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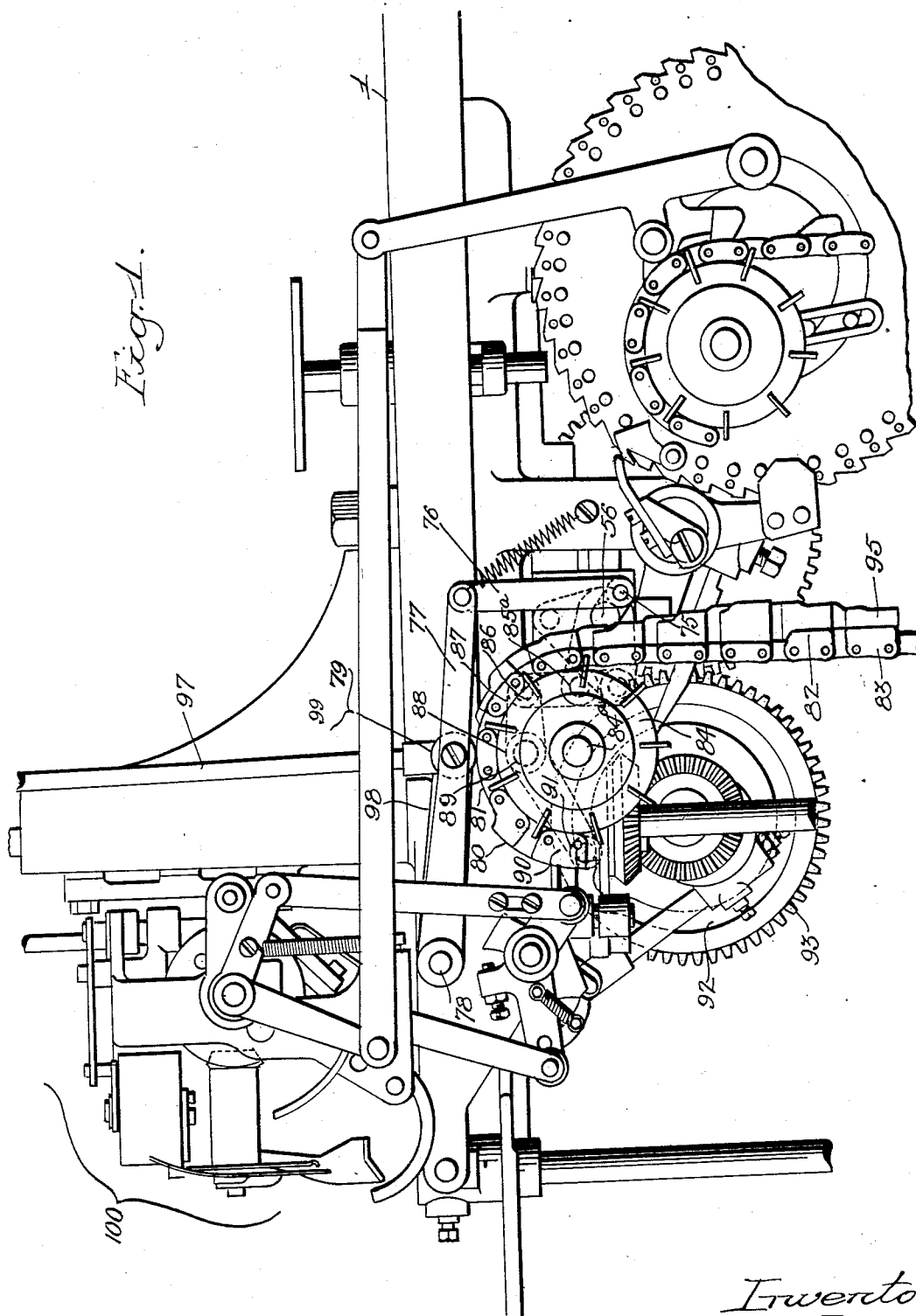
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1,949,314

