Dec. 24, 1935. V. LOMBARDI 2,025,463

KNITTING MACHINE

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Fig. 1

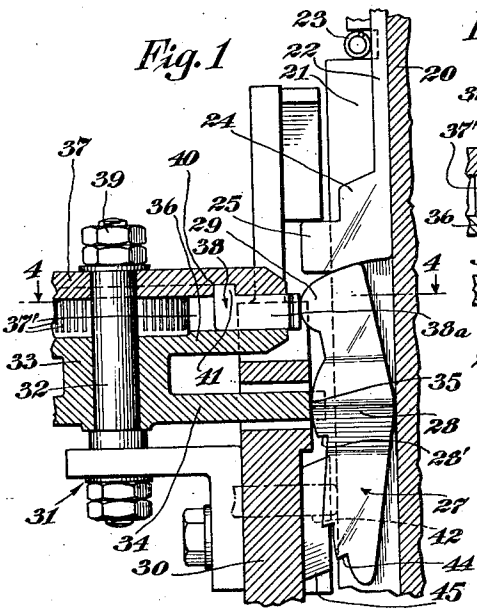

Fig. 2

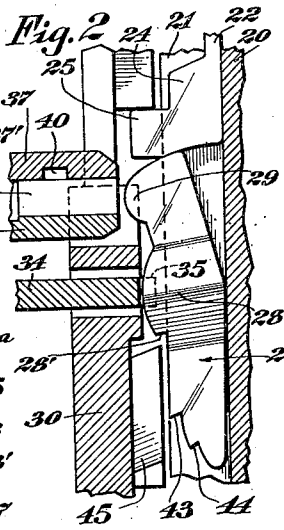

Fig. 3

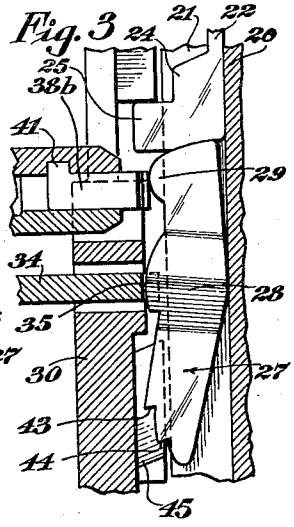

Fig. 4

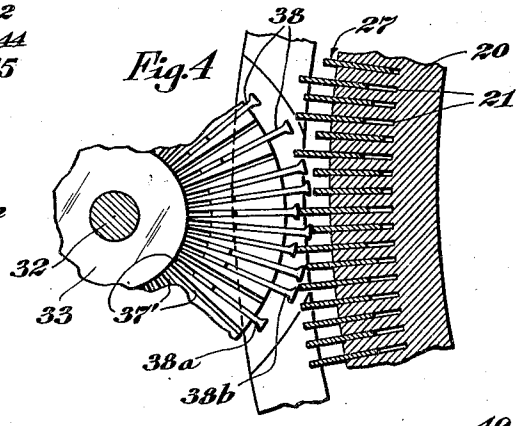

Fig. 8

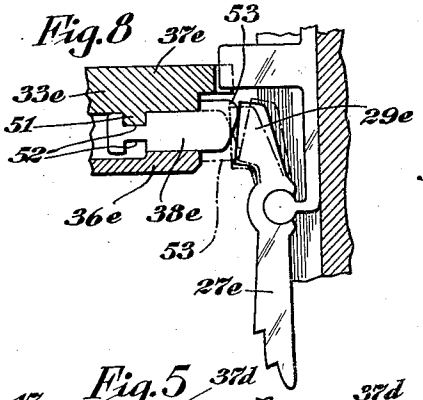

Fig. 5

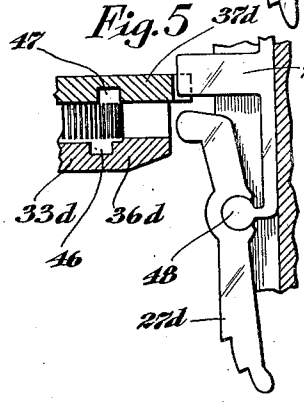

Fig. 6

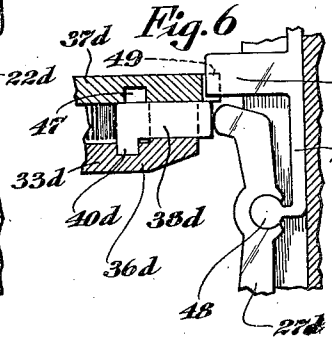

Fig. 7

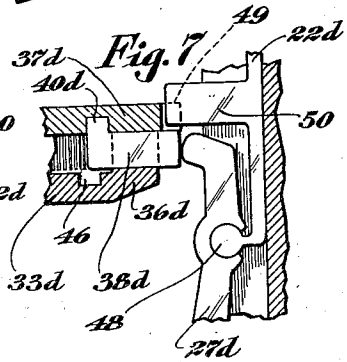

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Fig. 10

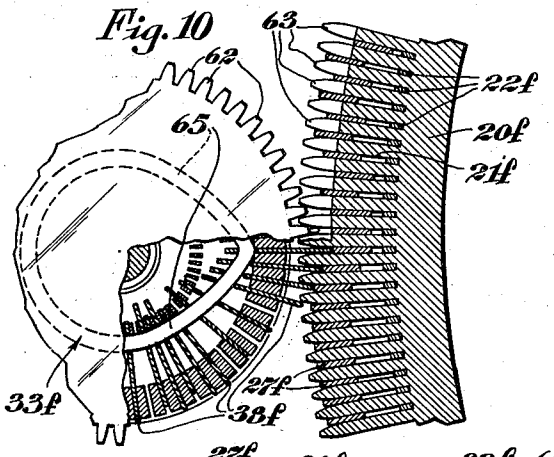


Fig. 9

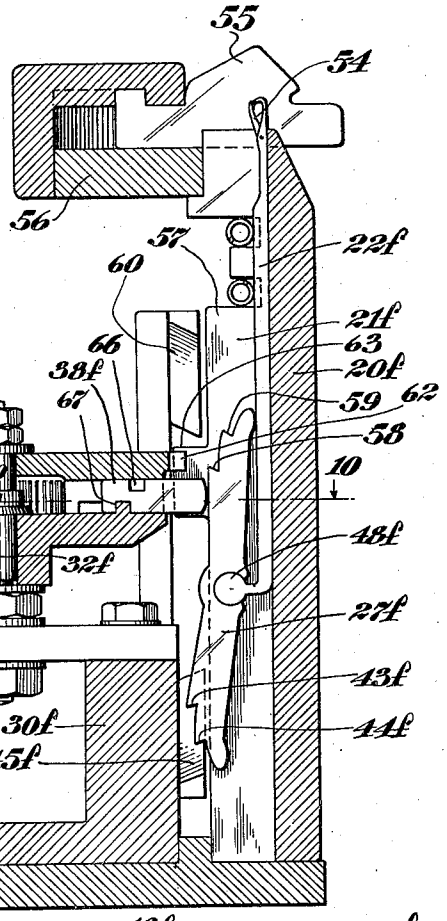


Fig. 12

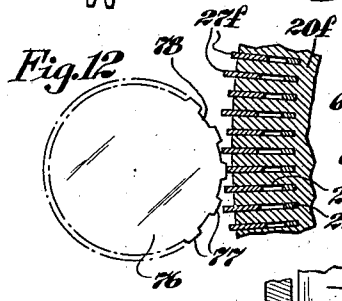


Fig. 11

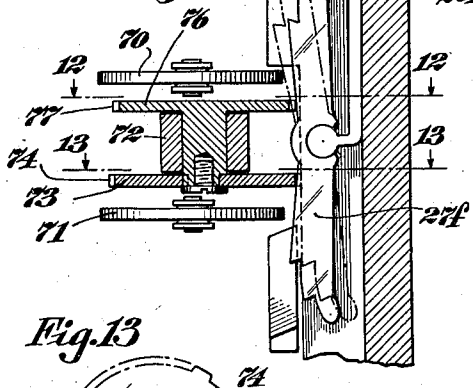


Fig. 13

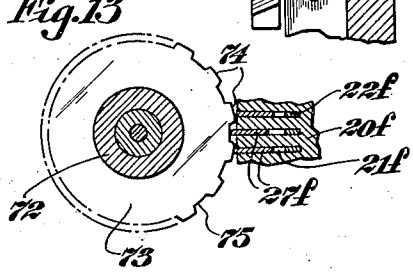
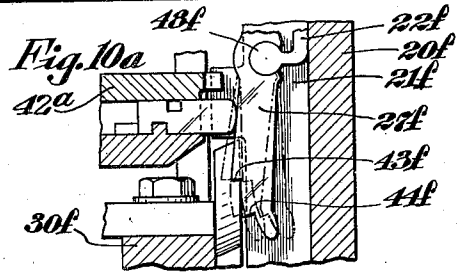


Fig. 10a



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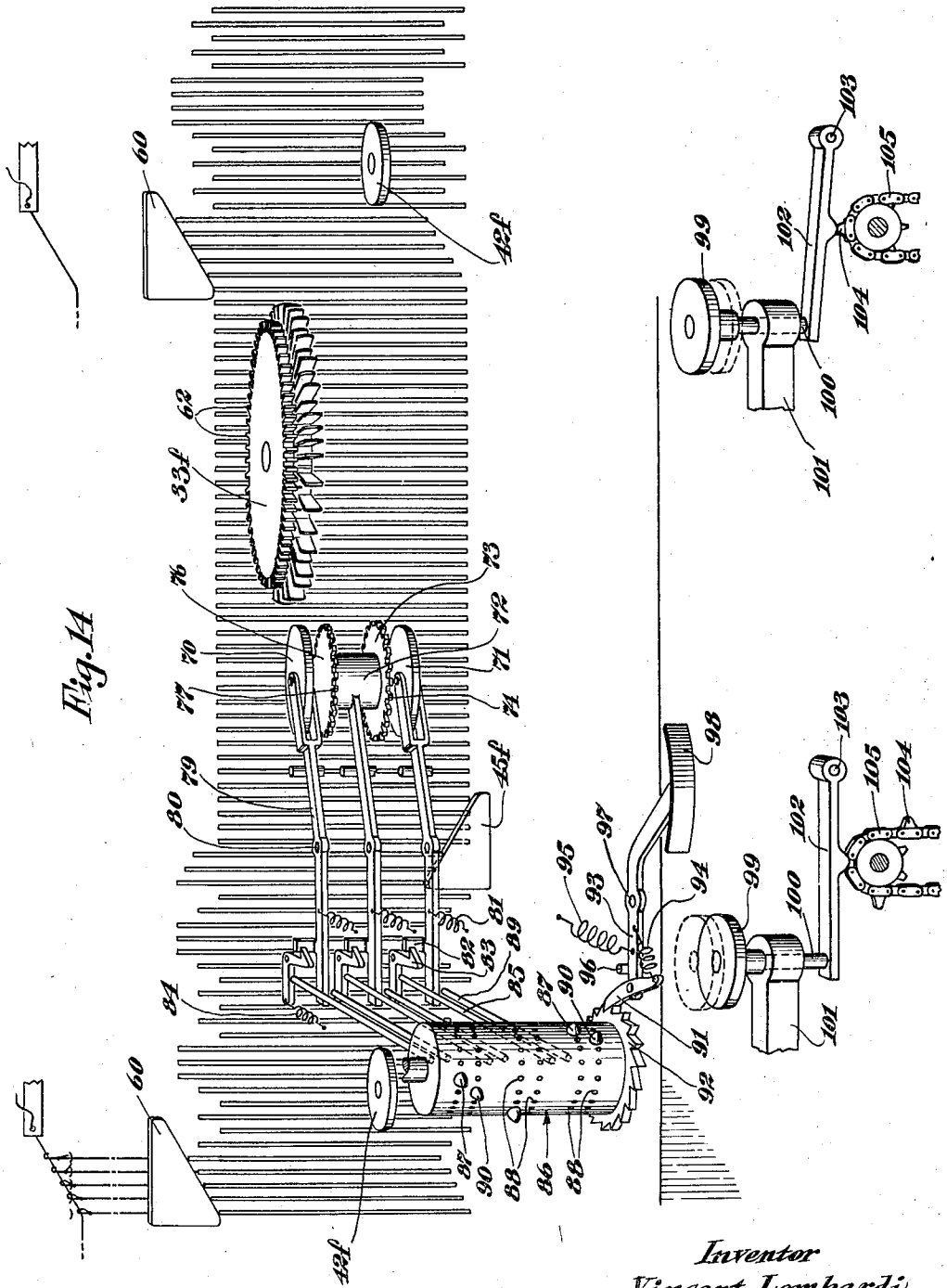

