. The drum 53 is maintained in position by a washer 54 detachably connected at the upper end of hub 37 but overhanging the same so as to engage within a shouldered recess in the drum 53 all as shown in Figs. 1 and 12.

A supporting flange or disc 55 rests upon the upper face of drum 53 and is attached thereto as by bolts or screws 56 so that the two elements rotate together. Above this disc 55 and extending centrally thereof, a tube 57 having a shouldered flange 58 at its lower end extends upwardly and carries upon a second similar flange or shoulder 59 at its upper end, a second disc 60. Screws 56 attach flange 58 to drum 53 and also pass through disc 55 That disc is permanently attached so that drum 53, disc 55, tube 57 and disc 60 are rotatable as a unit.

A tube or sleeve 61 works within the tube 57 and is set screwed to central spindle 31 by means of a screw 62 so that as this tube 61 rotates the central wrap spindle will be rotated also. A key 63 is fixed at the upper end of tube 57 and drives the sleeve 61 through the elongated keyway 64 in the latter. The position of the wrap and dial driving spindle 31 is determined by an adjustable collar 65 which regulates the height of those elements, a leather washer 66 serving to lessen the shock as the dial and wrap heads are lowered after being elevated. The leather washer 66 bears upon a second washer 67 fixed above the disc 60. Screws passing through washer 67 are threaded into shoulder 59 and also serve to hold disc 60 positioned.

The height of dial cam plate 34 is regulated by an adjustable washer 68, Figs. 1 and 12. Sleeve 35 has a shoulder 69 which engages above this said washer 68 and as the washer is adjusted vertically by means of adjusting screws 70, the position of the sleeve and attached parts including dial cam cap 34 is accordingly varied. Locking screws 71 fix the adjusted position of washer 68 and thus the height of the dial cams. Naturally the dial cams must be adjusted properly to engage butts on dial needles and this adjustment is herein shown to be independent of that for the central rotatable spindle 31, the latter serving to determine proper position of the rotatable dial itself.

The disc 55 mounts the wrap yarn spools 72 in more or less conventional manner. The wrap yarns *w* are drawn off and pass up through eyelets 73 to yarn locking and take-up mechanisms which are carried by the upper disc 60. These take-up devices include a post 74 with a swinging take-up arm 75 hinged adjacent the upper end of the post. A spring 76 normally draws the inner end of the take-up arm upwardly, the yarn being threaded through an eyelet 77 in the inner end of that take-up arm. The upper end of each post 74 is slotted and the yarn passes through said slotted portion beneath a locking or clamping element 78 which is at a short, curved end of a lever 79 also pivoted as was the take-up arm itself. This lever 79 curves upwardly at 80 and has a bent end which is engaged by the take-up arm 75 so that as a wrap yarn is drawn, take-up arm 75 is pulled inwardly against the tension of spring 76 until said arm contacts the aforementioned end of the lever 79. Then that lever 79 is in turn moved so as to release the yarn at the clamping or locking point. A spring 81 maintains the arm or lever 79 in a yarn clamping position except as the take-up arm is moved downwardly to release it. An attached piece 82 has eyelets 83 and 84 through which the yarn is threaded and by means of which it is more effectively guided. All wrap yarns are threaded down through the central opening in the spindle 31, that central opening being finished smoothly so that said yarns encounter no sharp corners or abrasive surfaces and are frictioned only slightly in their passage through this elongated opening.

Referring to Figs. 18, 19 and 21, the dial hub 85 has been turned down and a wrap head 86 is fixed to the hub carrying wrap yarn guiding fingers 87. These fingers have eyelets 88 and 89 through which the wrap yarns are threaded as they emerge from the lower end of spindle 31. This wrap head is of a diameter substantially less than the diameter of the needle circle and when moved to central, or approximately central, position, the wrap yarns will merely pass to the fabric indicated at *f* which is being drawn down within the cylinder. When in wrapping position as shown in Fig. 19, the fingers 87 are moved in a circular pathway eccentric of the needle circle and at the same angular speed as the needles. However, since the lineal speed is less, needles raised as hereinafter described take the wrap yarns and will plate them over knitted stitches of body yarn. The method of wrapping per se is substantially like that of United States Patent #1,702,608.

Drive and shogging means for dial and wrap spindle

Referring to Figs. 1, 4, 5, 6, 7, 11 and 12, the shaft 30 is driven from a ring gear (not shown) below the cylinder, and which meshes with a pinion at the lower end of that shaft. Pinion 39, as before stated, then drives gear 51, the ratio being unchanged so that the gear 51 rotates 1 x 1 with the needle cylinder. Gear 51 is maintained in position and is partially enclosed by a two piece cover or casing member 90, 90'. The drive from gear 51 to the combined driving and brake drum 53 is substantially like the drive described in Patent #2,255,068. The hub 52 of gear 51 has two projecting dogs 91 and 92 into which are threaded screws 93 and 94. Those screws are adjustable and may be locked in any

adjusted position. Attached within drum **53** so as to project downwardly is a driving lug **95** which extends or is positioned between the inner ends of the screws **93** and **94**. An adjustable segment **96** is attached to the top surface of the gear **51** and has a spring pressed latch **97** notched to engage the lug **95**. Such engagement is illustrated in Fig. 7 and when the parts are thus positioned, the gear **51** will drive the drum **53** through the latch **97** and lug **95**. There can be no backlash, and during reciprocatory knitting, the latch drives in one direction while screw **93** forces movement in the opposite direction.