CYLINDER CONTROLLING MECHANISM FOR KNITTING MACHINES

Filed Dec. 24, 1931

5 Sheets-Sheet 1



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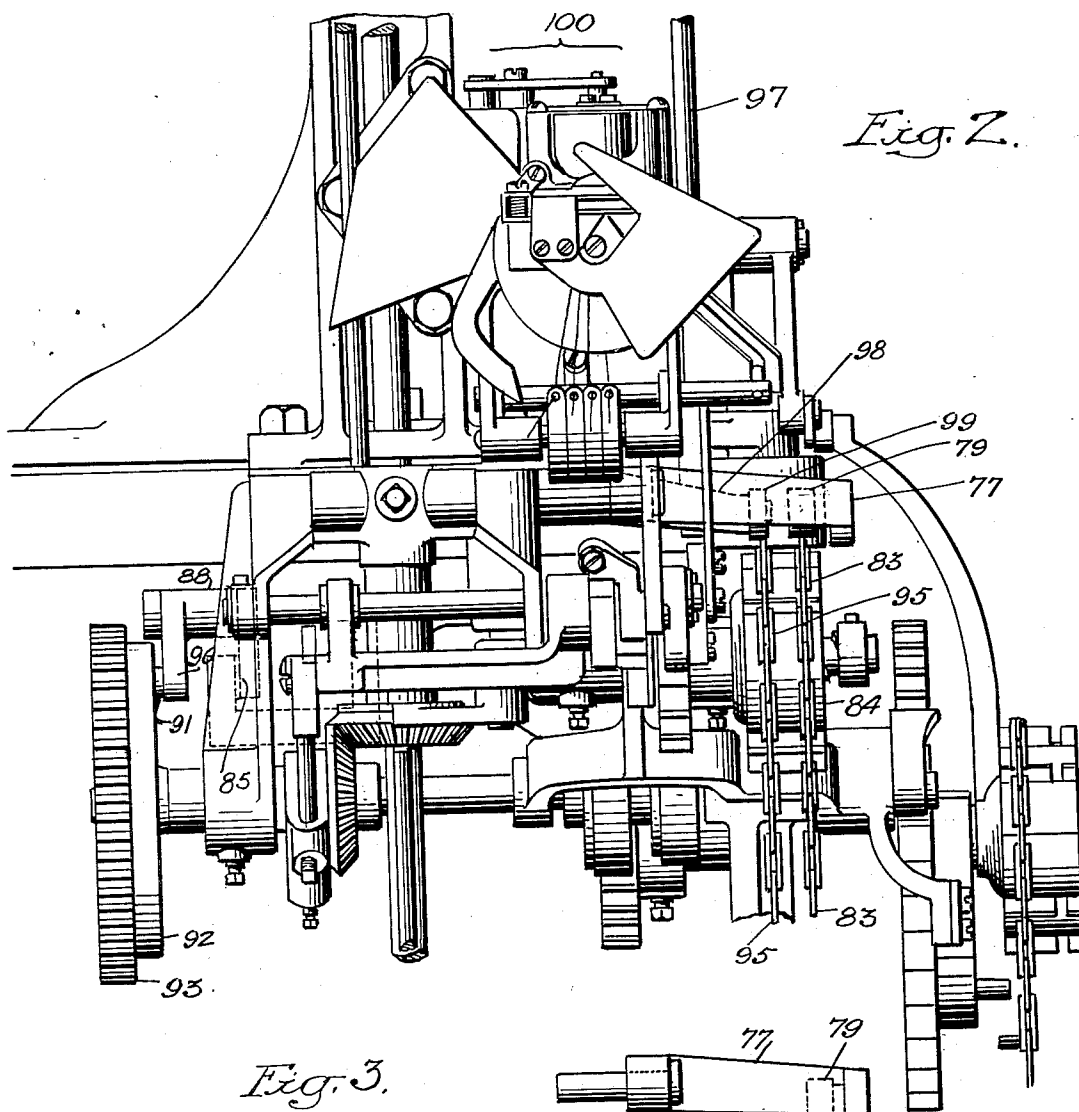
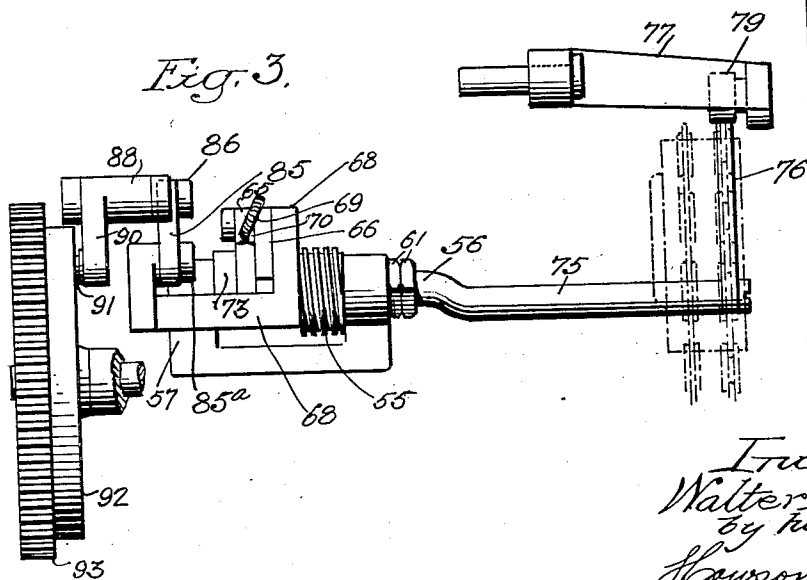


Fig. 3.