Fig. 14

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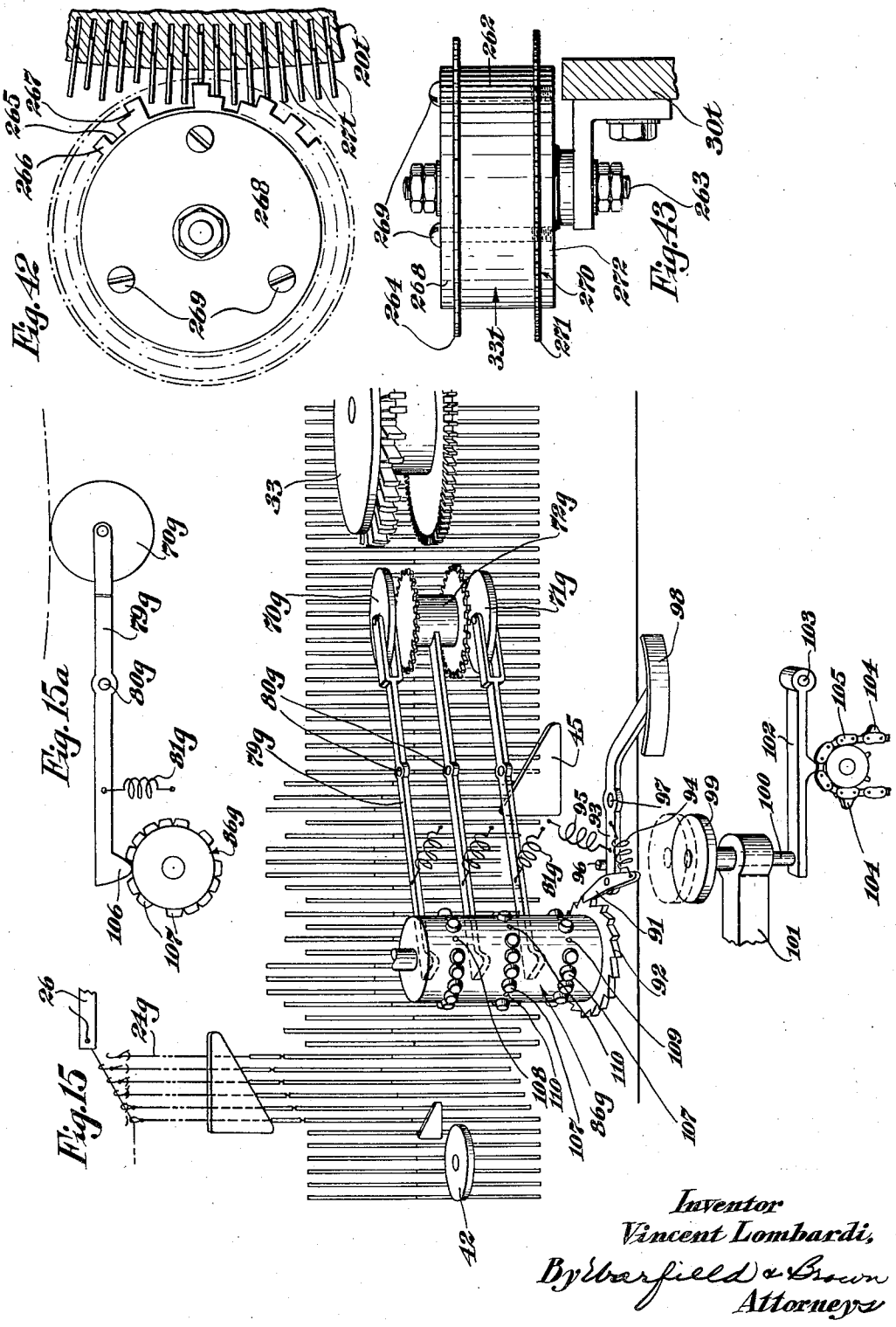

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Fig. 16

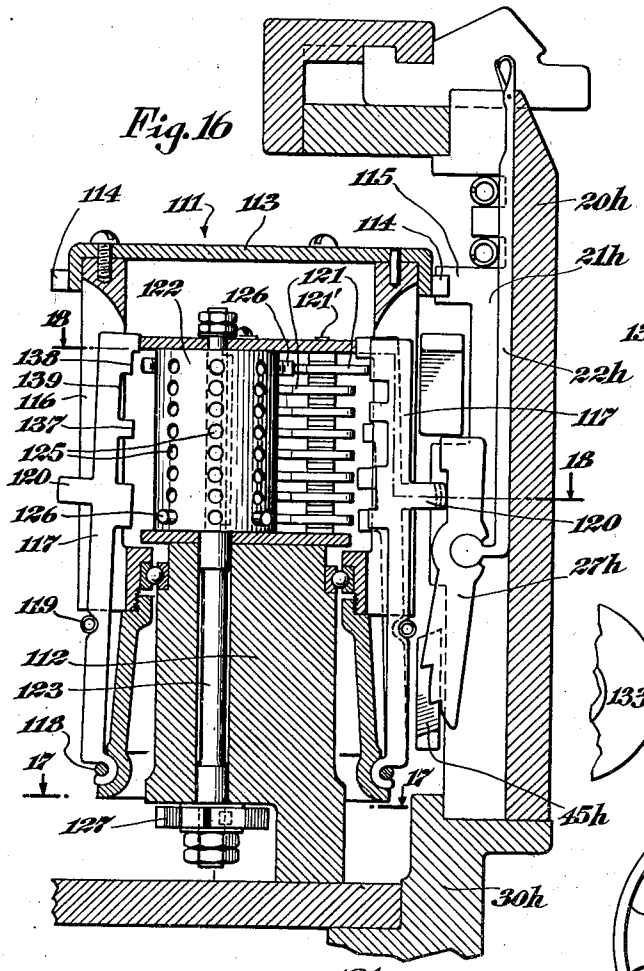
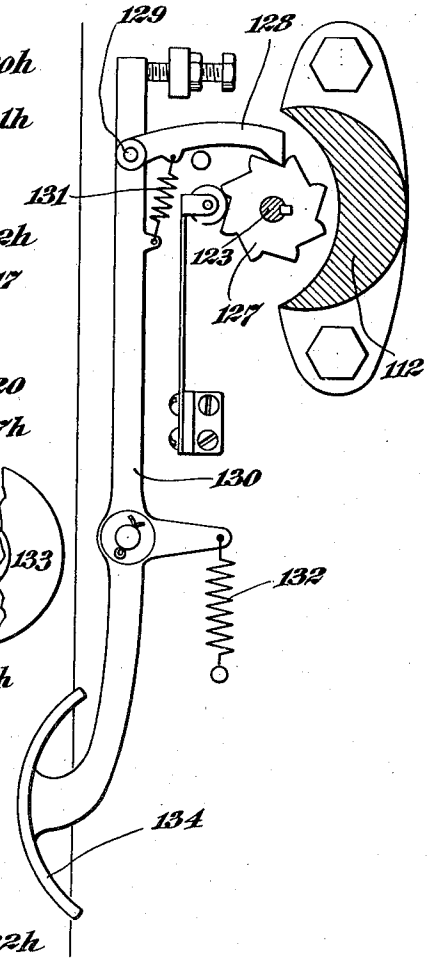