During transfer, as explained in Patent #2,255,068, latch **97** is tripped by the contact piece **98** at the inner end of lever **99** pivoted on a bracket **100**, thereby disengaging the lug **95**. Resistance to driving naturally retards or shogs the dial backwardly so that displacement of dial needles with respect to cylinder needles results. The screw **94** then becomes the driving connection rather than the latch and adjustment of that screw is such as to maintain proper driving relation during transfer. In a plain machine such as described in Patent #2,255,068, the dial is immediately moved to inactive position, or at least, the dial needles are retracted so that the relative position of the dial is unimportant until another rib top is to be started. As a matter of fact, the dial continues to rotate in retarded position until the first reverse stroke is knitted in the heel whereupon latch **97** will again spring inwardly to engage lug **95** as illustrated in Fig. 7. From that point the two remain in driving engagement until another transfer is reached.

In a machine of this type, after transfer is effected, there is no simple way to bring the dial and the attached wrap mechanism back to its original driving position until heel knitting starts. The timing of the wrap needle selection and association of parts is such that wrapping takes place while the dial and wrap head are in retarded position. This merely means that when the wrap pattern starts after transfer, the position of wrap yarn fingers relative to selected needles which are to function in taking wrap yarn from any particular finger are so timed as to operate while the wrap head and dial are in that retarded relationship.

Of course, when the heel is made at termination of knitting in the leg, the dial and wrap spindle drive will again occupy its latched position, Fig. 7, and if a pattern were to continue after knitting of the heel as normally is the case, at least throughout the instep, that pattern would be affected since the relation between wrap yarn fingers and the raising of selected needles would differ from that previously prevailing throughout knitting in the leg. The latch **97** is then tripped a second time and the dial and wrap mechanism are retarded so that the same relationship applies throughout knitting in the leg and also in the foot.

A brake generally indicated by numeral **101**, Figs. 7, 11 and 12 is pivoted within a bracket **102** and is applied at transfer and also after knitting the heel, that is, at each time the latch is tripped, so as to retard the dial immediately and positively.

As drum **53** is driven, the unit including the said drum, disc **55**, tube **57** and disc **60** are likewise rotated. The sleeve **61** is turned therewith through key **63** and since sleeve **61** is set screwed to the upper end of the spindle **31**, that and attached parts at its lower end are likewise driven. Since the center about which plate **38** is moved or swung when changing from dial knitting to wrap knitting and vice versa is the center of shaft **30**, the drive is always maintained in proper relationship for whichever condition prevails. Actually the center of spindle **31** is slightly offset with respect to the direct center of the needle cylinder, this for the purpose described in Patent No. 2,255,068.

Spindle raising means

Referring to Figs. 1, 2, 3, 5, 15, 16, 17 and 21, the spindle assembly including the central hollow spindle **31**, the sleeve **35** and driving sleeve or tube **61** may be raised at desired times thereby elevating the dial and wrap mechanism beneath the dial. A collar **103** having a groove **104** is fixed to the sleeve **35** and is engaged by the forked ends **105** and **106** of a lever **107**. The lever **107** is pivoted at **108**, a shoulder screw threaded into a block **109**. The block **109** is in turn capable of being swung about a vertical axis which includes a larger shoulder screw **110**. That shoulder screw is held within a bracket **111** supported by post **112**.

At the outer end of lever **107** is connected a depending rod **113** which extends down and is adjustably connected at **114** to another lever **115** pivoted at **116** and having a toe **117** engageable by certain cams on drum **118**. These cams are of a height sufficient to raise the wrap and dial spindle mechanism through the range just described so that the dial may be elevated and the wrap head brought to such a position that the wrap yarn feeding fingers will just feed their yarns to the hooks of selected needles. The timing of these cams may be varied according to the rib top to be knitted, wrapping of pattern yarns at desired parts of the stocking, and movement of the dial and wrap spindle mechanism.

In the preferred embodiment of the invention as herein set forth, heel and toe knitting in which instep needles are elevated as is the usual practice are accompanied by a swinging movement of the wrap spindle to, or approximately to, its central position. It is only necessary to swing the spindle inwardly toward central position so that wrap yarns and wrap yarn feeding fingers clear the raised instep needles, thus less interference with the binder and cutter is occasioned, also cam movement for the purpose is an easier one.

As an alternative, cams affecting the lever **115** may be of such a height that in heel and toe knitting the wrap mechanism will be elevated additionally, that is, to such a height that interference is avoided even though the wrapping means is still maintained eccentrically of the needle cylinder.

According to the preferred movement for the purpose just indicated, one cam will function to raise the dial and wrap spindle mechanism just after transfer. It will be raised to a proper wrapping height. That height is to be maintained until the knitting of the next rib top whereupon the wrap mechanism and the dial are dropped to such a position that the dial may properly knit in the rib work. The mechanism for swinging the wrap spindle to and from the center and its eccentric position is such that the movement may occur when the spindle is at any height except, of course, the swinging to eccentric position can not or should not be done until the dial has been elevated to avoid mechanical interference. When dropped to the lowermost position, shoulder **69** on sleeve **35** limits down-

ward movement of the dial cam cap 34 and attached parts. The adjustable collar 65 and washer 66 limit downward movement of sleeve 61 and the central hollow spindle 31. As before explained, either of these may be adjusted while elongated keyways 50 and 64 allow upward movement of the parts without affecting the rotation or non-rotation thereof and it is obvious that collar 103, when raised, lifts the non-rotating sleeve 35 which in turn pushes upwardly on the rotating sleeve 61 correspondingly elevating the same and raising spindle 31 and those rotating parts carried thereby.

Means for swinging dial and wrap spindle to and from wrap position

Referring to Figs. 1, 3, 4, 6, 7, 8, 9, 15–17, the plate 38 which centers and supports the whole dial and wrap spindle assembly is to be swung about the center 30 by means of cam control operable in timed relation throughout the various phases of the knitting. Movement of plate 38 is limited by stopping means including an adjustable stop screw 119, Figs. 6 and 7. That screw is threaded through a lug 120 and is locked in an adjusted position by means of lock nut 121. A flattened extension 122 on the plate 38 engages against said screw 119 when the spindle mechanism is in the position of Figs. 7 and 8. That is the so-called central position.