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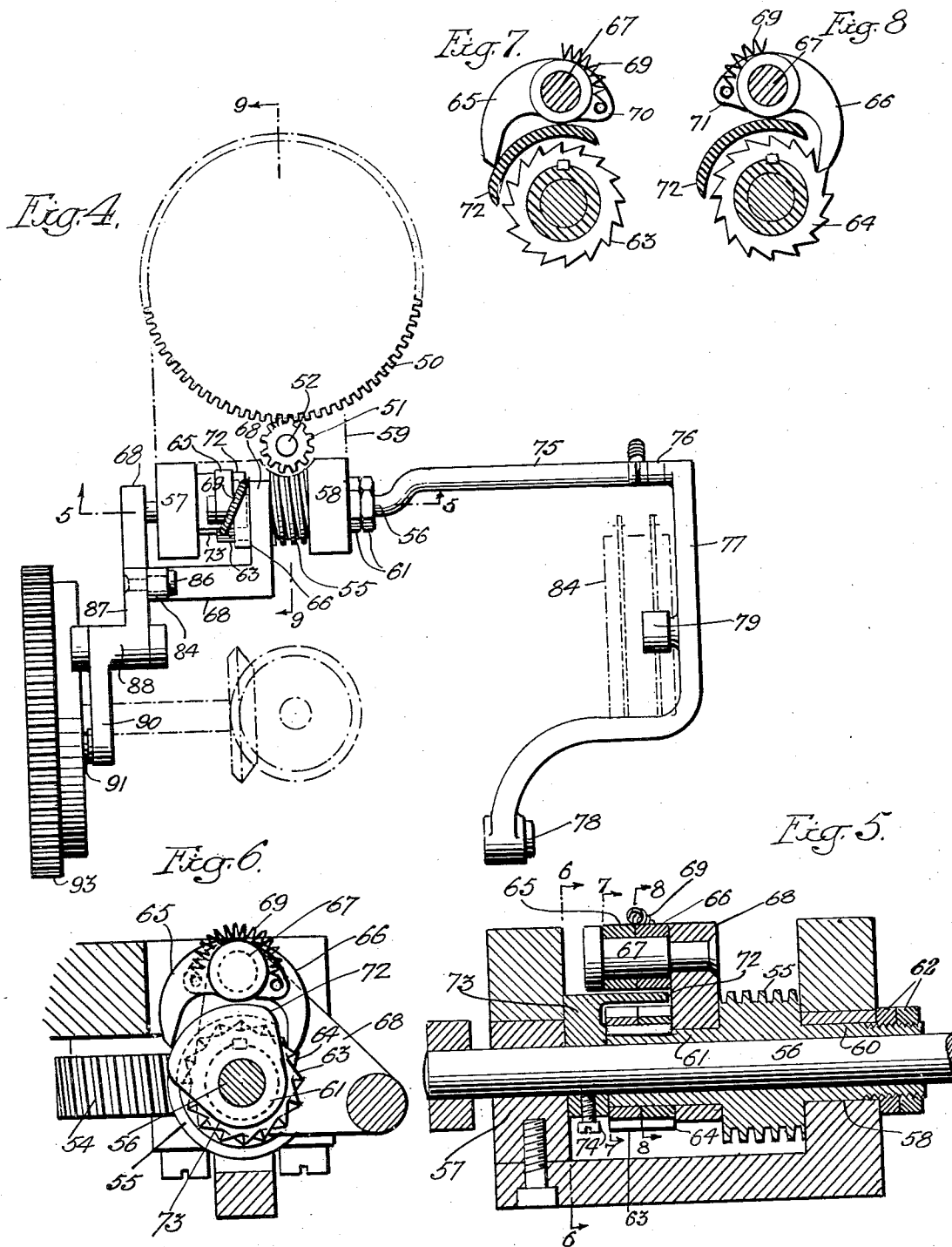
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5 Sheets-Sheet 3



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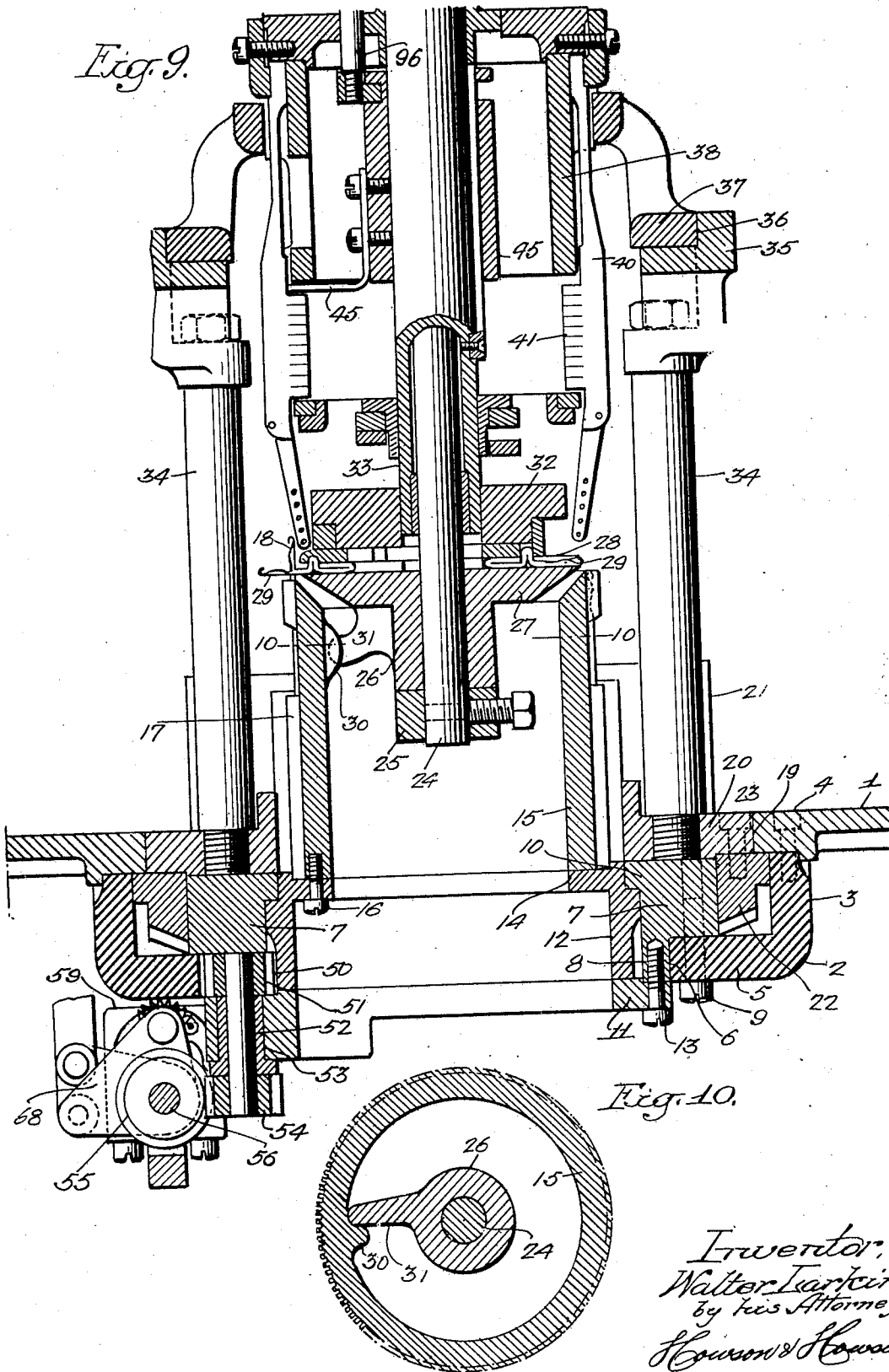
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Fig. 13.