Fig. 17



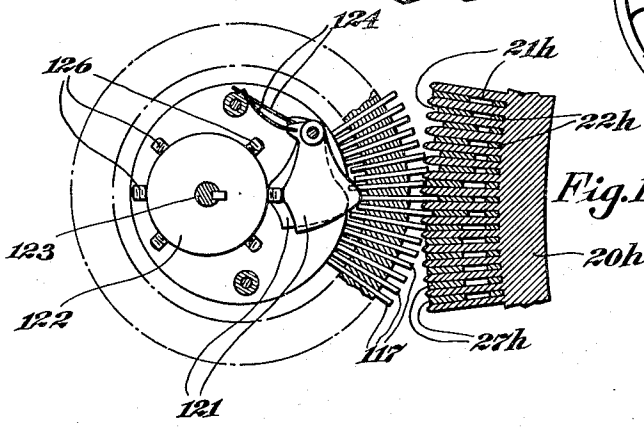


Fig. 18

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Fig. 19

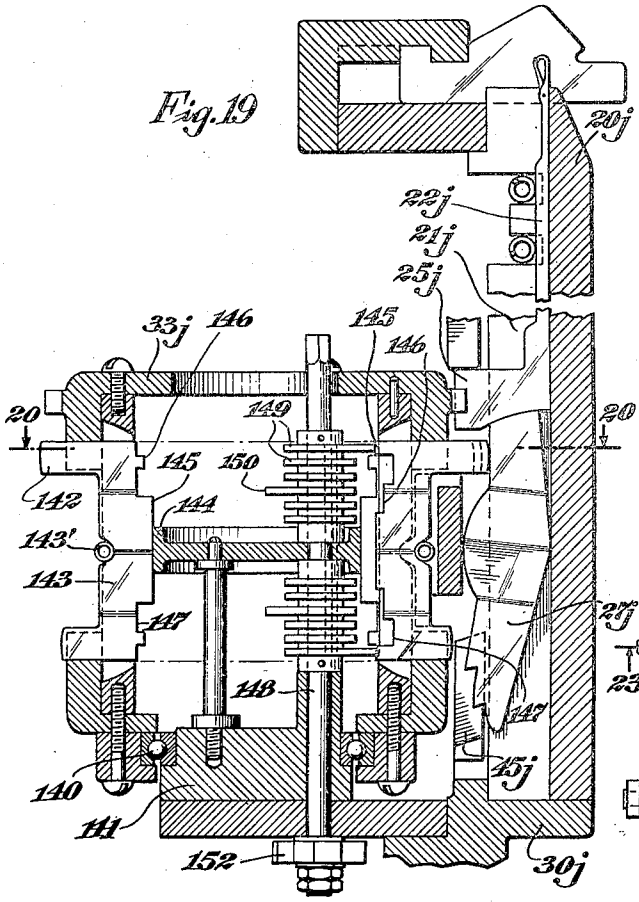

Fig. 21

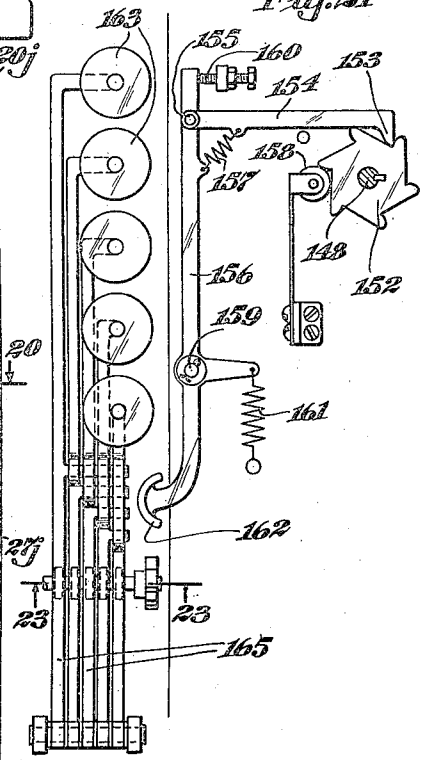

Fig. 23

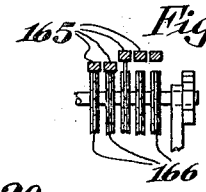

Fig. 20

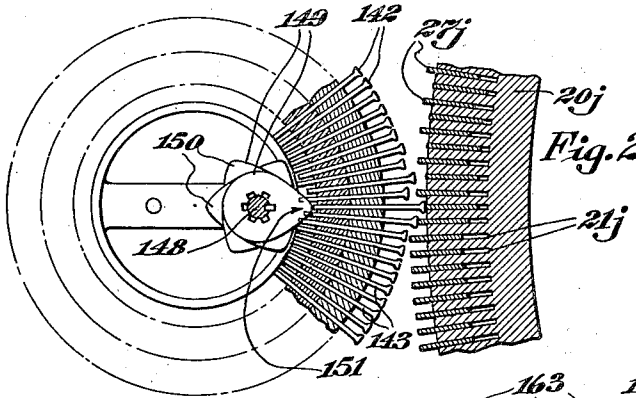

Fig. 22

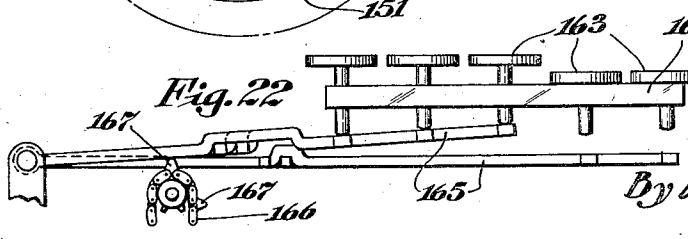

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Fig. 24

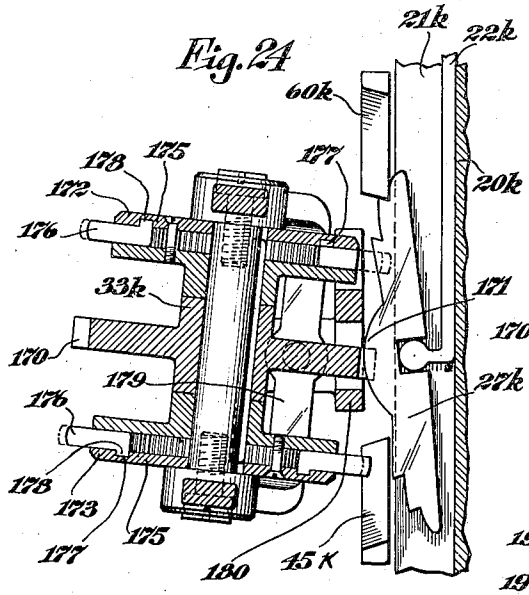
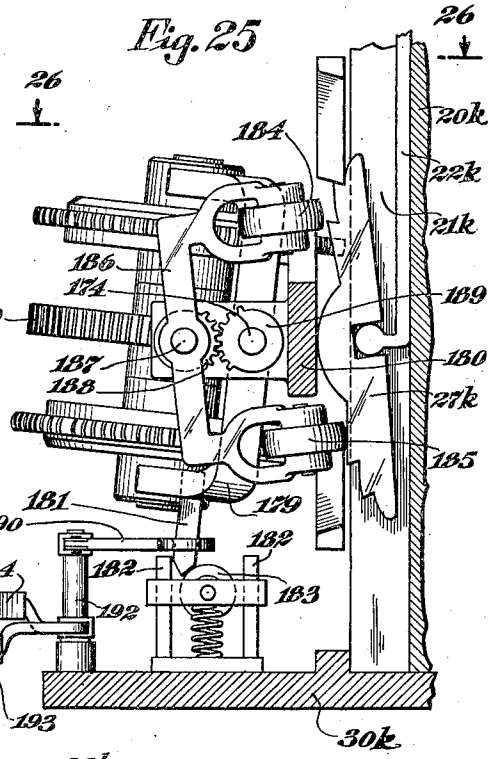


Fig. 25



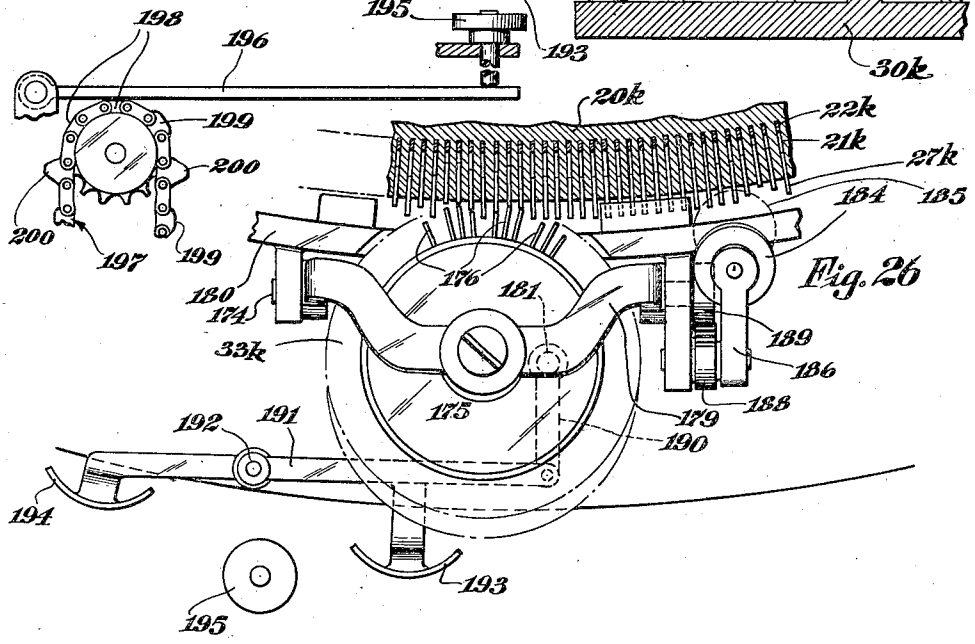


Fig. 26

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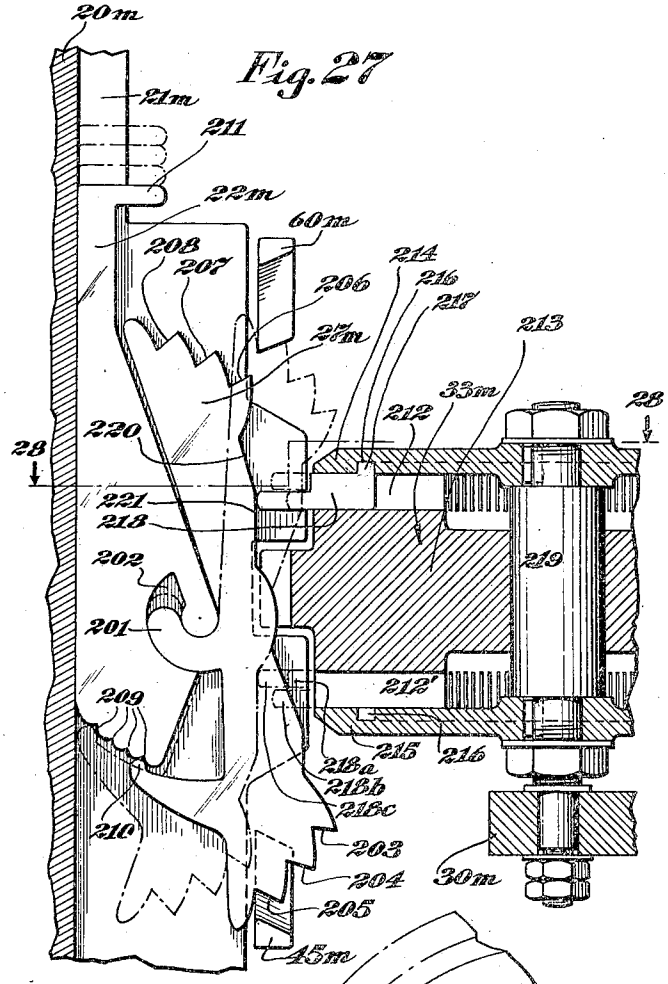

Fig. 27

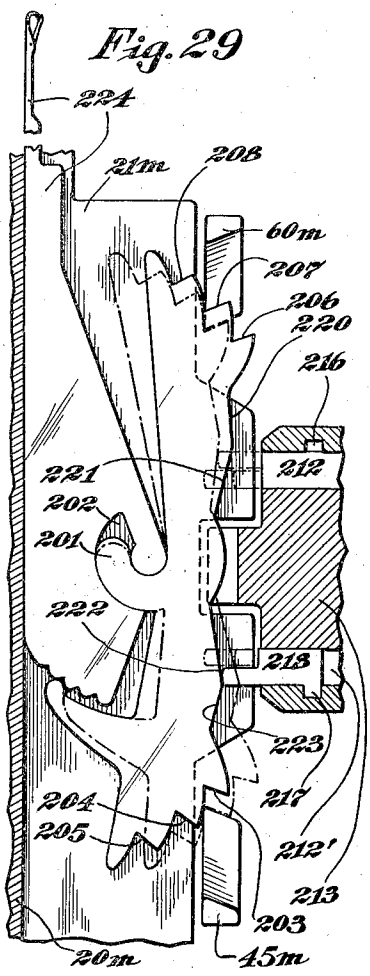

Fig. 29

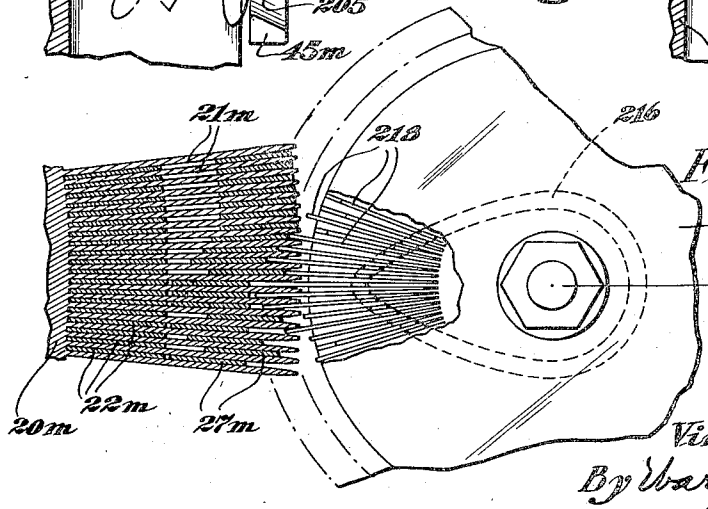

Fig. 28

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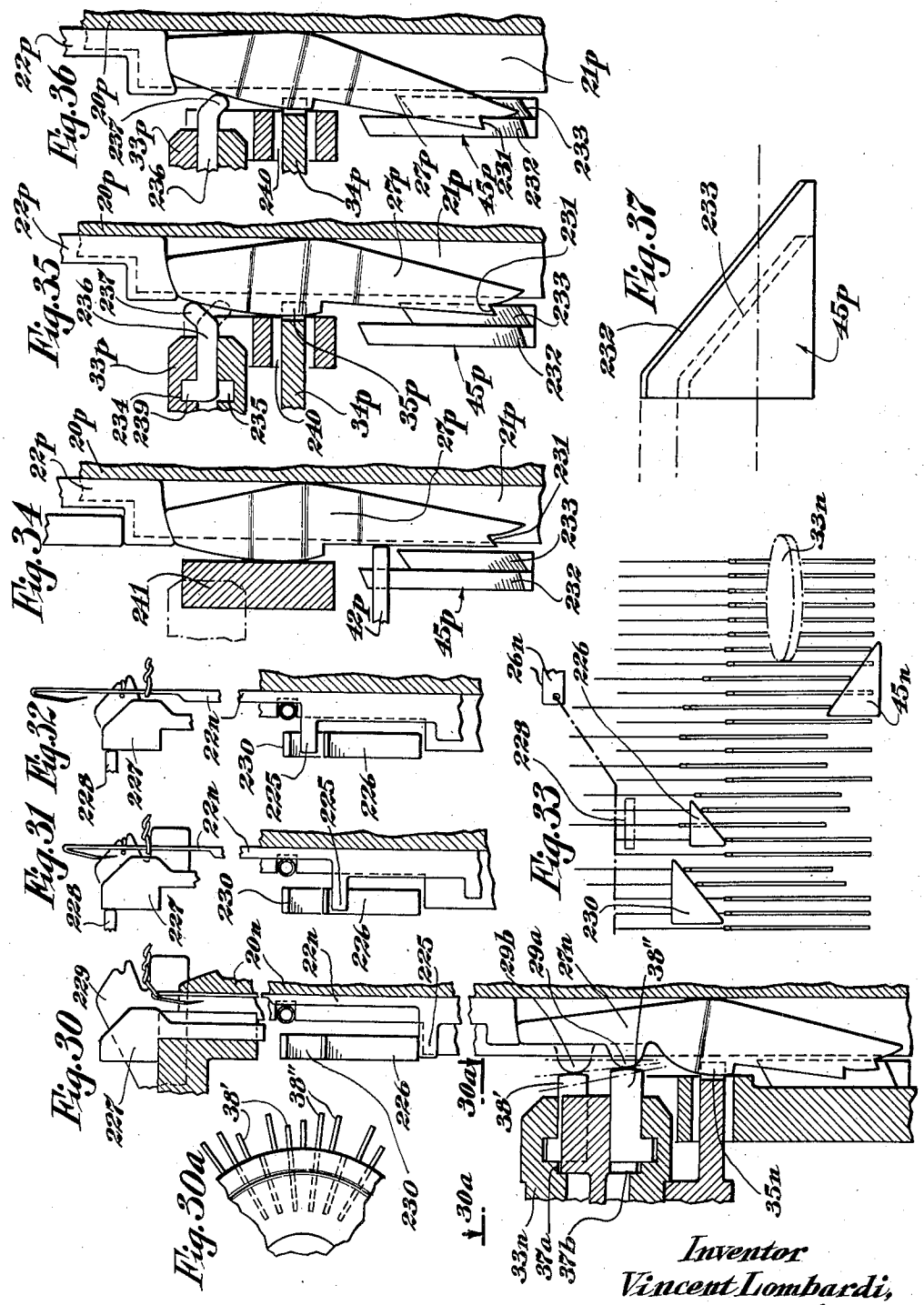