At the other side a stop screw 123 is likewise in position to abut against that side of the plate 38 whenever the same is moved to the wrapping position. A corresponding adjustment and locking of the screw in position are provided by lock nut 124. In Figs. 6 and 9 the assembly is shown in the wrapped position.

The movement of the plate 38 from one position to the other is accomplished by means of cam control from a drum 125 having cams 126 and 127 adapted to engage the toe 128 of a lever 129 pivoted at 130. That lever is connected to an adjustable link 131, Fig. 4, which is in turn connected to a bell crank lever 132 pivoted at the forward end of a projecting stud 133. That bell crank lever connects by means of a link 134 to a connecting point 135 at the forward part of plate 38, that is, the side of that plate opposite the pivotal point 30.

As the lever 129 is raised by one of the cams on drum 125, the plate 38 will be moved toward the central position to be occupied thereby. When the toe of the lever drops from a cam on to the drum itself, the mechanism moves to opposite position wherein the wrap spindle and attached parts may accomplish the intended function of feeding wrap yarns to selected needles. Cam 126 is shown in full height and is adapted to move the plate 38 to central position as for rib knitting. Cam 127 is not so high and merely serves to move the wrap plate and parts supported thereby sufficiently close to the center of the machine to avoid interference between wrap mechanism, wrap yarns and raised instep needles at heel and toe knitting. All cams may be of full height such as cam 126, in which event, during heel and toe knitting, the plate will be moved completely to central position.

The movement of the plate 38 does not affect the function of the raising mechanism since the block 109 to which lever 107 is pivoted, Figs. 15–17, is also adapted to swing about a pivot point 110. That pivot point 110 is close enough to the pivot 30 so that the lever 107 swings with the plate and proper maintenance of the wrap spindle height is not adversely affected. The bracket 100 within which lever 99 is pivoted is mounted on an extension 136 which projects from the plate 38. That is, the tripping of latch 97 by the element 98 may take place no matter what position is occupied by the plate 38. The tripping mechanism moves with the plate and always bears the same relationship to latch 97. This tripping mechanism is controlled by connection through a link 137 which extends downwardly to connect to a lever 138 and that in turn is moved by certain cams on one of the cam drums on shaft 6. A spring 139, Fig. 12, normally urges this link in a direction so that the toe of lever 138 is maintained downwardly upon the cam drum or a cam on that drum. Compared to the length of link 137, movement of the support and lever 99 is so slight that no appreciable difference is encountered to affect the function of these parts in any of the positions of plate 38.

The link 131, Fig. 4, is likewise urged in one direction by spring 140 so that the plate 38 is spring urged toward the wrap position and normal adjustment of parts is such that toe 128 of the lever 129 would not quite touch drum 125 when the plate was up against stop 123. Adjustment of link 131 allows precise movement of plate 38 into contact with stop 119 as shown in Fig. 7.

The brake 101 is not intended to be actuated except when the spindle is in central position. Thus the bracket 102 which supports the brake is fixed at the front of the machine on plate 29.

Control for dial cams

Referring to Figs. 2, 4, 8, 9 and 10, the control for dial cams has been modified somewhat over that shown in Patent #2,255,068, the changes being due mainly to the fact that the dial cams must be maintained in definite positions even though the position of the dial is varied vertically and also swung to different positions. The immediate control of dial cams is through plungers or sliders 141 and 142. The first of these controls the stitch cams while the second actuates the transfer cams. At the outermost end of each of these sliders is a roller 143 and 144 and the said sliders are momentarily urged inwardly by springs 145 and 146. Two bell crank levers 147 and 148 are pivoted on a bracket 149 which is in turn attached to the underside of plate 38, see Figs. 8 and 9. The plate 29 has a circular opening cut out at the left corner of each of Figs. 8 and 9, so that as the dial and wrap spindle mechanism are swung to wrapping position, Fig. 9, the bracket 149 will not interfere with the plate 29.

The levers 147 and 148 are formed with two arms at approximately 90 degrees from each other one of which extends approximately vertically, the other extending more or less in a horizontal direction. The vertical extension of each of the levers contacts with one of the rollers, lever 147 contacting roller 143 and the end of lever 148 contacting roller 144. Each of the horizontal arms of the levers is bent angularly as at 150 and 151. The bent ends are connected to depending links or rods 152 and 153. These are in turn connected to levers such as the lever 154, Fig. 4, having a toe 155 engageable by appropriate cams on drum 8 which will bring about movement of the dial cams as described and explained in Patent #2,250,068.

Each of the rods 152 and 153 connects by means of a slot at its upper end to a shoulder

screw threaded into the bent portions 150 and 151 of the levers. As the dial and wrap mechanism are moved to wrap position, these slots compensate for change of position and for the different angular position then occupied by the said rods or links. Movement of dial cams are made only when the dial mechanism is in central or rib knitting position. However, these cams are maintained in such position that the sliders 141 and 142 are drawn forwardly or against the tension of springs 145 and 146 at all other times. The movement from central position to wrap position would necessitate extremely fine adjustment and some compensating effect for the control mechanism applicable to these cams and sliders if it were not for employment of a special device as hereinafter explained.

As illustrated in Figs. 2, 4 and 10, a retaining catch is attached to the plate 29 and has a lever engaging projection 156 at such an elevation that as the plate 38 is swung to wrap position, the horizontally disposed arms of the levers 147 and 148 are engaged by an inclined edge 157 and then rest upon the extension 156. In that position the sliders 141 and 142 are maintained outwardly against their springs and angular movement of the rod 152 and 153 has no effect on the actual position of the dial cams.