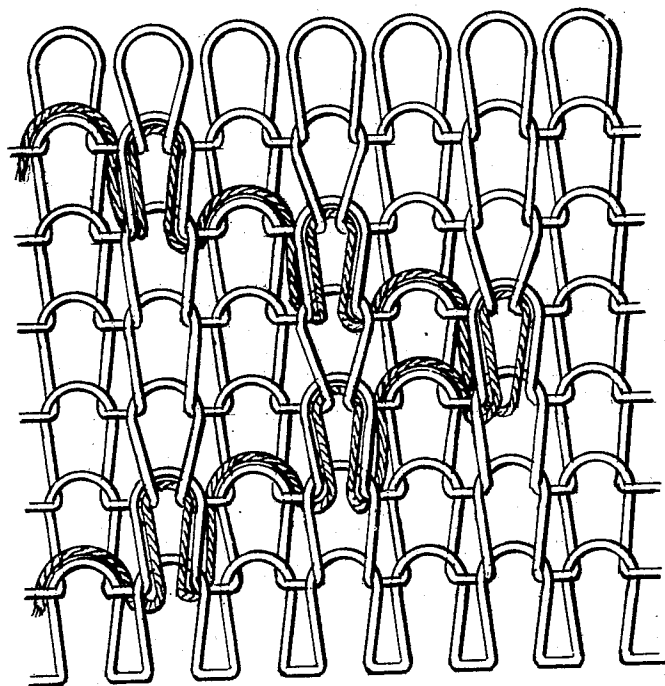


Fig. 11.

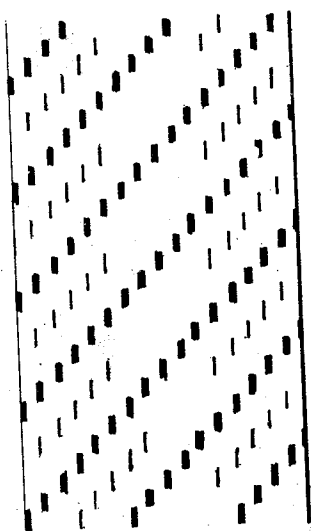
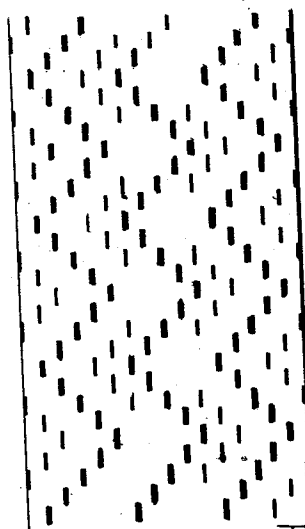


Fig. 12.



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UNITED STATES PATENT OFFICE

1,949,314

CYLINDER CONTROLLING MECHANISM FOR
KNITTING MACHINESWalter Larkin, Norristown, Pa., assignor to
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a corporation of DelawareApplication December 24, 1931
Serial No. 583,088

11 Claims. (Cl. 66—25)

This invention relates to improvements in multi-design rib knitting machines of the type shown and described in U. S. Letters Patent, No. 1,841,249, dated January 12, 1932, in which a needle cylinder and a needle dial are arranged with needle-wrapping elements above the dial needles, for co-operation with the cylinder needles, to wrap design-forming threads selectively around the cylinder needles, for producing designs of desired configurations and color combinations in the outer or cylinder wales of the tubular ribbed fabric formed by cooperation between the cylinder and dial needles and which constitutes a foundation or background for the designs.

In machines of the type noted, each needle-wrapping element is individual to the cylinder needle above which it is disposed and with it co-operates, thus, the design-forming thread carried by each wrapping element is confined, in the formation of designs, to the cylinder needle with which it co-operates and will produce its individual portion of the design in a straight line, either continuously or in predetermined longitudinally spaced, disconnected sections, in the single stitch wale formed by the particular cylinder needle with which that particular wrapping element co-operates.

The object of the present invention is to provide mechanism which will be capable of producing relative lateral movement between the needle cylinder and the needle-wrapping elements, in order that the wrapping elements may each co-operate with any one of a plurality of predetermined laterally spaced cylinder needles to wrap the design-forming thread which it carries around such needles in the formation of predetermined successively knit courses respectively, thus providing for the formation of spirals, complete or in segmental disconnected sections, or, to provide zig-zag lines in whole or in disconnected parts, continuously, or at predetermined relatively spaced places, throughout the length of the fabric.