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Fig. 39

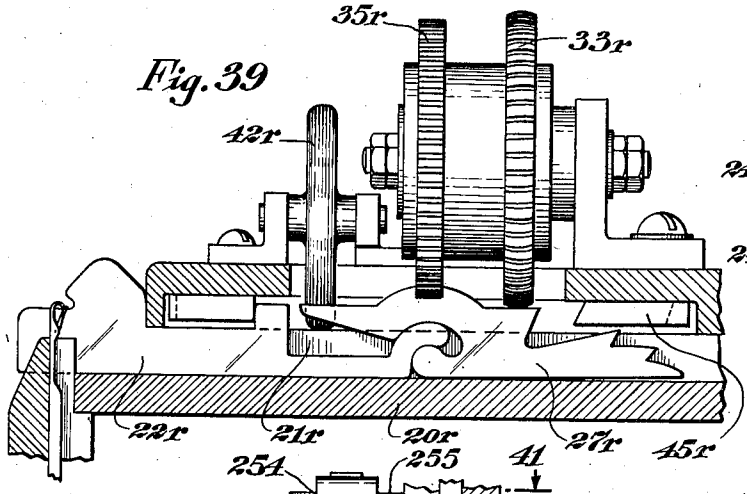


Fig. 38

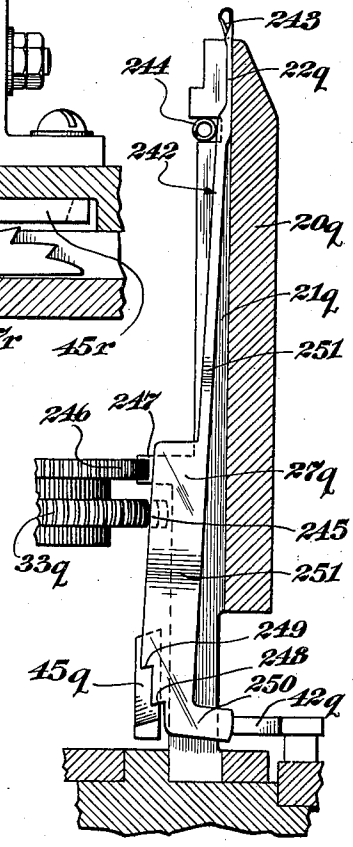


Fig. 40

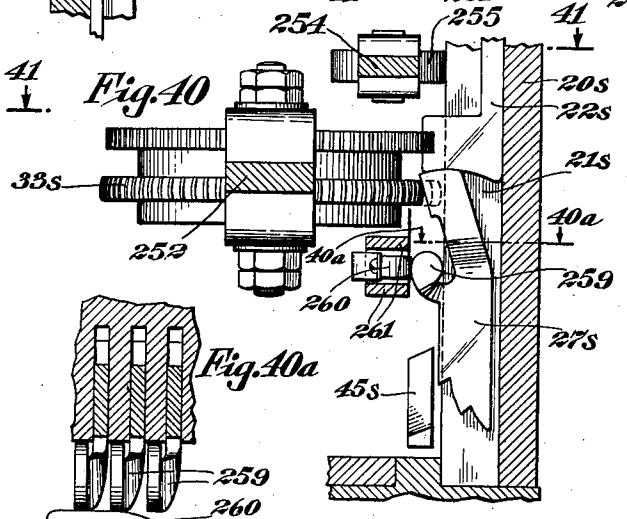
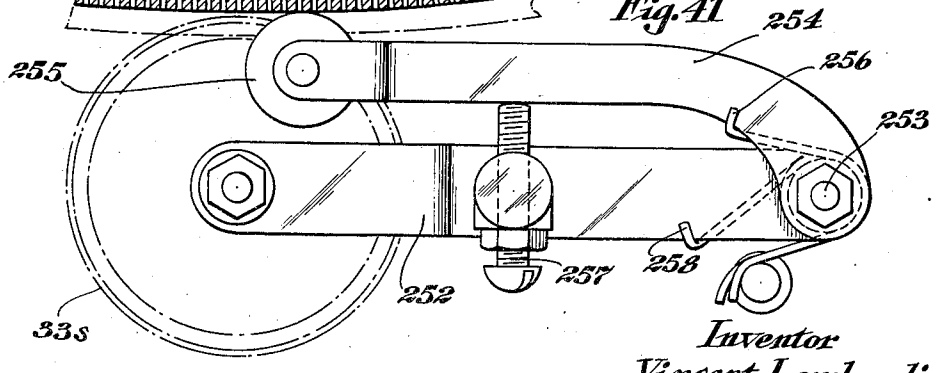


Fig. 40a

Fig. 41



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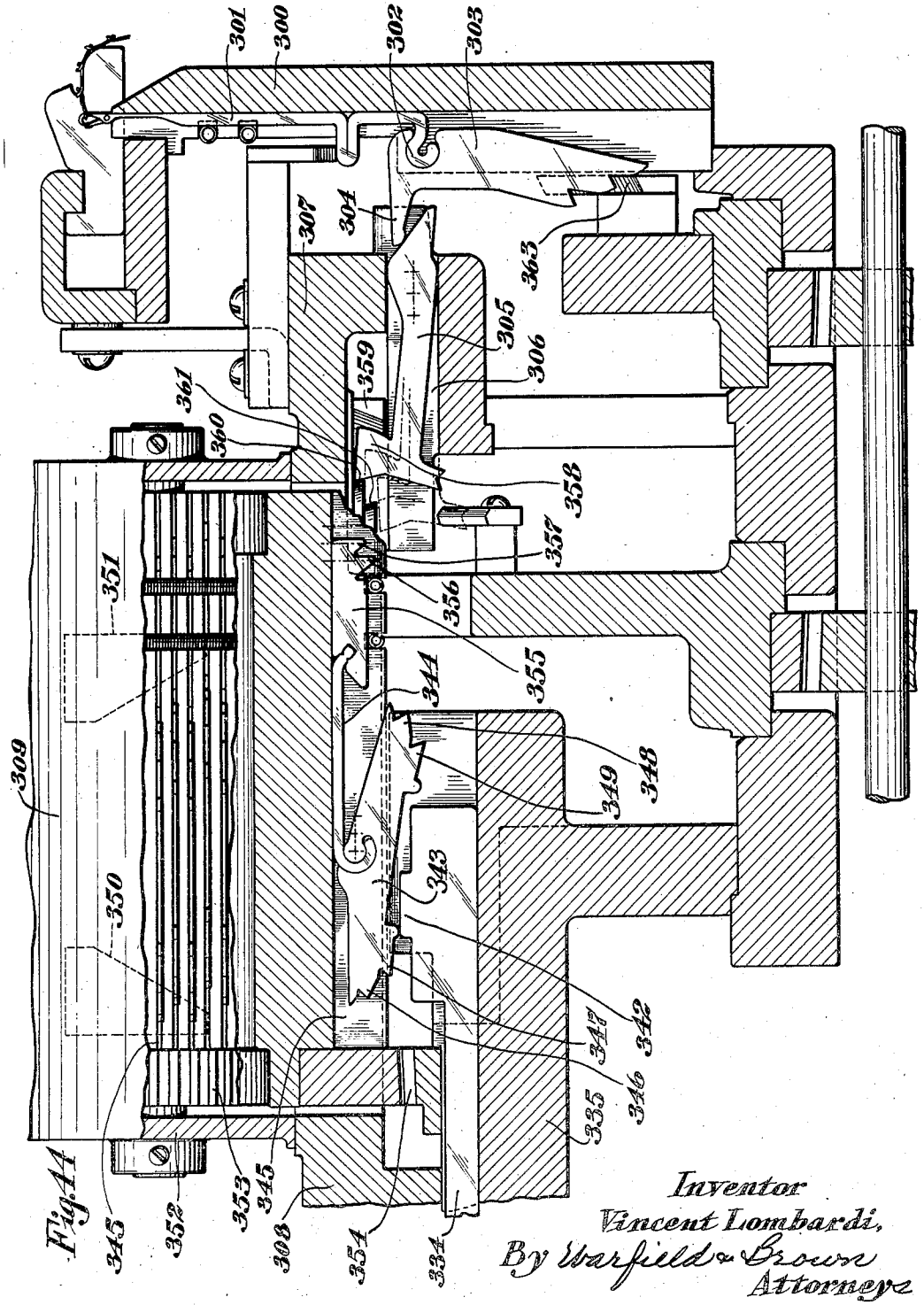

Fig. 44

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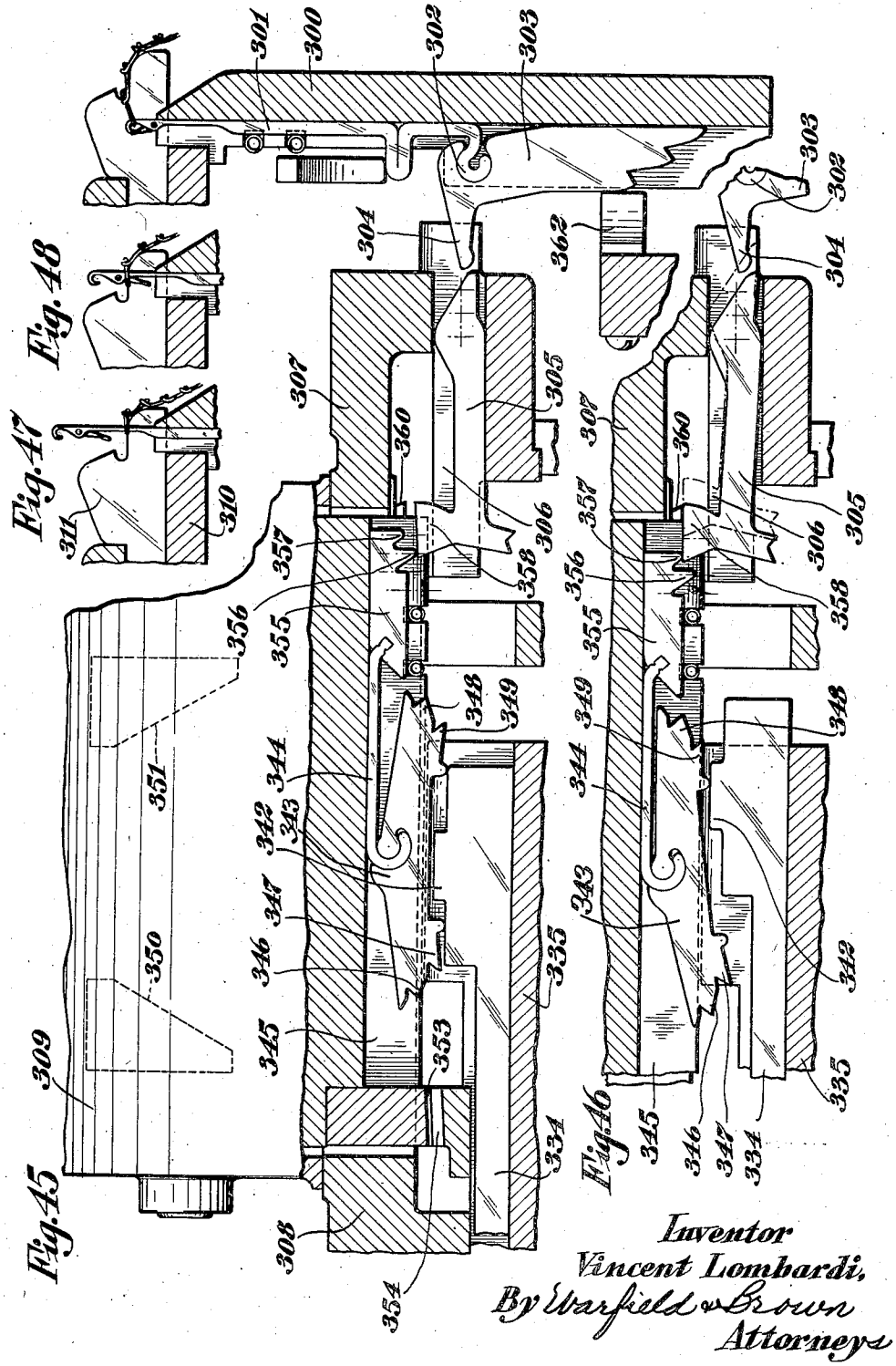