As an alternative, the sliders 141 and 142 are sometimes pulled outwardly far enough so that change of angular position for the rods 152 and 153 may allow the said sliders to move inwardly to some extent, but not enough to vary the cam position to a noticeable extent.

Main yarn feeding

Referring to Figs. 2, 33 and 34, a carrier ring 158 has several yarn feeding levers 159 pivoted at 160 and urged by means of springs 161 into a lowermost or a feeding position. Yarns are to be mounted on the usual creel and as indicated at *y* are fed down through plate 29, Fig. 7, through eyelets 162, then through a series of eyelets 163 and to the respective yarn feeding levers 159 by means of which they are to be fed. The pivot 160 is lower in this particular machine than in other machines of the Banner type so that as the said levers are moved upwardly, they do not swing inwardly to the needle circle. This avoids any interference with the dial as the same is raised from knitting position, or as it is swung to central position while elevated to the level it occupies during wrap knitting. All the levers 159 may be raised at once by a cam 164 which is to be manually operated by the short lever or handle 165.

At the upper end of yarn lever box 4 several sliders 166 engage projections 167 on levers 159. Each of the sliders 166 is in alignment with and may engage a projection on its cooperating lever. Pivoted at 168, are a corresponding number of levers having depending arms 169 and more or less horizontally directed arms 170. Inclined edges 171 on these levers engage the outer ends of the sliders 166 and as a lever is swung about its pivot, the slider will be pushed inwardly engaging projection 167 of a corresponding yarn feeding lever 159 thereby elevating the same against the tension of its spring 161 so as to withdraw a yarn fed thereby from the needles. The ends 170 of the bell crank levers pivoted at 168 have connecting wires which are pulled downwardly by mechanism described in United States Patent #933,443, or by any other satisfactory cam mechanism operable to control yarn change.

One or more of the yarns to be fed may pass through a disc or other tension such as the tension 172, Fig. 7, that is of conventional construction and is to be opened and the yarn released to run freely by a lever 173 pivoted on a bracket 174 and operable by a connection such as that at 175 which is in turn caused to function by cam means not shown or described here.

Binder and cutter

Referring to Figs. 33–41, a binder and cutter has been illustrated which is capable of being moved outside the needle circle, but which normally functions just inside the needle circle in taking in or releasing yarns. Whenever the dial is to be raised the binder and cutter unit is swung to a position out of the way and wherein there will be no interference. The swinging movement does not interfere with the yarn being held in the binder, although no action of the same is ever contemplated except when the assembly is in its operative position.

Bent strip or bracket 176 is attached to the side of the carrier ring 158 and pivotally supports on a bolt or screw 177 a main binder and cutter frame 178. The frame 178 is shown in detail at Fig. 40 and has a downwardly projecting part 179 which is slotted vertically while the horizontal portion has a slot 180 of lesser depth than the slot above mentioned, indicated at 181. A beveled part 182 at the lower end of the projection 179 acts in conjunction with a horizontal edge 183 as the lower part of a binding and cutting element. A lever 184, Figs. 33, 35, 36 and 37, is pivoted at 185 on a projecting support 186 and has a bent end 187 which engages beneath the horizontal part of the binder frame 178 and raises the same to the dot and dash line position of Fig. 37 at desired times. The lever 184 is actuated by connections to certain cams on any convenient cam drum, the particular drum and cams not being illustrated in this case.

At one side of the part 179, a slide 188 is attached by means of bolts or screws 189 and 190 which project through slots in the part 179 and also engage a second plate 191 which is sharpened at its lower end to form a cutter blade. A spring 192 on the lower bolt 190 serves to press the binder slide and the cutter blade together against the slides of the binder frame. Within the slot 181 a vertically movable plunger 193 is allowed to slide up and down since it has a working fit in the slot or groove 181 and is also slotted for the reception of bolts 189 and 190. A spring 194 presses downwardly on this plunger and the lower edge thereof is beveled to form a divergent angle with the beveled surface 182 to facilitate entrance of the yarn or yarns. The spring pressure on plunger 193 is relatively light and that merely serves as an auxiliary binder for holding in those yarns not to be withdrawn whenever yarn change is made and the binder and cutter are purposely opened.

A slide 195 works in the slot 180 and has a cam slot 196 which engages the bolt 189 so as to raise the binder and cutter elements 188 and 191 whenever the said slide 195 is drawn outwardly or to the position of Fig. 36. A spring 197 normally maintains the slide 195 in a position in which the binder and cutter remain closed, that is, the position of Fig. 37. A second spring 198 holds the entire assembly in the working position, Figs. 36 and 37, except when raised by mechanism described with respect to lever 184. A stop screw 199 is adjustable and limits the downward posi-

tion of the binder and cutter assembly so as to maintain the same slightly above the top of dial cam cap **34**.

A lever **200** is also pivoted at **177** and is releasably engaged with a shoulder screw **201** at the upper end of link **202**. This link **202** is the binder operating link and whenever the binder is raised in inactive position, the link is disengaged, but is immediately reengaged upon return of the binder to its natural working position. The lever **200** has an angular projection **203** which engages a roller **204** at the end of slide **195**, the slide actually being drawn outwardly against the tension of spring **197** whenever the binder and cutter are to be operated. A plate **205** attaches at the side of slot **180** and retains the slider **195** in position.

A wire **206** is bent as indicated in Figs. 33, 34 and 41 and attaches at the side of the binder and cutter frame so that the wire moves with the unit when it is swung to and from operative position. This wire serves to guide yarns which are being drawn into the binder and cutter, that is, within the divergent angular opening presented by surface **182** and the lower part of the plunger **193**. It also assists in introducing yarn to the needles since, as shown in Figs. 33 and 34, the yarn is held at a low position just inside the needle circle and when a lever is dropped to feeding position, that yarn is very effectively cut across the needle circle and is more readily taken by an intended needle.