The construction and operation of the mechanism forming the subject of the present invention will be fully disclosed hereinafter, reference being had to the accompanying drawings, of which:

Fig. 1 is a side elevation of sufficient of the knitting machine disclosed in the above noted patent to illustrate the present invention as applied thereto;

Fig. 2 is a rear elevation of the mechanism shown in Fig. 1;

Fig. 3 is a rear elevation of the mechanism of the present invention detached from the other elements of the machine;

Fig. 4 is a plan view of the mechanism shown in Fig. 3;

Fig. 5 is a sectional elevation taken on the line 5—5, Fig. 4;

Figs. 6, 7 and 8 are sectional elevations taken respectively on the line 6—6, 7—7, and 8—8, Fig. 5;

Fig. 9 is a sectional elevation taken on the line 9—9, Fig. 4, and including a goodly portion of the mechanism of the machine with which the mechanism of the present invention co-operates;

Fig. 10 is a sectional plan view taken on the line 10—10, Fig. 9;

Figs. 11 and 12 diagrammatically illustrate the simple spiral and zig-zag designs capable of being produced on the machine equipped with the mechanism of the present invention; and

Fig. 13 diagrammatically illustrates the stitch formation.

Referring more particularly to Fig. 9, the machine comprises a main base plate 1, to the underside of which is secured a hollow annular support 2 comprising a vertical wall 3 rigidly secured to the bed plate 1 as by screws 4. The annular support 2 is provided with a horizontally disposed inturned flange or base 5 having a central circular opening 6 in which is mounted a depending annular flange 8 of a base ring 7, said base ring being secured to the base 5 of the annular element 2 as by screws 9.

The base ring 7 is provided with an inturned annular flange 10 between which and a cap ring 11 is rotatably mounted a cylinder-supporting ring 12, the cap ring 11 being rigidly secured to the base ring 7 as by screws 13. The cylinder-supporting ring 12 is provided with an inturned annular counter bored flange 14 upon which the lower end of the needle cylinder 15 rests and to which said cylinder is rigidly secured as by screws 16. Slidably mounted in the grooves 17 formed in the peripheral surface of the cylinder 15 are the cylinder needles 18.

Rotatably mounted on the base ring 7 and within a circular opening 19 formed in the base plate 1 is the cylinder cam plate 20 which supports and rotates the cylinder cam ring 21 which is provided with the usual series of stitch cams, etc. for operating the cylinder needles 18.

Mounted in the hollow element 2 between the vertical wall 3 thereof and a concentric peripheral wall of the base ring 7 is the ring gear 22 which is

secured to the cylinder cam plate 20, as by screws 23, through which rotation of the gear ring 22 is transmitted to the cylinder cam plate 20 and cam ring 21 carried thereby.

5 Axially aligned with the cylinder 15 is the stationary dial post 24 which is supported and held against rotation in the manner shown and described in the above mentioned patent. Loosely mounted on the dial post 24 above a rigidly secured collar 25 thereon is the hub 26 of the needle dial 27, in the radial grooves 28 of which are disposed the dial needles 29, which co-operate with the cylinder needles 18 to produce tubular knit ribbed fabric.

15 In order to maintain the dial needles 29 in their correct relation to and intermediate adjacent cylinder needles 18 the cylinder 15 is provided with a suitable lug 30 against which bears a lug or dog 31 in the present instance formed integral with the dial 27 and hub 26 thereof.

20 The dial needles are operated in the usual manner by the usual set of stitch and welt cams carried by the relatively rotating dial cam plate 32, which is suitably secured to the lower end of a tubular shaft 33 which encircles and revolves about the fixed dial post 24, the tubular shaft 33 being driven in the manner illustrated in the above noted patent.

25 Projecting vertically from the cylinder cam plate 20 is a pair of posts 34, 34 which support and revolve a ring 35 having a raceway 36 in which is mounted a fixed ring 37 which supports a cylindrical carrier 38 for the needle-wrapping elements, in the form of fingers 40, the carrier 38 being held against rotation with the fingers 40 in substantially vertical alignment with the cylinder needles 18 respectively by means shown and described in the above mentioned patent.

35 Each of the wrapping fingers 40 is provided with a radially inwardly extending butt 41 which is adapted to have predetermined portions removed, leaving other inwardly projecting vertically spaced butts which are adapted to be selectively engaged by the operating cam 45 which is splined to and revolves with the tubular shaft 33, for the purpose of moving the wrapping fingers 41 selectively radially outward to wrap the design-forming threads carried thereby around predetermined cylinder needles 18 when such needles are raised above the dial needles in the manner shown and described in the above mentioned patent.

40 With the arrangement above described and with the cylinder 15 held against rotation, the needle-wrapping fingers 40 may be selectively moved in the manner noted to produce continuous design-forming lines along the cylinder wales formed respectively by the cylinder needles with which the fingers individually and respectively co-operate, or to produce interrupted lines forming components of a predetermined design produced by a number of adjacently disposed cylinder needles collectively.

45 The present invention contemplates relative rotation between the normally stationary needle cylinder 15 and the relatively fixed finger carrier 38, whereby the wrapping fingers 40 may be caused to co-operate with and wrap individually threads around predetermined cylinder needles in the formation of one course of stitches and in the next successive course wrap the same design-forming threads individually around different cylinder needles laterally spaced with respect to those around which the design-forming threads were wrapped in the formation of the previous

course of stitches. Obviously, by producing a relative rotation between the cylinder 15 and carrier 38 to the extent of the space between two adjacently positioned cylinder needles and continuing this step by step relative rotation in the same direction throughout a number of successively formed courses of stitches the needle wrappings will be effected in lines running spirally around the fabric being produced.