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Fig. 49

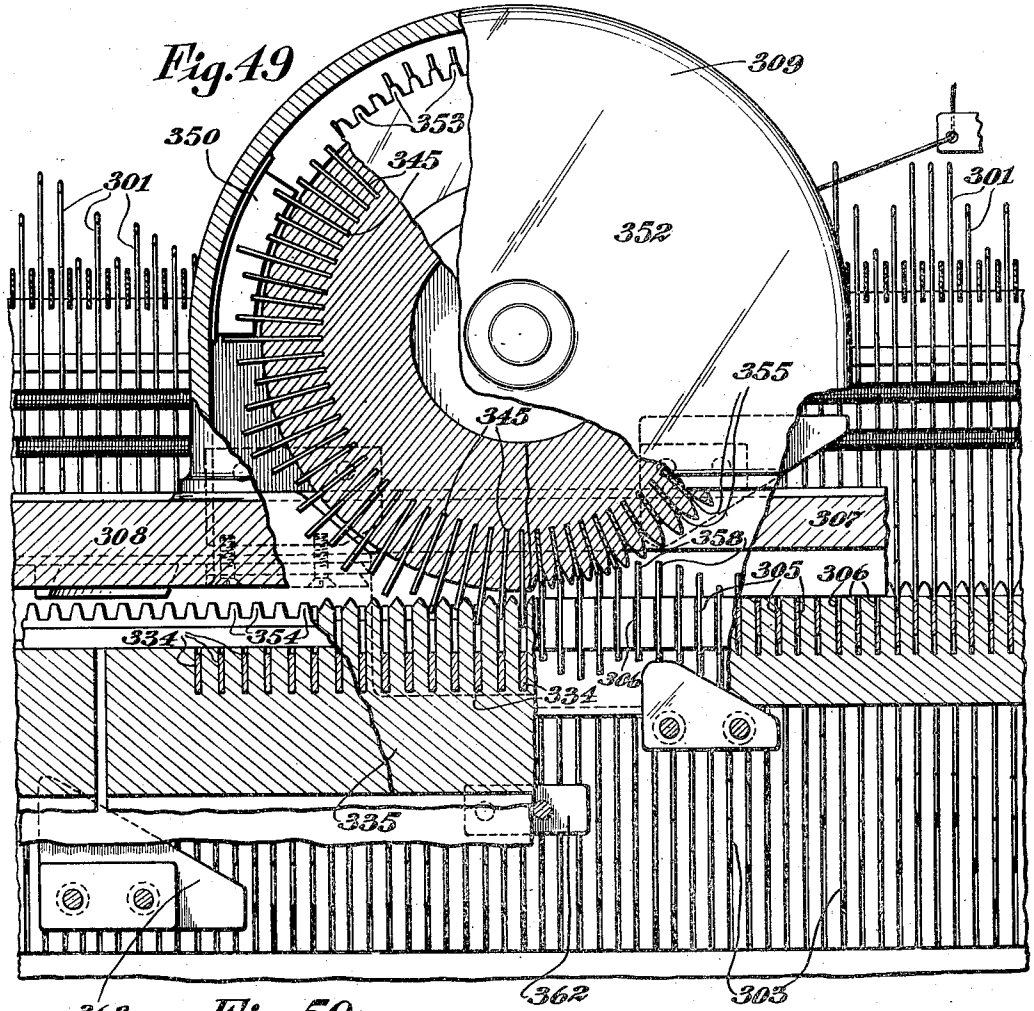
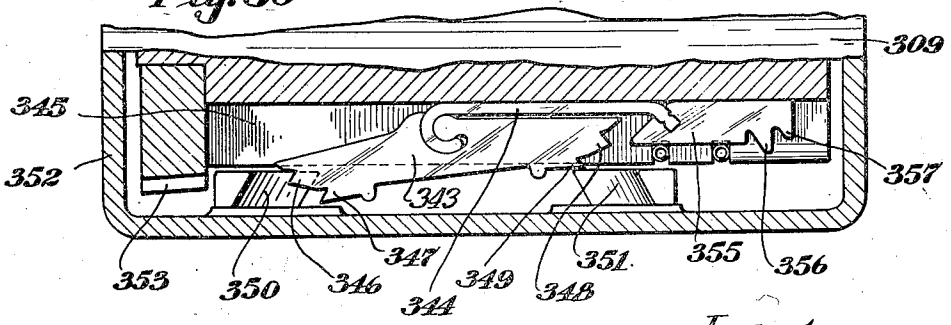


Fig. 50



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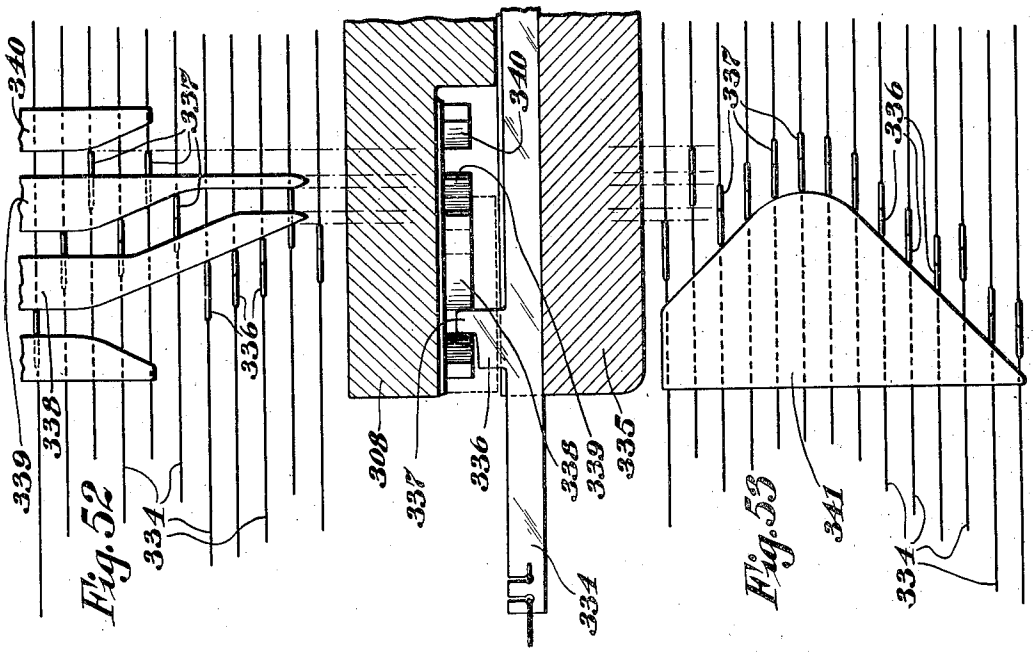

Fig. 52

Fig. 53

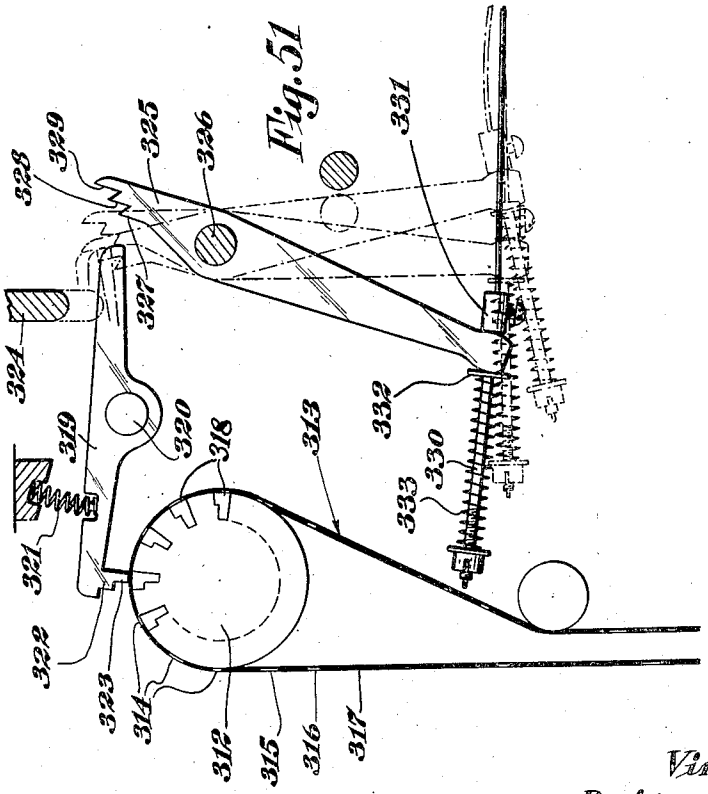

Fig. 51

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Patented Dec. 24, 1935 2,025,463

UNITED STATES PATENT OFFICE

2,025,463

KNITTING MACHINE

Vincent Lombardi, Garden City, N. Y., assignor to Lombardi Knitting Machine Co., Inc., New York, N. Y., a corporation of New York

Application April 17, 1934, Serial No. 720,921

29 Claims. (Cl. 66—50)

This invention relates to knitting machines and is in part a continuation of my co-pending application Serial No. 680,168, filed July 13, 1933.

An object of the invention is the production of improved mechanism whereby there may be produced knitted fabric embodying a wide variety of designs.

A further object is the provision of knitting mechanism which possesses a high degree of simplicity with relation to character of work to be performed.

A still further object is to provide knitting mechanism which is economical of construction, certain in operation, capable of a wide variety of uses, and adapted efficiently and effectively to effectuate the purposes for which it is intended.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the several steps and the relation and order of one or more of such steps with respect to each of the others, and the apparatus embodying features of construction, combinations of elements and arrangement of parts which are adapted to effect such steps, all as exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a fragmentary vertical sectional view of one form of knitting machine embodying the invention;

Figs. 2 and 3 are similar views showing the parts in different positions;

Fig. 4 is a horizontal sectional view along the line 4—4 in Fig. 1;

Fig. 5 is a view similar to Fig. 1 illustrating certain modifications;

Figs. 6 and 7 are views similar to Fig. 5 showing the parts in different positions;

Fig. 8 is a view similar to Fig. 5 showing further modifications;

Fig. 9 is a view similar to Fig. 1 showing another modified form of mechanism and including a showing of a needle and sinker;

Fig. 10 is a horizontal sectional view along the line 10—10 in Fig. 9;

Fig. 10*a* is a fragmentary vertical sectional view showing a form of mechanism which may be utilized to perform a modified type of operation upon the selective elements shown in Fig. 9;

Fig. 11 is a fragmentary vertical sectional view illustrating a portion of a wiping out mechanism adapted for use in connection with the arrangement shown in Fig. 9;

Figs. 12 and 13 are sectional views taken respectively along the lines 12—12 and 13—13 in the direction of the arrows in Fig. 11;

Fig. 14 is a somewhat diagrammatic view illustrating a form of machine embodying the disclosures of Fig. 9 thru 13;

Fig. 15 is a similar view showing a form of machine embodying the disclosure of Fig. 1 and including a modified form of wiping out mechanism;

Fig. 15*a* is a plan view of a portion of machine shown in Fig. 15;

Fig. 16 is a view similar to Fig. 1 showing a modified form of machine;

Fig. 17 is a fragmentary view looking down along the line 17—17 in Fig. 16;

Fig. 18 is a sectional view along the line 18—18 in Fig. 16;

Fig. 19 is a view similar to Fig. 16 showing a further modification;

Fig. 20 is a sectional view along the line 20—20 in Fig. 19;

Fig. 21 is a horizontal view showing one form of means for imparting a selective stepped movement to the rotary member;

Fig. 22 is a side view of a portion of this mechanism;

Fig. 23 is a sectional view along the line 23—23 in Fig. 21;

Fig. 24 is a view similar to Fig. 1 showing another modified form of mechanism;

Fig. 25 is a similar view taken somewhat forwardly of Fig. 24;

Fig. 26 is a partly sectional view along the line 26—26 in Fig. 25;

Fig. 27 is a fragmentary vertical sectional view illustrating another modification;

Fig. 28 is a sectional view along the line 28—28 in Fig. 27;

Fig. 29 is a view similar to Fig. 27 showing additional positioning of the elements and a modified form of knitting element;

Fig. 30 is a view similar to Fig. 1 showing mechanism as exemplified in Fig. 1 utilized to operate a spring needle;

Fig. 30*a* is a fragmentary horizontal section;

Fig. 31 is a view similar to the upper part of Fig. 30, showing the needle in another position;

Fig. 32 is a similar view showing the needle in still another position;

Fig. 33 is a diagrammatic showing of a manner of operation.