The active position of these elements is that of Fig. 36 in which it is shown just above the dial. Whenever the dial is to be raised as it is after transfer, the lever **184** will swing the binder and cutter assembly to the dot and dash line position of Fig. 37. The dial spindle is immediately moved outwardly to wrap position and the binder and cutter are then moved back to operative relationship to the remaining parts of the machine.

During heel and toe, the movement of the dial and wrap mechanism to the center or toward the center does not interfere with the binder and cutter, although that must be raised again to allow the dial to move to its knitting position prior to starting another rib top.

Wrap yarn controlling hook

In Figs. 2, 18, 19 and 22–31, we have illustrated a wrap yarn controlling hook **207** which is mounted so that during wrap yarn knitting it will occupy a proper position within the needle circle and perform its function which is practically identical with that of the similar element in United States Patent #2,146,705. At other times, or at least when the dial is in central position and rib knitting is being done, the said hook **207** is automatically swung outwardly to an inactive position. The hook is tapering in form and curved downwardly as at **208**, the supporting end being connected or integral with a vertical column **209** which attaches to an adjustable holder **210**. The holder is really an extension of the supporting arm **211** permanently connected at the upper end of a post **212**. The post **212** is vertically slidable within a bearing in sleeve **213** which is connected at the side of the carrier ring. The sleeve **213** is provided with a vertical slot **214** and an angularly disposed slot **215**, one being a continuation of the other. A pin **216** is threaded into the post **212** and maintains the hook in a central position as in Fig. 18, until the same has been moved upwardly beyond the top edge of the carrier ring whereupon the angular part **215** of the slot causes these parts to move to the position of Fig. 30. In that position the dial may be lowered to rib position and there will be no interference. A spring **217** normally holds the post **212** down in its lowermost position. Collar **218** limits upward movement.

When in central position, the supporting arm **211** is guided by abutments **219** and **220**. These abutments, shown in detail in Fig. 20, maintain the hook rigidly in position as it is lowered to its active or wrap yarn controlling position.

The movement of this hook is accomplished by certain cams on drum **118**, Fig. 3, those cams acting on a lever **221**, Fig. 5, and by means of link **222** and another lever **223** pivoted on a bracket **224**, raise the hook or allow the same to move inwardly and down to its position within the needle cylinder depending upon the disposal of cams for the purpose. The lever **223** has a horizontal extension **225** which engages beneath the post **212** and raises that post whenever the toe portion of lever **221** is engaged by a cam. That is shown in Fig. 5. A spring **226** moves the levers **221**, **223** and link **222** in the opposite direction to movement imparted by cams on the drum.

Normally this hook would be swung to the inactive position during rib knitting or at any time while the dial occupies its central, lower position. During wrap yarn knitting it is in the position of Fig. 18. When knitting in the heel or toe, it is also preferable to withdraw the hook to the position of Fig. 30 and thus any interference between the point of the hook and passing needles during reciprocation is avoided. Furthermore, as the hook is raised and/or swung outwardly, the end thereof will not catch on the fabric during reciprocations.

Throughout Figs. 22–29 wrapping of a pair of needles *n* is shown, the wrap yarn being illustrated as it is controlled by the hook **207**. Wrap yarns fed from fingers **87** are connected to the inside of the fabric when knitted in wrap patterns and each extends within the hook **207** up to the particular wrap yarn feeding finger **87** appropriate to each yarn. The hook **207** as shown in Fig. 25, maintains a wrap yarn *w* at such an elevation that only selected or raised needles would encounter and take the same in their hooks. The said hook continues around being inclined upwardly to follow the needle wave to a depending and downwardly inclined point **208**. It keeps the wrap yarn loose or in an extended loop, Figs. 26 and 27, until the loop indicated by numeral **227** drops from point **208**. At that time the actual wrap yarn stitch has been taken into the fabric and is of such size that as the wrap yarn take-ups draw slack back, there will be no undue tightness of the wrap yarn stitch or the float at the back of a wrap yarn area. This hook also has a function of maintaining the wrap loop low on the needle, or at least inwardly against the shank of the needle so that it will be disposed at a proper position for plating. Completed wrap stitches are indicated at Figs. 28 and 29, the needle *n* being drawn down to about its lowermost position with respect to stitch drawing edges of sinkers *s*

Gap closer

Referring to Figs. 18 and 19, the carrier ring is cut out as shown at **227** for clearance of the wrapping mechanism, and a gap closer is to be used during certain phases of knitting such as during heel and toe knitting when instep needles are raised. This gap closer consists of an arcuate cam **228** which is cut to the same curvature as the latch guiding portion of the carrier ring. This

cam **228** is provided with a stem or slide **229** which projects through a slot in the outer ring and has at its outer end a pin **230** which is contacted by some suitable element which will cause the gap closer cam **228** to move in to a position for controlling needle latches at desired times as during heel and toe knitting. This gap closer performs a similar function to the gap closer described and claimed in United States Patent #2,146,750 and may be operated in a similar way.

Selecting means

Referring to Fig. 14, we have shown a selecting means including a plurality of jack butt engaging plungers **231** slidable in supports **232** and **233**. These plungers vary in number according to the number of steps of selection desired. A pattern drum is generally indicated at **234** and has a plurality of pattern discs or other pattern elements with removable selective butts thereon by means of which a pattern may be set-up. A plurality of levers **235** are provided at **236** and have toe portions **237** engageable with the butts on the above mentioned pattern discs or other pattern elements. There is one lever **235** connected to each of the plungers **231** and the position of the plungers is thus controlled from the pattern on drum **234**.

A so-called master cam **238** is adapted to engage a master butt on jacks and will thus raise jacks and needles which have been preliminarily selected by any one of the plungers **231**. This selecting means is more or less conventional on Banner machines and need not be described in detail here. During heel and toe knitting or at other times when it is desired to discontinue a pattern, or part of a pattern, a toothed sector **239** engages a pinion **240** and rotates a cam for pushing all or any desired portion of levers **235** to a common position, that is, a position in which they will withdraw their respective plungers from engagement with jack butts.