80 When the step by step relative rotation between the needle cylinder and the finger carrier is carried on in one direction for a predetermined number of courses and then reversed so that the relative rotation between the needle cylinder and the finger carrier is continued in an opposite direction, the wrappings will then be effected in the form of zig-zag lines throughout the length of the fabric.

85 It then follows that by selectively effecting the needle-wrapping movements of the fingers with respect to the needles the spiral or zig-zag lines may be broken up into sections which alone or in company with needle wrappings on adjacent needles will form predetermined designs of predetermined contour and predetermined color on the outer or cylinder wales of the fabric.

90 The needle cylinder, which normally and as described in the above noted patent remains stationary at all times, is, in accordance with the principles of the present invention, adapted to receive the step by step rotation above referred to, with respect to the finger carrier 38 which, in both the above patent and in the present instance, is maintained in a fixed position, thus providing for the formation of the angular lines above referred to.

95 In order to provide for the step by step rotation of the needle cylinder the cylinder-supporting ring 12 is provided in the present instance with gear teeth 50 around the lower edge of its entire peripheral surface. The gear teeth 50 mesh with corresponding teeth of a pinion 51 which is secured to the upper end of a vertically disposed shaft 52 rotatably mounted in a suitable bearing 53 carried by or formed integral with the cap ring 11.

100 The lower end of the shaft 52 is provided with a spiral gear 54 which meshes with a similar spiral gear 55 which is loosely mounted on a horizontally disposed shaft 56 that is rotatably supported in bearings 57 and 58 formed integral with or carried by a projection 59 extending laterally from the cap ring 11.

105 The spiral gear 55 is provided with lateral axially aligned cylindrical extensions 60 and 61, the first of which passes through the bearing 58 and is provided outside said bearing with lock nuts 62 which permit rotation of the gear 55 but prevents axial movement thereof.

110 Secured to the cylindrical extension 61 at the opposite end of the spiral gear 55 is a pair of ratchet wheels 63 and 64 respectively, the teeth of which extend in opposite directions for co-operation with pawls 65 and 66 respectively, which are pivotally mounted on a stud 67 projecting laterally from a pawl carrier 68 which is loosely rotatably mounted on the extension 61 of the gear 55, a spring 69 being connected at its opposite ends to projections 70 and 71 on the pawls 65 and 66 respectively, tending at all times to force the said pawls into co-operative engagement with the teeth of the ratchet wheels 63 and 64 respectively.

115 In order to selectively control the actuation of the pawls 65 and 66, a segmental shield 72 is

provided between the peripheries of the ratchet wheels 63 and 64 and the pawls 65 and 66 which co-operate therewith. This shield 72 is adapted to be rocked about the axis of the shaft 56 from a neutral position, wherein both pawls are held out of engagement with the teeth of the ratchet wheels with which they respectively cooperate, to a position at either side of said neutral position, wherein one pawl will be permitted to engage the teeth of the ratchet wheel with which it co-operates while the other pawl is held out of action with respect to the ratchet wheel with which it co-operates, or the shield may be rocked in an opposite direction to make the last said pawl effective while the first said pawl is held out of action. Obviously, by rotating one or the other of the ratchet wheels 63 or 64 the spiral gear 55 will be rotated accordingly and this rotation will be transmitted through the gear 54, shaft 52 and gear 51 to the cylinder-supporting ring 12 which in turn will effect the step by step rotation of the cylinder 15 as above noted.

The shield 72 in the present instance extends laterally from and is formed integral with an arm 73 which is secured in the present instance, by a screw 74, to the horizontal shaft 56, this shaft having at its outer end a lateral offset section in the form of a crank 75.

The crank 75 is connected by a link 76 to the outer end of a lever 77 which is pivotally mounted at its opposite end on a stud 78 secured to and extending laterally from the main bed plate 1 of the machine. Intermediate its ends the lever 77 is provided with a roller 79 which is adapted to ride on high, low, or intermediate links 80, 81 and 82 respectively of a pattern chain 83, which passes around and is moved step by step by a drum or wheel 84 which is rotatably mounted on a stud or shaft 84a carried by the main frame of the machine and intermittently rotated by mechanism disclosed in the above noted patent.

When the roller 79 is riding the high links 80, the shield 72 will be moved into the position shown in Figs. 7 and 8 to hold the pawl 65 out of action while the pawl 66 is operative. When the roller 79 is riding the low links 81, the position of the shield 72 will be reversed, the pawl 66 being held out of action while the pawl 65 is effective. When the roller 79 is riding the intermediate links 82, the shield 72 will be maintained in an intermediate position in which both the pawls 65 and 66 are held out of action, the cylinder 15 consequently being locked in a stationary position, by virtue of the locking effect produced between the spiral gears 54 and 55, while the pawl carrier 68 is being constantly rocked about the axis of the shaft 56.