Fig. 34 is a view similar to Fig. 1 showing a modified form of construction;

Figs. 35 and 36 are similar views showing the parts in other positions;

Fig. 37 is a side view of the cam shown in Figs. 34, 35 and 36;

Fig. 38 is a view similar to Fig. 1, showing a form of construction wherein the knitting element and the selective element are unitary;

Fig. 39 is a fragmentary vertical sectional view showing sinker-operating mechanism;

Fig. 40 is a view similar to Fig. 1, showing a further modification;

Fig. 40*a* is a sectional view along the line 40*a*—40*a* of Fig. 40;

Fig. 41 is a sectional view along the line 41—41 of Fig. 40;

Fig. 42 is a fragmentary, horizontal, sectional view showing a further modification;

Fig. 43 is a view from one side of Fig. 42;

Fig. 44 is a view similar to Fig. 1 showing another modified form of construction;

Fig. 45 is a similar view showing certain of the parts in other positions;

Fig. 46 is a fragmentary view showing still another positioning of the parts;

Figs. 47 and 48 are fragmentary views showing other positions of other parts;

Fig. 49 is a sectional view along the line 49—49 in Fig. 44 with various of the parts broken away to reveal the mechanism;

Fig. 50 is a fragmentary sectional view along the line 50—50 in Fig. 49;

Fig. 51 is a view showing mechanism disposed beyond the left-hand end of Fig. 44; and

Figs. 52 and 53 are somewhat diagrammatic horizontal views of certain of the mechanism shown in Fig. 51.

Mechanism of the character under consideration ordinarily includes a stationary needle bed of cylindrical form and a plurality of units revolving about the cylinder. Commonly, the mechanism is equipped with an even number of revolving yarn feeds and with an actuator unit acting in advance of the passage of each yarn feed. It is to be understood, however, that the needle bed may be of any well known or desired shape or contour; that either the bed or the units may be movably mounted; and that a single yarn feed and unit or any greater number thereof may be utilized without departing from the invention. It is also to be understood that the invention in its more generic aspects is adapted for use in connection with the actuation of any desired type of knitting element whether latch needle, beard needle, jack, sinker, yarn controller or the like.

While a considerable number of means for producing complicated patterns by effectuating movements of knitting elements between a multiplicity of positions have been devised in the past, these usually involve mechanisms which are extremely complicated and/or involve the use of arrangements wherein fragile elements are so placed that they are extremely likely to be broken in operation. In spite of the fact that the pattern machines in commonest use have for many years utilized pattern wheels or other rotating pattern elements to separate knitting elements and other elements into two positions for subsequent operations, the use of such rotating elements for multiple positioning, so far as is known, has not occurred to the art even though there has been very considerable activity over a number of years in the development of mechanisms for the production of complicated fabrics.

The invention contemplates the use of selective elements individual to each of a series of knitting elements carried by a needle bed and arranged to be mounted for setting movement as on an axis, between a multiplicity of different positions and to be selectively actuated to effect actuations of the knitting elements in accordance with the setting thereof, and in response to the passages of a selecting member such as a cam element. The invention further contemplates the provision of actuator means including an element which is rotatable during relative movement of the needle bed and the actuator means for effecting a selective setting of the selective elements in a multiplicity of positions. Desirably the selective elements are mounted so as to be swingable between said positions. The selective elements and the knitting elements may be made unitary, if desired, or may be independent elements either attached or unattached. The rotary actuator member may be a pattern wheel, pattern drum, or other rotary mechanism of any of a variety of types and may be arranged to operate upon a selective portion either directly or indirectly.

The form of construction exemplified in Figs. 1, 2, 3 and 4 comprises a needle cylinder 20 having vertical slots 21 about its periphery. In these slots are disposed knitting elements 22 held in place by a circular resilient member 23 and are formed at their lower ends with outwardly-extending portions 24 terminating in butts 25. The knitting elements may be latch needles arranged to receive yarn from a suitable yarn carrier (such for instance as shown at 26 in Fig. 15) both when they are in a fully advanced position or "knitting" position or when they are in a partially advanced or "tucking" position. While the members 22 are hereinafter described as needles, it will be appreciated that they may be jacks, sinkers, etc. In this connection it is to be observed that in certain instances it is the usual practice to omit a needle or other knitting element from one or more of the slots of a bed, and that references herein to members individual to the slots of a series are not to be construed as implying that there are no empty slots.

Beneath each needle 22, and arranged to work against the portion 24 thereof, is a selective element in the form of a rocker 27. These rockers, in the present instance, are of a form described and claimed in my co-pending application Serial No. 720,960, filed herewith. They are frictionally held in the slots 21 by means of a bend 28 at their central portions. They are each provided with an aligning notch 28′ to permit their alignment by an aligning cam. The upper end of each rocker is formed in the present instance with a nub 29 adapted to be pressed inwardly to adjust the position of the rocker. About the needle cylinder there is rotatably mounted an annulus 30 suitably connected in any well known or suitable manner to means on which the yarn feeds are carried. Mounted on the annulus 30 in advance of each yarn feed is a revolving unit 31 including a shaft 32. On this shaft there is rotatably mounted a pattern wheel 33 including an element 34 having a toothed periphery 35 adapted to mesh with portions 28 of the rockers 27 so that the pattern wheel will rotate as it revolves about the cylinder. It is to be noted that the axis of the pattern wheel is parallel to the direction of needle movement. The pattern wheel itself com-

prises a lower disc 36 and an upper disc 37. In the present instance the disc 36 is formed with slots 37' for the reception of actuator members 38. The discs are held together by nuts 39 on the shaft 32. The disc 37 is formed with a series of notches 40, and the actuators 38 are formed with projections 41 adapted to seat in these notches. The number of slots in the disc 36 is similar to the number of teeth on the member 34 so that each notch will be aligned with the nub 29 of a single rocker during a rotation of the pattern wheel. In the exemplified construction two lengths of actuators, shown respectively at 38*a* in Fig. 1 and at 38*b* in Fig. 3, are utilized; being provided in such manner that at certain of the notches 40 actuators 38*a* are provided, that at others actuators 38*b* are provided, and at still others no actuators are provided, the arrangement being such as may be desired for a particular type of knitting operation to be performed. Accordingly, the pattern wheel provides a series of configurations of a multiplicity of types (as shown in Figs. 2, 1 and 3) for effectuating the setting of the selective elements in the multiplicity of positions shown in these figures. It is to be noted in this connection that the term "multiplicity" is used herein as the equivalent of the phrase "three or more".

In actual use, the pattern wheel is put together for the production of the particular type of design upon the fabric by inserting actuators such as shown at 38*a* in some of the slots to provide one type of configuration, by inserting actuators such as shown at 38*b* in other of the slots to provide another type of configuration, and by leaving still others of the slots without actuators to provide a third type of configuration. After the desired amount of fabric with the particular design has been produced, the nut 39 is unscrewed, the disc 37 removed and the arrangement altered as to give any desired type of selection for the next piece of fabric. It will be observed that the re-arrangement of these actuators is a matter of extreme simplicity. It is to be noted that the long actuators, the short actuators, and the open slots are all disposed in various relationships about the wheel to provide a varied arrangement of actuator elements; and that, while two or any larger number of long actuators, of short actuators, or of empty slots, may be juxtaposed on any particular part of the wheel and still permit such a varied arrangement, the construction exemplified above and the constructions exemplified hereinafter are to be distinguished from arrangements in which a camming element has a plurality of spaced active portions arranged progressively in increasingly or decreasingly advanced positions so as to follow a regular cam curve.

As will be seen, if a rocker 27 is in the position shown in Fig. 2 the pattern wheel will act, either to leave the rocker in this position if there is no actuator 38 in line with the rocker, to move the rocker to the position shown in Fig. 1 if the actuator is of the type shown at 38*a*, or to move the rocker to the position shown in Fig. 3 if the actuator is of the character shown at 38*b*. In order to move all the actuators to the position shown in Fig. 2 there is provided a roller 42 acting in advance of the pattern wheel. As will be seen, the rocker arms are provided with a plurality of shoulders 43 and 44 at their lower ends and there is provided a cam 45 for operating them; the surfaces of the shoulders and the cam being bevelled to assure against transverse movement of the rockers in the slots. The cam is carried on the supporting annulus 30 adapted to impart, when the rocker is in either of the positions shown in Figs. 1 and 3, but not when in the position shown in Fig. 2, longitudinal movement to the rocker arm and likewise to the needle or other knitting element. Accordingly, after the passage of the pattern wheel, if the rockers have not been otherwise acted upon, they will not be moved longitudinally or impart longitudinal movement to the needles or other knitting elements when in the position shown in Fig. 2; but when in the position shown in Fig. 1 the cam 45 will act against the shoulder 43 to partially advance the rocker and the knitting element with it, so that if the knitting element is a needle the needle will be raised to a partially advanced or "tucking" position; and when in the position shown in Fig. 3, the cam 45 will act on the shoulder 44 to fully advance the rocker and the knitting element with it, so that if the knitting element is a needle, the needle may be moved to a fully advanced or "casting" position. Preferably, each cam 45 is disposed a considerable distance to the rear of a unit 31 so as to permit the setting of the rockers to be wiped out or otherwise changed, if desired, before the passage of the cam 45. It will thus be seen that the invention permits the use of a pattern wheel or other rotating element to impart selective movements to selective mechanism by an action at right angles to the mechanism and in a manner such that the knitting elements are not directly affected, and permits a subsequent action upon the selective mechanism such that the knitting elements, after such action, will be in any of a multiplicity of (three or more) positions. It is to be noted in this connection that the use of a rotating pattern wheel or pattern drum in connection with a series of knitting elements which is indivisible by the number of actuating spaces on the rotating element permits designs with obliquely controlled effects to be obtained in a manner otherwise impossible except by extraordinarily complicated mechanism. Such condition obtains where the pattern wheel contains actuating portions about its periphery and the needle cylinder contains slots, as in the exemplified apparatus. It is also to be noted that, whereas the ordinary pattern wheel acts obliquely upon the knitting elements with the result that there is always considerable difficulty due to bending or breaking of the butts or to lack of proper alignment, the present invention permits the use of a pattern wheel acting on a plane perpendicular to the axis of the cylinder and acting directly on the nubs or other portions of the selective elements so as to avoid these difficulties.

In many instances it is desirable that all the actuators have the same size and configuration, so that they may be kept together and utilized as desired without sorting. To this end the pattern wheel and the actuators may be so formed as to permit actuators to protrude at different extents when differently placed. For instance, the pattern wheel may be formed with two or more sets of notches or projections, so that when a projection or notch in an actuator registers with one of these the end of the actuator will be at one distance from the pattern wheel, and when it registers with another the end will be at a further distance from the pattern wheel. In Figs. 5, 6 and 7 there is shown an arrangement similar to that of Figs. 1–4, but of this type wherein a pattern wheel 33*d* com-

prises a lower plate or disc **36a** having an inwardly disposed notch **46** and an upper plate **37d** having an outwardly disposed notch **47**. Actuators **38d** are provided. These have projections **40d** adapted to register with a notch **46** when the projection is turned downwardly or with a notch **47** when the projection **40d** is turned upwardly. In the former case, as shown in Fig. 6, the actuator projects a short distance from the pattern wheel, and in the latter case the actuator projects an additional distance.

Selective elements may be arranged to be rocked on their inner portions or may be swung on a special pivot as desired. Figs. 5, 6 and 7 also illustrate selective elements **27d**, each mounted on a pivot **48** integral with knitting elements **22d**. In these figures, there is also shown an arrangement whereby the pattern wheel is rotated by meshing with projections on the knitting elements. In the present instance, the upper plate **37d** is formed with a toothed periphery **49**, adapted to receive projections **50** on the knitting elements **22d**.

If desired, the actuator may be formed with a forward portion which will protrude different extents when in opposite positions and the pattern wheel may be formed to retain the actuators in such positions. Such an arrangement is shown in Fig. 8 wherein there is illustrated an arrangement similar to that of Figs. 1–4 as modified in Figs. 5–7, except as indicated. Here there is provided a selective element **27e** similar to the element **27d** except that its upper portion is longitudinally extended. The upper plate **37e** of the pattern wheel **33e** is formed with an annular projection **51**, and there are employed actuators **38e** provided with upper and lower notches **52** each of which is adapted to register with the rim **51** depending upon the position of the actuator. The lower plate **36e** is formed to receive the actuator regardless of its position. The forward end of the actuator extends a distance beyond its center line, as indicated at **53**, and extends forwardly at this point so that when the actuator is in the position shown in heavy lines it will press inwardly the portion **29e** of the selective element **27e** a less distance than when in the position shown in dot-and-dash lines.

In certain instances it is desirable that the selective element be formed with stepped shoulders at each of its ends so that it may be shifted longitudinally in either direction as desired, depending upon the position into which it has been swung. One such arrangement is illustrated in Fig. 9 wherein there is exemplified a vertical needle cylinder **20f** carrying a series of needles **22f** having pivoted latches **54** at their upper ends and carrying also a series of sinkers **55** in a sinker ring **56**. The needles **22f** rest in slots **21f** between ribs **57** on the cylinder. Each needle carries at its lower end a pivot element **48f** on which there is swingingly mounted a selective element **27f** adapted to be acted upon by a pattern wheel **33f**. At the lower portion of the selective element there are provided stepped shoulders **43f** and **44f** adapted to be operated upon by a cam **45f**, and at its upper end there are provided stepped shoulders **58** and **59** adapted to be operated upon by a stitch cam **60**.