The selecting mechanism herein shown and described is of a type for raising needles at a single point, that is, not what is generally known at a two point selection or one in which more complicated patterns may be knitted. The more complicated patterns can be knitted and it is contemplated doing so, but in that event a more comprehensive selecting means would be employed such as that described and illustrated in United States Patent #2,167,390.

Needle and jack set-up

Cylinder needles *n* are divided into two series, the usual long butt and short butt series. Long butts are indicated at Fig. 42 by numeral **241** while short butts **242** are shown at the right of the figure. Preferably the needles are divided into opposed series at opposite halves of the needle cylinder. Directly beneath each needle is a jack **243**, alternate ones of these jacks having butts **244** at a lower level while the intermediate ones have butts **245** at a higher level. Likewise, these jacks are divided into equivalent groups of long and short butts. These jacks, by means of certain cams contacting the butts **244** and **245**, control needle movements during rib knitting and during transfer. All this has been described in detail in Patent #2,255,068 and further description is not necessary at this point.

Pattern jacks **246** are used wherever desired, but preferably under each of the jacks **243**, that is, one for each needle. Each of the jacks has a plurality of frangible butts **247**, these being known as the selecting butts and being engageable by the plungers **231**. Normally the pattern set-up is made something similar to that shown in Fig. 42 wherein each jack **246** will have only one or two of the butts left thereon. The jack at the left side of the figure is shown with all butts **247** intact merely to show the construction of one of these elements before any pattern has been set up. Each jack has a master butt **248** which is to be engaged by the so-called master cam **238**, also a butt **249** for the purpose of moving jacks downwardly, either by the well-known plain sole cam or by any of the usual cams designed to draw jacks downwardly at appropriate times for safety or for other reasons. In this case we have illustrated the pattern jacks as having saw tooth type butts **247** and **248**. Of course, it is quite possible that other selecting means may be employed and in that event jack butts may be of different shape. Selection might involve so-called "sinking" of jacks rather than purely axial movements of the same.

Operation

In knitting a stocking from top to toe, this particular machine is preferably used in knitting string work, although it is within the invention to knit individual articles dropping each from the needles at the completion thereof. While a take-up has not been described in this case, any of the applicable take-up means may be employed, for example, we may use a take-up such as described in Patent 2,255,068 or sinkers may be so constructed as to feed fabric down beneath the dial during rib work, it being understood that at other times, it is not necessary to employ a take-up since ordinary sinkers are sufficient.

At the start in a rib top, the dial assembly will occupy a central position such as illustrated in Fig. 21, for example, and rib knitting throughout a desired length of top is carried on. Of course, at this time, the binder and cutter will be in active position while the hook **207** will be swung to inactive position. Dial knitting cams will cause dial needles to pass through the proper stitch wave all as described in Patent #2,255,068.

At transfer, transfer cams are moved to engagement with dial needles as are the corresponding cams which function on cylinder needles at that time. After the transfer dial needles are withdrawn into the dial, the binder and cutter are swung to inactive position and the dial assembly by means of the raising mechanism will be lifted vertically to a wrap height. Practically at the instant the dial is raised to a safe height, the plate **38** will be swung to wrap position and the binder and cutter are immediately moved back to their working position. The hook **207** is swung inwardly and by means of the slot described with respect thereto, drops down and is more or less locked in a permanent position within the needle circle until it is desired to remove the same.

Wrap knitting throughout the leg of a stocking may then be accomplished, the pattern being determined in any well-known way. Of course, while no shogging means has been described at this time it is contemplated to employ such means and very obviously the spindle **31** can be shogged angularly further to vary the pattern.

At reaching the heel of the stocking, reciprocatory work must be started and instep needles will be raised. The dial and wrap mechanism are then swung inwardly to the position of Figs.

30 and 31, that being a position in which wrap fingers 87 and the wrap threads themselves will not engage needles, neither will they contact or interfere with the binder and cutter mechanism. The hook is temporarily withdrawn at this time to avoid interference on reverse strokes in this reciprocatory work. The heel is knitted in the customary way and on the first reverse stroke, as above explained, the shogging or retarding means for the dial will have again been latched so that the wrap head will, throughout the knitting of the heel, be out of time, although that is immaterial since no pattern is being made at that period. The tripping means 98 is again moved into the pathway of latch 97 on the return to rotary work in the foot so that the dial and wrap mechanism will be returned to the same timed relationship prevailing throughout knitting of the leg. The wrap spindle is again moved to its eccentric wrapping position and hook 207 returns inwardly so as to control the wrapping function. During the knitting in the heel, the gap closed will have been moved to latch controlling position and, of course, is withdrawn upon resuming knitting in the foot.

Throughout the foot knitting continues as in the leg although, as is the practice, a pattern will preferably be knitted in the instep only. A ring toe may be knitted as described whereupon the toe will be started. At this time, movements similar to those at the start of the heel are again made and the toe is knitted as the heel was. Loopers rounds are knitted in continuation of the toe and, if string work is being made, waste fabric and connecting courses are probably to be knitted before another rib top is started. Of course, when another rib top is to be commenced, the dial is moved completely to its central position and down to the position of Fig. 21 whereupon the cycle is repeated.