The pawl carrier 68 is constantly rocked back and forth through the medium of a link 85, one end of which is pivotally connected to the pawl carrier at 85a while the opposite end is pivotally connected at 86 to one arm 87 of a lever 88 which is pivotally mounted at 89 intermediate its ends to a fixed portion of the machine. The opposite end 90 of the lever 88 is provided with a roller or other cam follower 91, which rides in a cam groove 92 formed in one side of the gear wheel 93 in the present instance which, as described in the above noted patent, receives one complete revolution for each complete revolution of the ring gear 22 which, as above noted, effects rotation of the cylinder cam ring 21 about the cylinder 15, consequently for every revolution of the said cam ring 21 about the cylinder 15 the pawl carrier 68 is rocked sufficiently to cause one of its

pawls 65 or 66 to engage and move the ratchet wheel with which it co-operates to the extent of one tooth and this in turn through the gearing 55, 54, 51 and 50 moves the cylinder 15 to the extent of one needle, thereby throwing the needles carried by the cylinder out of alignment with the fingers 40 with which they have previously been aligned into alignment with the next adjacent fingers 40, to one side or the other, depending upon which of the ratchet wheels 63 or 64 is effective at the time.

The chain 83 as noted above is carried by the wheel 84 around which also passes the chain 95 that controls the position of the selector cam 45 relative to the remaining butt portions of the butts 41 on the needle-wrapping fingers 40, the cam 45 being controlled as noted in the above mentioned patent by a vertically extending rod 96 which in turn is controlled by a vertically extending rod 97 which is connected at its lower end to a lever 98 having a roller 99 which in the present instance is coaxially aligned with the roller 79 of the shield rocking mechanism, the roller 99 of the design cam controlling mechanism riding on the variously elevated links of the chain 95 for raising and lowering the cam 45 with respect to the finger butts 41 for selectively effecting the wrapping of the design-forming threads by the fingers 40 around the cylinder needles 18 aligned with the fingers 40 at the point in the relative rotation between the cam ring 21 and the cylinder 15 at which the cylinder needles 18 are raised above the dial needles 29 to have the design-forming threads wrapped therearound.

During the step by step rotation of the cylinder 15 the proper relation between the dial needles 29 and the cylinder needles 18 is maintained at all times by the fact that at all times some portion of the cylinder needles 18 and the dial needles 29 are in more or less interlocking relation with each other as shown at the left side of Fig. 9 in the drawings, at which point the cylinder needles 18 are raised to receive the foundation fabric thread and/or to have the design-forming thread wrapped therearound while the dial needles 29 are extending radially to receive the foundation fabric thread.

In order to relieve the needles of the strain and to maintain the dial needles in their correct positions intermediate the adjacent cylinder needles against the driving thrust of the dial cams carried by the dial cam plate 32 the lugs 30 and 31 are provided respectively on the cylinder and dial, as above noted, it being noted that the dial 27 is loosely mounted on the fixed dial post 24 and tends to rotate with the dial cam plate 32 due to the driving thrust exerted upon the dial needles 29, which maintains the dial and cylinder in correct co-operating relation regardless of the direction in which the cylinder may be moved by the mechanism providing for the step by step rotation thereof.

In the same manner as described in the above mentioned patent, the machine to which the present apparatus is applied is equipped with yarn-changing mechanism 100 by which the foundation fabric thread may be changed in color and in order, to produce a predetermined design coordinately with the wrapping of the needles by the fingers 40.

Obviously, by moving the needle cylinder 15 selectively in opposite directions, or in one direction continuously, and by supplying adjacent wrapping fingers, or groups thereof, with differently colored threads respectively, and by selec-