As will be seen, when the element **27f** is in the position shown in Fig. 9 the cam **45f** will act upon the shoulder **44f** to raise the selective element a full distance and the needle with it; when the selective element has not been acted upon by the pattern wheel, the cam **45f** will not raise it; and when the selective element is in an intermediate position the cam **45f** will act upon the shoulder **43f** to move the selective element and the needle to partly raised position. When means such as a roller **42f** is provided for swinging all the selective elements in a counter-clockwise direction prior to the passage of the stitch cam **60**, as shown in Fig. 14, the cam **60** will act upon the shoulders **59** to cause the retraction of all the selective elements and needles. However, because of the provision of the shoulder **58** the cam **60** may be made to act in a variety of selective manners upon the selective elements, depending upon a suitable setting of the selective elements after the passage of the cam **45f**. Such setting may be performed by a suitable member, such for instance as a pattern wheel **42a** in the nature of the pattern wheel **33f**, positioned similarly to the position of the roller **42f** and acting on the lower portions of the selective elements. After such setting the selective elements which have been fully raised by the cam **45f** and which remain in a full clockwise position will not be retracted by the stitch cam **60**. Accordingly, an associated needle may receive a yarn without knitting it. If the selective element has been moved to a full counter-clockwise position after it has been lifted by the cam **45f**, the ordinary knitting operation will take place. If it has been moved to an intermediate position after being fully raised by the cam **45f** the cam **60** will act on the shoulder **58** and will cause merely a short stitch with or without casting, as may be desired. As will be appreciated, if a pattern wheel is substituted for the roller **42f** a roller may be substituted for the pattern wheel **33f**, if desired, or for the performance of more complicated operations pattern wheels may be utilized at each point. As exemplified, the pattern wheel **33f** comprises a single rotating disc **37f** and in this disc is formed the slots indicated at **61** in which the actuators **38f** are set. The disc **37f** has a toothed periphery **62** which meshes with projections **63** on the ribs **57** so as to rotate the disc upon the shaft **32f** carried by the annulus **30f**. Beneath the disc **37f** is a stationary disc **64** fixedly secured to the annulus **30f** and carrying a continuous, generally annular, upward projection **65**. Each of the actuators **38f** is formed with a forward notch **66** and a rearward notch **67**. Thus there is provided, as in the case of Fig. 1, mutually abutting means on the pattern wheel and on the actuator members to assure that the actuator members will be properly positioned. In this connection it is to be noted that the terms "rotatable pattern member", "rotatable pattern means", "rotary pattern member", "pattern wheel", "pattern drum", and the like, are used herein to include not only members all parts of which rotate on their axes during operation, but also members with which include relatively stationary guide means and the like which are nevertheless a part of the pattern member in effect, and such terms are to be so understood.

As will be seen, the effective extent of the actuators **38f** depends upon whether the actuator is inserted so that the notch **66** registers with the continuous projection **65**, or so that the notch **67** registers with it. In the present instance, the projection **65** is irregularly shaped so as to effect a camming action as the actuators approach the selective elements, and to thrust the actuators forwardly at this point.

This forward thrust permits the actuators readily to fit into the slots in the cylinder. This arrangement is desirable in cases where the selective elements are disposed somewhat rearwardly of the effective periphery of the needle cylinder; where a particularly large swinging movement of the selective elements is desired; or where fine gage machines are utilized. As will be seen the slotted portion of the disc 37*f* is formed with a recess 68 adapted to receive the continuous projection 65. The shaft 32*f* is spread outwardly at 69 to provide a shoulder against which the disc 64 is held by a nut 69'. Movement of the stationary disc 64 is thus prevented.

As will be apparent various other types of selective elements, actuators, rotating pattern members and other elements may be utilized. Certain of these are exemplified hereinafter. It will also be understood that needle beds such as exemplified may be disposed at any desired angle with respect to the horizontal and may be of any desired shape.

As has been indicated, the pattern wheel or other rotating element and the selecting cam (e. g. 45 or 45*f*) are desirably sufficiently spaced to permit the wiping out of the settings effectuated by the pattern wheel prior to the operation of the selecting cam. For example, there are many instances when it is desirable to knit several rows of plain Jersey cloth intermediate repetitions of a given pattern, and there are other instances when it is desirable to prevent needles at one or more yarn feeds from knitting while a given pattern is being knit at other yarn feeds. Again, it is often desirable to intermingle with certain patterns a number of rows of knitting in which yarns are interlocked by a method, for instance, as set forth in my Patent No. 1,541,230, dated June 9, 1925. This may involve, for instance, moving only alternate needles to tucking positions at one yarn feed (the intermediate needles passing the yarn), and moving all of the needles to casting position at the next yarn feed. Furthermore, there are a variety of other variations in the operation of needles and other knitting elements which are desirable to effectuate at certain stages of the knitting, and to this end the invention in certain of its aspects contemplates the provision of means which may be operative at certain times during the knitting to re-set the selective elements after the passage of the pattern wheel and before the operation of the selecting cam. One form of mechanism to this end adapted for operation in connection with the type of mechanism illustrated in Figs. 9 and 10 is exemplified in Figs. 11, 12, 13 and 14. This mechanism includes an upper roller 70 adapted when moved inwardly to press inwardly the upper ends of the selective elements 27*f*, a roller 71 adapted when moved inwardly to press in the lower ends of the selective elements 27*f*, and a wheel 72 adapted when pressed inwardly to effectuate a positioning wherein every other selective element is in a position with its lower end extending inwardly, and wherein the remaining selective elements are in an intermediate position. The wheel 72 comprises a lower disc 73 having teeth 74 adapted to press the lower end of every other selective element inwardly and notches 75 arranged for the intermediate positioning of the selective elements. The wheel 72 also comprises an upper disc 76 having teeth 77 the outer diameter of which is the same as the inner diameter of the notches 75, and notches 78 adapted to receive the upper ends of selective elements whose lower ends are pressed inwardly by the teeth 74.

The members 70, 71 and 72 are each mounted for independent inward and outward movement which may be effectuated manually or by automatic mechanism. In Fig. 14 there is exemplified one type of automatic control of such movement. The elements 70, 72 and 73 are individually mounted on arms 79 each centrally pivoted at 80 and tending under the influence of a spring 81 to thrust its roller or wheel inwardly. The free end of each arm carries a lug 82 which is normally held in an inward position against the tension of the spring by means of a catch 83. Each catch is normally held in effective position by a spring 84, but is releasable by pressure on it by a rod 85. In order to move the rods 85 inwardly in a selective manner, there is provided a cylinder 86 having at suitable points on its periphery protuberances 87 which are preferably removably mounted in holes 88. The cylinder may be rotated step-by-step either manually or by pattern-control mechanism, such for instance as hereinafter described. Whenever a protuberance 87 registers with a rod 85 the rod will move inwardly, the catch will be released, and the spring 81 will pull the free end of the arm 79 outwardly so that the roller or wheel will move inwardly. In order to restore the lugs 82 behind the catches 83 there are provided supplemental rods 89 adapted to be pressed inwardly by protuberances 90 on the cylinder 86. When such a rod is pressed inwardly by a protuberance 90, the rod presses an arm 79 inwardly to bring its lug 82 under the catch 83.

The form of mechanism for automatically stepping the cylinder 86 here exemplified comprises a pawl 91 acting on a ratchet 92 at the base of the cylinder and pivotally mounted on one end of an arm 93. A spring 94 is provided to hold the pawl in place and a spring 95 tends to hold against a stop 96 the arm 93 which is pivoted at 97. At the free end of the arm there is provided a pressure surface 98. A pressure disc 99 is provided for selective engagement with the pressure surface 98 to swing the arm 93 against the pressure of the spring 95. The disc 99 is carried on a post 100 encircled by one end of an arm 101 which is stationary with respect to the needle cylinder. The disc 99 normally is in a position beneath the lower end of the surface 98 so as to pass it without contact, but is adapted to be raised by a lever 102 so as to contact with the surface 98 and cause the pawl to slip back one notch. The lever 102 which is pivoted at 103 may be lifted from time to time by suitable mechanism such as protuberances 104 on a pattern chain 105. Any desired number of discs 99 and operating mechanism therefor may be disposed about the machine.

Similar "wiping out" or re-setting mechanism may be utilized intermediate the operations of any type of rotating element and selecting cam or other members to re-set the selective elements. In Figs. 15 and 15*a* one such form of mechanism arranged for operation in connection with mechanism such as shown in Fig. 1 is exemplified. Intermediate the pattern wheel 33 and the cam 45 there are provided upper and lower rollers 70*g* and 71*g* and an interlocking wheel 72*g*. Each of these members is carried by an arm 79*g* pivoted at 80*g* and normally pulled inwardly by a spring 81*g*. At the free end of each arm there is provided a nub 106 adapted to be pressed outwardly by protuberances 107 removably mounted on a cylinder 86*g* which may be operated by members

91 to 98 inclusive, and members 99 to 105, inclusive, which are similar in all respects to similarly numbered members shown in Fig. 14. As will be seen, the knitting elements, which are in the form of latched needles 24*g* will, when the members 70*g*, 71*g* and 72*g* are all in an outward position, effect knitting operations in response to the operation of cam 45 upon rockers in accordance with the setting imparted to the rockers by the pattern wheel 33. When the nub on the upper arm, however, registers with a point, such as 108, on the cylinder 86*g* where there is no protuberance 107, the roller 70*g* will be operative and the needles will knit plain Jersey cloth (or will properly operate in connection with an interlocking setting at a previous yarn feed) until the pawl 91 is operated to move the cylinder. When the nub on the lower arm registers with a point such as 109 where there is no protuberance, the needles on the succeeding yarn feed 26 will not catch the yarn at all until the cylinder 86*g* has again been moved forward a step. When the nub on the middle arm registers with a point such as 110 where there is no protuberance, the needles will be alternately in retracted and partially raised positions for an interlocking operation at the yarn feed 26.

In instances where it is desired to obtain the advantages of the use of re-setting mechanism without re-setting the parts, there may be utilized a rotatable member carrying adjustable actuators and means automatically to adjust the actuators for varying operations. Such means also lends itself to operations where radical changes in the type of design at different stages of the knitting are desirable; and in cases where some sacrifice in simplicity is permissible, means of this character may be utilized. One type of such means is exemplified in Figs. 16, 17 and 18, wherein there is illustrated a needle bed 20*h* formed with a series of slots 21*h* carrying knitting elements in the form of latch needles 22*h*. On each needle there is pivotally mounted a selective element 27*h*. An annulus 30*h* is mounted for movement relative to the needle bed and carries a suitable cam 45*h* for selective operation of the selective elements in a manner similar to the action of the cam 45 on the elements 27. The element 30*h* also carries a rotatable pattern member 111 somewhat in the nature of a pattern wheel and mounted on a bearing 112. The pattern member includes a disc 113 formed with peripheral teeth 114 meshing with projections 115 which extend from the needle bed between the slots 21*h*. This pattern member is formed about its periphery with slots 116 in which are set adjustable actuators 117. The actuators are held in place by a pivot spring 118 at their lower ends and by a spring 119 which tends to move them toward the axis of the pattern member. Each actuator is provided with an outward projection 120 adapted to register with a selective element and with varying conformations on its inner side along a multiplicity of positions. In the present instance such conformations are disposed at eight positions. Within the pattern member at the side adjacent the needle bed there are provided a multiplicity of cam elements 121 (eight in the present instance) mounted on a pivot rod 121' and normally thrust against a cylinder 122 which is fixed on a shaft 123. Springs 124 may provide this thrust. The shaft 123 is disposed at the side of the axis of the pattern member remote from the needle bed and is mounted for rotation within the bearing member 112. It will be seen that the pattern member provides a series of configurations of a multiplicity of different types consisting of the members 120 under the influence of an operative element 121 as the pattern member moves past the bed. Vertically disposed on the cylinder 122 are eight series of vertically-disposed holes 125, and in certain of these holes are selectively disposed removable protuberances 126. At the bottom of the shaft 123 is a ratchet 127 whereby one or another of the series of holes may be moved to a position in line with the elements 121. A suitable mechanism may be provided for effectuating desired rotations of the shaft 123 from time to time in the operation of the machine, as desired. The mechanism exemplified comprises a pawl 128 pivoted at 129 on an arm 130 and held by a spring 131 against the ratchet. The pawl is retracted to a desired extent by the arm 130 and returned by a spring 132. The movements of the arm 130 are effectuated by a pressure disc 133 acting on a pressure surface 134 on the arm. The disc 133 may be operated by mechanism of the character utilized in operating the disc 99. It is to be observed that the inner conformations on the actuators comprise surfaces at three positions;—an inner position 137, an intermediate position 138, and an outer position 139;—so that, provided that a surface in position 137 is in line with an element 121, when the element 121 is projected by a protuberance 126 it will press the actuator all the way out from the pattern wheel and swing the selective element so that its lower end is all the way out from the cylinder. If a surface 138 is in line with the element 121 the actuator and the selective element will be moved only part way, and if a surface 139 is in line with the element 121, the actuator and the selective element will not be moved at all, or at least will not be moved to a material extent. Accordingly, the type of knitting operations to be performed will be determined by which of the elements 121 is projected by a protuberance on the cylinder 122. For instance, if a series of holes 125 containing no protuberances is aligned with the elements 121, the actuators will all be held inwardly by the spring 119 and will not affect the selective elements, so that if they have been properly positioned with their lower ends inwardly, the cam 45*h* would not affect them and the yarn carried by the yarn feed corresponding to the particular pattern member will not be caught by the needles. If each of the actuators is formed with an inwardly-extending surface 137 in line with the lowermost element 121, the projection of this element will cause all of the selective elements to be in the position shown at full lines, and if the knitting elements 23*h* are latched needles will cause them to knit Jersey cloth. Again, if alternate actuators have an outward surface 139 in position in line with the second element 121, and if the remaining actuators have an intermediate surface 138 in line with this actuator, the actuators will operate upon the selective elements so that the cam will move these to cause latched needles to be positioned to receive yarn for interlocking. If at a position in line with the third selective element 121 a few of the actuators have an inward surface 137 and the remaining actuators have an intermediate surface 138, the action will be such that latched needles will perform a tucking operation. Various unusual and pleasing patterns may be performed by arranging the configurations in line with the fourth, fifth, sixth, seventh and eighth elements