Referring to Fig. 43, various cams have been shown and pathways are illustrated, the figure actually showing knitting during wrap pattern work. In addition to cams already described, the cam 250 acts to level butts 244 and 245 while cam 251 moves the pattern jacks downwardly by contacting butts 249. Cam 252 is a rib knitting cam while cam 253 functions during transfer. Cams 254 and 255 are instep cams. The cam 256 levels jacks upon approaching the selecting mechanism, also guides jacks past the selecting means on reciprocatory work. Pathway 257 is that taken by needle butts 241 and 242 as they approach cam 23 to be raised by that and the front stitch cam 12 to a corresponding position whereupon they take yarn under cam 14 and knit at the point of cam 13. As jacks are raised by plungers 231 and master cam 238 jack butts take the pathways 258 and 259 raising needle butts to a pathway 260, that being elevated sufficiently above the normal pathway 257 so that those needles thus raised will take the wrap yarn as shown in Figs. 19 and 25 while other non-selected needles pass too low for the purpose. The jacks 243 and accompanying needles raised to take the wrap yarns move so that their butts pass along the pathways 261 or 262. Of course, non-selected jacks 246 and corresponding jacks 243 would not be elevated except by cam 256 and would pass along in pathways other than those illustrated herein. For the sake of simplicity and clearness we have not shown them.

Of course many yarn changes are made throughout the knitting of a stocking and the binder and cutter will function at such times. That is a normal phase in the operation of such a machine and need not be described here. Reinforcing such as in the high-splice or double sole is carried out in the usual way, and likewise, a double sole trimmer or other mechanism of that type may be used if so desired. The invention has been described while pointing out features thereon as evident in a preferred embodiment, but it is to be understood that this disclosure is descriptive only of one example, and we are not to be limited except by the scope of the appended claims:

We claim:

1. In a knitting machine, means for knitting rib fabric, means for transferring from rib to plain fabric and for knitting plain fabric in continuation thereof, and in combination, eccentrically disposed wrapping mechanism operable during the knitting of plain fabric and means for moving said wrapping mechanism to a position in which it will not interfere with the knitting of rib fabric or the transfer from rib to plain fabric.

2. In a knitting machine the combination of a dial, a cylinder, wrap yarn feeding means as a part of said dial, needles in said dial and cylinder and cam mechanism operable thereon whereby rib fabric or plain fabric may be knitted and whereby transfer from knitting rib fabric may be made to plain fabric, said dial being movable from a rib knitting position to bring the wrap yarn feeding means to an eccentric relationship with said cylinder for feeding wrap threads to selected needles in said cylinder needle group.

3. In a knitting machine the combination af a cylinder and a dial, a dial spindle and supporting means for said spindle within which the latter is driven, wrap yarn feeding means also carried by said dial spindle and means for moving said supporting means to and from a substantially central rib knitting position and an eccentrically disposed wrap yarn feeding position.

4. In a knitting machine the combination of a rotatable needle cylinder, a rotatable dial, a spindle carrying said dial and rotatable within a supporting means, driving means for said dial spindle about which said supporting means is also adapted to be swung, wrap yarn feeding means beneath said dial and rotatable with said dial and its spindle and means for moving said supporting means about said driving means to and from rib knitting and wrap yarn feeding positions.

5. In a knitting machine the combination of a rotatable needle cylinder, a rotatable dial, a dial spindle, a support for said spindle, and driving means including gearing for rotating the spindle at the same angular speed as the cylinder, said support for said spindle including a plate pivoted to be swung about the center of said driving means, wrap yarn feeding means on the same spindle as said dial and means for moving the supporting plate so that said dial and wrap yarn feeding means may be moved to different positions and other means for raising said spindle in conjunction with the swinging of the same.

6. In a knitting machine the combination of a cylinder, a dial, means for rotating said cylinder, a spindle carrying said dial and for rotating it, a dial cap and cams thereon, a plate for supporting said spindle rotatably and for fixedly supporting said dial cap and cams, driving means from said cylinder driving means to said dial spindle including a shaft and intermeshing gears, the construction being such that the supporting plate may be swung about the driving shaft, means for swinging the plate to and from dif-

ferent positions and stops for limiting the movement of the plate thereby determining different positions for the dial and wrap yarn feeding means.

7. In a knitting machine the combination of a rotatable needle cylinder, a rotatable dial, a dial spindle and a supporting plate having bearing means within which said spindle may be rotated, driving means including a shaft and intermeshing gears for said spindle, said supporting plate being constructed to swing about the center of said shaft, wrap yarn feeding means on said spindle beneath said dial and rotatable therewith, means for raising said spindle vertically and other means for swinging the plate from a substantially central rib knitting position to a position eccentrically of said needle cylinder when said spindle is raised.

8. In an automatic type knitting machine, a dial, a spindle to which said dial is attached and by which it is rotated, supporting means for said spindle and driving means for rotating the spindle and also about which the support for the spindle is adapted to be swung, wrap yarn feeding means beneath said dial and rotatable with the dial and its spindle, wrap yarn supplies and means for carrying the same rotatable with said spindle, the latter being tubular whereby said wrap yarns may be threaded through the center of the spindle and through the wrap yarn feeding means to be fed to selected needles.

9. In an automatic type knitting machine, a dial, a hollow spindle to which said dial is attached and by means of which it is rotated, supporting means for said spindle including a bearing within which the spindle is rotatably held, wrap yarn feeding means beneath said dial also rotatable with the spindle, said supporting means being movable to and from rib knitting position and wrap positions, the construction being such that wrap yarns are fed through the hollow spindle, through the center of the dial and through feeding openings in the wrap yarn feeding means itself.

10. In an automatic type knitting machine, a combined dial and wrap yarn feeding means including a hollow spindle, a dial and wrap yarn feeding means carried by said spindle, wrap yarns and wrap yarn take-up means also carried by and rotatable with the spindle and a support for said above mentioned means so movable about a common driving means that the said spindle may occupy different operative positions without affecting its drive.