- tively moving the fingers 40 to wrap their threads about the cylinder needles, a practically unlimited scope of design may be produced; and by changing the foundation thread selectively such
- 5 thread may be made to coordinate with the needle wrappings to form other designs, thus increasing the scope of practical adaptability of the machine equipped in accordance with the principles of the present invention.
- 10 By the means and method described above, the maximum area of the fabric may be covered with designs with a minimum number of needle-wrapping fingers and a minimum number of differently colored design threads.
- 15 Furthermore, by the means and method above noted the design-forming threads are tied into the fabric by being caught and knit in by the dial needles which the design threads cross during the relative lateral shifting between the needles and
- 20 the needle-wrapping elements, thereby eliminating floats on the back face of the fabric.
- I claim:
1. The combination of a needle cylinder, needles supported by said cylinder, a needle dial, needles supported by said dial in interposed relation to the needles carried by said cylinder, needle-wrapping elements correlated with predetermined needles respectively, means for rotating the cylinder and the needles carried thereby with respect to the wrapping elements to vary the correlative positions of the needles relative to the wrapping elements, and means for maintaining said interposed relation between the cylinder and dial needles during the said rotation of the cylinder needles relative to the wrapping elements.
 2. The combination of a needle cylinder, needles carried by said cylinder, wrapping elements correlated with predetermined needles, a fixed cylindrical carrier for said wrapping elements coaxially aligned with said needle cylinder, means normally locking said needle cylinder against rotation relative to said carrier, and means for intermittently rotating said needle cylinder with respect to said carrier.
 3. The combination of a needle cylinder, needles carried by said cylinder, wrapping elements correlated with predetermined needles, a fixed cylindrical carrier for said wrapping elements coaxially aligned with said needle cylinder, means normally locking said needle cylinder against rotation relative to said carrier, and means for intermittently rotating said needle cylinder selectively with respect to said carrier.
 4. The combination of a needle cylinder, needles carried by said cylinder, wrapping elements correlated with predetermined needles, a fixed cylindrical carrier for said wrapping elements coaxially aligned with said needle cylinder, means normally locking said needle cylinder against rotation relative to said carrier, and means for intermittently rotating said needle cylinder selectively in opposite directions with respect to said carrier.
 5. The combination of a needle cylinder, needles carried by said cylinder, wrapping elements correlated with predetermined needles, a cylindrical carrier for said wrapping elements coaxially aligned with said needle cylinder, means for maintaining said carrier against rotation relative to the needle cylinder, means normally maintaining said needle cylinder against rotation relative to said carrier including a pair of co-operating right angle gears, one of which is operatively connected to said cylinder and normally held against rotation by the other of said gears, a pair of ratchet elements operatively connected to the last said gear, a pawl carrier, means for moving the pawl carrier to and fro, pawls carried by said pawl carrier and arranged for co-operation with said ratchet elements respectively, and a shield operable selectively between the pawls and the ratchet elements to selectively control the action of the last said gear and the consequent rotation of the needles relative to the wrapping elements.
 6. The combination of a needle cylinder, needles carried by said cylinder, wrapping elements correlated with predetermined needles, a cylindrical carrier for said wrapping elements coaxially aligned with said needle cylinder, means for maintaining said carrier against rotation relative to the needle cylinder, means normally maintaining said needle cylinder against rotation relative to said carrier including a pair of co-operating right angle gears, one of which is
 7. The combination of a needle cylinder, needles carried by said cylinder, wrapping elements correlated with predetermined needles, a cylindrical carrier for said wrapping elements coaxially aligned with said needle cylinder, means for maintaining said carrier against rotation relative to the needle cylinder, means normally maintaining said needle cylinder against rotation relative to said carrier including a pair of co-operating right angle gears, one of which is operatively connected to said cylinder and normally held against rotation by the other of said gears, a pair of ratchet elements operatively connected to the last said gear, a pawl carrier, means for moving the pawl carrier to and fro, pawls carried by said pawl carrier and arranged for co-operation with said ratchet wheels respectively, and means for selectively controlling the co-operation between the pawls and the ratchet wheels.
 8. The combination of a needle cylinder, needles carried by said cylinder, wrapping elements correlated with predetermined needles, a cylindrical carrier for said wrapping elements coaxially aligned with said needle cylinder, means for maintaining said carrier against rotation relative to the needle cylinder, means normally maintaining said needle cylinder against rotation relative to said carrier including a pair of co-operating right angle gears, one of which is operatively connected to said cylinder and normally held against rotation by the other of said gears, a pair of ratchet elements operatively connected to the last said gear, a pawl carrier, means for moving the pawl carrier to and fro, pawls carried by said pawl carrier and arranged for selective co-operation with the oppositely pointed teeth of said ratchet wheels respectively, a shield coaxially aligned with the pawl carrier and the ratchet wheels and disposed intermediate the peripheries of the ratchet wheels and the pawls, and means for selectively rocking the shield in opposite directions to selectively render the pawls effective and ineffective.
 9. The combination of a needle cylinder, needles carried by said cylinder, wrapping elements correlated with predetermined needles, a cylindrical carrier for said wrapping elements coaxially aligned with said needle cylinder, means for maintaining said carrier against rotation relative to the needle cylinder, means normally maintaining said needle cylinder against rotation relative to said carrier including a pair of co-operating right angle gears, one of which is

operatively connected to said cylinder and normally held against rotation by the other of said gears, a pair of ratchet elements operatively connected to the last said gear, a pawl carrier, means
 5 for moving the pawl carrier to and fro, pawls carried by said pawl carrier and arranged for co-operation with said ratchet elements respectively, a shield operable selectively between the pawls and the ratchet elements to selectively control the actuation of the last said gear and the consequent rotation of the needles relative to the wrapping elements, and means for selectively operating said shield.

10. The combination of a needle cylinder, needles carried by said cylinder, wrapping elements correlated with predetermined needles, a cylindrical carrier for said wrapping elements co-axially aligned with said needle cylinder, means for maintaining said carrier against rotation relative to the needle cylinder, means normally maintaining said needle cylinder against rotation relative to said carrier including a pair of co-operating right angle gears, one of which is operatively connected to said cylinder and normally held against rotation by the other of said gears, a pair of ratchet elements operatively connected to the last said gear, a pawl carrier, means for moving the pawl carrier to and fro, pawls carried by said pawl carrier and arranged for co-operation with said ratchet elements respectively, a shield operable selectively between the pawls and the ratchet elements to selectively control the actuation of the last said gear and the consequent rotation of the needles relative to the wrapping elements, and means for selectively actuating said wrapping elements to wrap the needles respectively aligned therewith.

11. The combination of a needle cylinder, needles carried by said cylinder, wrapping elements correlated with predetermined needles, a cylindrical carrier for said wrapping elements co-axially aligned with said needle cylinder, means for maintaining said carrier against rotation relative to the needle cylinder, means normally maintaining said needle cylinder against rotation relative to said carrier including a pair of co-operating right angle gears, one of which is operatively connected to said cylinder and normally held against rotation by the other of said gears, a pair of ratchet elements operatively connected to the last said gear, a pawl carrier, means for moving the pawl carrier to and fro, pawls carried by said pawl carrier and arranged for co-operation with said ratchet elements respectively, a shield operable selectively between the pawls and the ratchet elements to selectively control the actuation of the last said gear and the consequent rotation of the needles relative to the wrapping elements, means for actuating the wrapping elements to wrap the needles respectively aligned therewith, means for selectively controlling said actuating means, means for selectively controlling the said shield, and common actuating means for both of said controlling means.

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