11. In an automatic type knitting machine, a combined dial and wrap yarn feeding means, a hollow spindle carrying said dial and wrap means and supporting means for the spindle including a bearing within which it is adapted to rotate, said supporting means also being movable about a center determined by a common driving shaft, means for shogging the relationship of the dial including a releasable drive and a retarding brake, means for swinging the support about said common driving means, the construction being such that movements of the support do not affect the driving nor the retarding of the spindle.

12. In an automatic type knitting machine, a dial and combined wrap yarn feeding mechanism, a hollow spindle carrying said dial and wrap feeding means and by means of which rotation is imparted to those elements, a support and driving means including a train of gears and a shaft, said support being swingable about said shaft, a wrap yarn supply carried by said support and driving means, and a plurality of take-up devices, one for each of the wrap yarns, carried on an extension of said driving means, the construction being such that rotation is imparted through the driving and supporting means to the central hollow spindle while that spindle may be freely moved axially for lifting the combined dial and wrap yarn feeding means from a dial knitting position to a yarn wrapping position.

13. In an automatic type knitting machine, the combination of a rotatable needle cylinder, a rotatable dial, a spindle carrying said dial and rotatable in timed relation to said cylinder, wrap yarn feeding means beneath said dial and rotatable therewith adapted to be moved to a position eccentric to the needle cylinder for feeding wrap threads to knitting instrumentalities, means for supporting said spindle capable of being moved from a central rib knitting position to said eccentric yarn wrapping position and means operable in phase with the operation of said knitting machine for moving said spindle, dial and wrap yarn feeding means to and from the so-called central and eccentric positions and also to a position intermediate these extreme positions.

14. Mechanism as defined in claim 13, including means for raising said spindle, dial and wrap yarn feeding means and for lowering it at desired times.

15. In an automatic type knitting machine, a dial and combined wrap yarn feeding means, a spindle carrying said dial and wrap yarn feeding means and for rotating them, a support for said spindle movable whereby said dial and wrap yarn feeding means may be moved to rib knitting position or to an eccentrically disposed wrapping position, a dial cam cap having dial cams therein, controlling means for said dial cams and a means for engaging said controlling means to maintain them in one of their positions when said dial supporting means is swung away from rib knitting position.

16. In a wrap stripe knitting machine, a needle cylinder, needles independently operable in said cylinder, a carrier ring and means for feeding wrap yarns to selected ones of said needles, and an arcuate finger or hook supported outside said needle cylinder and adapted to guide wrap yarns to selected ones of said needles and to maintain the wrap yarn floats from course to course in an extended loop up to approximately a point where stitches are completed and means for bodily moving said arcuate hook to and from its operative position within the circle of needles to a position completely outside the circle of needles.

17. In a wrap stripe knitting machine, a needle cylinder, needles independently operable in said cylinder, a carrier ring, means for feeding wrap yarns to certain ones of said needles, and an arcuate finger or hook projectable within a circle of needles and of a height for supporting wrap yarns to be fed only to desired needles and tapering to a point adjacent the knitting point of the machine, a support for said finger or hook so constructed as to allow it to be swung to and from its position within the needle circle to a position completely without that circle.

18. An automatic wrap stripe knitting machine having independently operated needles, eccentric wrapping means and a dial, said wrapping means and dial being mounted upon and rotatable with a spindle, a support therefor by means of which the dial and wrap yarn feeding

means may be moved to and from rib knitting and yarn wrapping positions, an arcuate wrap yarn guiding and float controlling hook and a support therefor and means operable in conjunction with the means for moving said dial and wrap thread feeding means for moving the hook within the needle circle during wrapping and to a position wholly outside the needle circle when not wrapping.

19. In a wrap stripe knitting machine, a needle cylinder and needles independently operable therein, a wrap thread and wrap float guiding and controlling hook, a support therefor and means for raising said hook and thereafter swinging it bodily from a position within the circle of needles to a position outside that circle.

20. In a wrap stripe knitting machine, a needle cylinder, independently operable needles in said cylinder, a carrier ring and a wrap thread and wrap float controlling and guiding hook, a support for said hook outside the carrier ring, a bayonet slot in said support, an extension from said hook within said support and a pin threaded into said projection and extending through said bayonet slot, the construction being such that said hook may be lifted until it will clear the top edge of said carrier ring and thereafter be swung outwardly over said carrier ring to a position outside the circle of needles.

21. An automatic wrap stripe knitting machine having a dial and means for raising that dial from its active, rib knitting position, a yarn binder and cutter normally operable in a position above said dial and capable of being moved outwardly thereby to provide clearance as said dial is elevated and then movable to operative position beneath said raised dial.

22. An automatic wrap stripe knitting machine having a dial movable vertically to and from an active rib knitting position, yarn feeding means, and adjacent said yarn feeding means, a binder and cutter pivoted to be swung upwardly and outwardly, the construction being such that said binder retains yarns within a circle of needles and above said dial when the dial is in rib knitting position, but may be moved out of the way of said dial as it is raised and thereafter returned to active position without affecting the holding of yarns retained within the binder.

23. An automatic wrap stripe knitting machine having in combination a cylinder and a dial, needles in said cylinder and in said dial, a main yarn feeding means and a binder and cutter adjacent thereto pivoted without said circle of needles in said cylinder and movable upwardly and outwardly whereby when said dial is raised, the binder and cutter may be swung to a position in which the dial will not interfere with said binder and cutter nor the yarns held therein and whereby said binder and cutter may be returned to operative position beneath said raised dial without affecting yarns held therein.

24. In an automatic type knitting machine, a cylinder, a dial, dial needles and a dial cap having cams for actuating said needles, a spindle carrying said dial and for rotating the same, a suport for said spindle movable to and from a rib knitting position substantially concentric to said cylinder and a position eccentrically disposed with respect to said rib knitting position and control means for said dial cams, means operable to control the position of the dial cams when the dial is in rib knitting position, and further means for maintaining said dial cam control means in a predetermined position while said dial is moved from the rib knitting position.

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