121 in various manners and by turning the cylinder 122 to various extents at varying times.

In Figs. 19 thru 23 there is exemplified a generally similar form of construction wherein the pattern wheel itself is simplified somewhat and a plurality of pattern chains utilized to effectuate changes in pattern. As exemplified, the machine includes a needle bed 20j formed with slots 21j in which are disposed a series of needles 22j having projections 25j. Beneath the needle in each slot is disposed a rocker member 27j generally similar to the rocker 27 and arranged to be similarly operated by a cam 45j carried on an annulus 30j arranged for movement relative to the needle bed. A pattern wheel 33j is rotatably mounted by means of bearings 140 on a member 141 carried by the annulus 30j. The pattern wheel carries actuators 142 forming a part of axial members 143. The members 143 are normally held against an annulus 144 by means of a spring 143', and are formed at their inner edges with surface portions in a multiplicity of positions. Certain of these surface portions, as indicated at 145, extend farthest toward the axis of the pattern wheel, others shown at 146 extend a less distance toward the axis of the pattern wheel, and still others shown at 147 extend a still less distance toward the surface. It will be seen that on each member 143 the surfaces 145 are symmetrically disposed about the annulus 144 as are the surfaces 146 and 147. Within the pattern wheel at the side thereof adjacent the needle bed, there is provided a post 148 rotatably supported by the member 141 and carrying a plurality of cam elements 149 having protruding cam portions 150 arranged to act on the surfaces 145, 146 and 147 in a manner somewhat similar to the action of the elements 121 on the surfaces 137, 138 and 139. It is to be observed that the cam portions 150 of the various elements 149 are evenly disposed about the periphery of the shaft 148 and that they are symmetrically disposed above and below the annulus 144 so that the top element 149 and the bottom element 149 each has its cam portion 150 at the same side of the shaft 148; and the portions 150 of the elements 149 next to the top and next to the bottom extend from another side, etc. It will thus be seen that by rotation of the shaft 148 one or another of the cam portions 150 may be brought into a position as indicated at 151 in Fig. 20, wherein they will be operative to cause a selective movement toward the needle bed of the members 143 against the pressure of the spring 143', and a selective projection of the actuators 142. Those members 143 having surfaces 145 aligned with the operative pair of cam portions 150 will be thrust to the positions shown in full lines in Fig. 19; those members 143 having surfaces 146 aligned with the operative cam portions 150 will be partially moved; and those members 143 having surfaces 147 aligned with the operative cam portions 150 will not be moved.

While the rotation of the shaft 148, to bring various cam portions 150 into operative position as desired, may readily be caused manually, there is exemplified automatic means for causing such movement. This mechanism comprises a ratchet 152 on the bottom of the shaft 148, and a pawl 153 carried on an arm 154 pivotally connected at 155 with an arm 156. The pawl is held against the ratchet by means of a spring 157 and the movement of the ratchet is limited by means of a spring-pressed wheel 158. The arm 156 is pivoted at 159 and normally held against a stop 160 by means of a spring 161. The free end of the arm carries a pressure surface 162 adapted to contact one or more of a group of discs 163. The discs normally rest on a plate 164 in a plane beneath the pressure surface 162, but are adapted to be raised into a plane wherein they will contact the pressure surface and swing the arm 156 when moved laterally thereof. The plate 164 is stationary with respect to the needle cylinder. Plates 164 may be disposed about the cylinder at any desired points. It is to be noted that the contact of one disc 163 with the pressure surface 162 will effect a rotation of the shaft 148 which will move one cam portion 150 from operative position and bring into operative position the cam portion next above it, whereas contact of all five discs with the pressure surface 162 will effect five movements of the shaft 148 so as to remove a cam portion 150 from operative position and bring into operative position the cam next below it. Accordingly, the particular pair of cam portions to be moved into operative position will be determined by the number of discs 163 which are elevated. In order to elevate the discs there are provided beneath each plate 164 a plurality of arms 165, one of which is arranged to raise all the discs, another of which is arranged to raise all the discs but one, and the last of which is arranged to raise only one of the discs; so that any desired number of discs may be raised. In connection with each arm 165 there is provided a pattern chain 166 having selectively arranged protuberances 167 thereon. Accordingly, when none of the chains have protuberances in operative positions all the discs 163 will be in operative positions, but when one of the chains 166 has a protuberance 167 in operative position, one or more of the discs 163 will be raised, the number of discs raised depending upon which of the arms 165 is operated by the particular chain carrying the operative protuberance.

In Figs. 24, 25 and 26 there is illustrated a form of mechanism wherein certain of the advantages of the constructions shown in Figs. 16 thru 18, and 19 thru 23, are made available with a considerable gain in simplicity. There are many instances in which it is desirable to alternate two patterns at a single yarn feed. In the exemplification illustrated in Figs. 24, 25 and 26 there is provided a needle cylinder 20k formed with slots 21k in which knitting elements 22k, such for instance as needles and jacks, are mounted for longitudinal movement. Pivotally supported on each knitting element is a selective element 27k similar to the elements 27f and arranged to be moved longitudinally by cams 45k and 60k in a similar manner. One or more rotary elements 33k are mounted on a revolving annulus 30k and are provided with a toothed disc 170 arranged to mesh with portions 171 on the elements 27k. The rotary element 33k embodies two pattern wheel portions 172 and 173 and is rockingly mounted on a pivot rod 174 so that one or the other of the wheels 172 and 173 may be brought into operative relationship with the selective elements. Each of the wheels 172 and 173 comprises a removable, radially slotted disc 175 adapted to contain actuators 176, having associated therewith a removable, non-rotating disc 175 formed with an annular groove 177 adapted to receive protuberances 178 on the actuators. Actuators of two lengths are used, as is the case with the actuators 38 of Fig. 1. Some of the slots in the members 172 and 173 receive

actuators of one length; some, actuators of another length; and some, no actuators; so that the action of the actuators on the upper portion, or the lower portion of the selective element, as the case may be, will be similar to the selective action of the configurations on the pattern wheel **33** shown in Fig. 1. The rotary element **33***k* is mounted on the pivot rod **174** by means of a bracket **179** and the pivot rod is itself mounted on a brace **180** which may be integral with the annulus **30***k*. In order to maintain the rotary element in one or the other of positions in which it is adapted to be set, there is provided a projection **181** on the bracket **179**. This is held against one or another of two stops **182**, having between them a spring-pressed roller **183** which yields to permit the rotary element to be rocked on the pivot element **174**, but holds it firmly in place after it has been swung. Inasmuch as the selective elements should all be aligned with their upper ends out from the needle cylinder for action by the wheel **172**, and since the selective elements should all be aligned with their lower ends out for action by the wheel **173**, a single roller-aligning means may be replaced by a pair of rollers, as indicated at **184** and **185** carried on a bracket **186** pivoted on a rod **187**. For convenience in operation the rod **187** is supported on the brace **180** and carries a gear **188** meshing with a gear **189** on the pivot rod **174**. Accordingly, when the bracket **179** is swung in one direction the bracket **186** will be swung in the other direction, and the selective elements will always be aligned by the proper one of the rollers **184**, **185** for action by the operative one of the wheels **172** and **173**.

The projection **181** may be shifted manually, if desired, or automatic mechanism for shifting it at suitable times in the operation may be provided. One form of such mechanism is exemplified as comprising a link **190**, one end of which encircles the projection **181** and the other end of which is connected to an arm **191** pivoted at **192**. The arm **191** carries pressure surfaces **193** and **194** disposed respectively on opposite sides of the pivot point **192** and in different planes. One or more discs **195** are arranged for movement in line with one or another of the pressure surfaces **193** and **194** for causing the rotary element to be swung in one direction or in the other, as desired. Each disc may be arranged to be operated by a lever **196** which may be left in a lowermost position, partially raised, or fully raised, depending on whether a link of an associated pattern chain **197** is formed without protuberances as at **198**, with a low protuberance as at **199**, or with a high protuberance as at **200**, at the point adjacent the lever.

It will be appreciated that a rockable pattern wheel of various other types,—as for instance a pattern wheel wherein the configurations at the two ends are each automatically variable,—may be employed.

As above indicated, mechanism for effecting a movement of a knitting element between more than three positions may be provided in accordance with the invention. Mechanism of this character is exemplified in Figs. 27, 28 and 29. This form of construction comprises a needle bed **20***m* in the form of a needle cylinder provided with slots **21***m* carrying knitting elements **22***m*, which as exemplified in Fig. 27 are in the form of jacks. The slots also carry selective elements **27***m* of the character disclosed in my co-pending application Serial No. 680,168 above referred to. Each selective element **27***m* is pivotally connected with its jack by means of an inturned curled element **201** fitting into into a curved slot **202** in the jack; and each selective element is provided with shoulders **203**, **204** and **205** at its lower end, and with shoulders **206**, **207** and **208** at its upper end. The shoulders are so positioned that when either of the innermost shoulders **205** and **208** are at operative position outside the slots no other shoulders will be in such position; whereas the shoulders **204** and **206** will be in operative position at the same time, and the shoulders **203** and **207** will be in operative position at the same time. Longitudinal positioning of the selective elements is caused by the passage of one or the other of two cams **45***m* and **60***m* which are spaced in vertical direction a distance equal to the distance between the shoulders **204** and **206**, or between the shoulders **203** and **207**. The lower end of the jack is provided with four indentations **209** and the selective element is provided with a cooperating lug **210** whereby the selective element will be effectively retained in any position into which it is swung. The upper portion of the jack is provided with a butt **211** which may be contacted by a suitable knitting cam. In order to set the selective elements **27***m* in desired positions there is provided a pattern wheel **33***m* which, as will be observed, includes portions operative on the upper and lower parts of the selective elements so that certain of the selective elements may be swung in a counter-clockwise direction and other of the selective elements in a clockwise position during a single rotation of the pattern wheel. These portions, indicated respectively at **212** and **212'**, are provided by radially-slotted ends of a central drum **213**. These slotted ends are covered by stationary, removable discs **214** and **215**, each provided with a cam groove **216** adapted to receive projections **217** on actuator members **218** in the slots. The discs are fitted on the shaft **219** on which the drum **213** rotates. The shaft is carried on an annulus **30***m* to which the cams **45***m* and **60***m* are suitably connected.

The actuators are formed with three lengths, as indicated at **218***a*, **218***b* and **218***c*, so that at each portion of the pattern wheel there may be provided four types of configurations, including one at which no actuator is present. The construction as exemplified contemplates an operation without the use of an aligning roller such as a roller **42** or **42***f*, since, as will be seen, if it is desired to move a selective element in a counter-clockwise direction a suitable actuator will be provided at the upper portion of the wheel, and if it is desired to move a selective element in a clockwise direction a suitable actuator will be provided at the lower portion. Since each selective element will be in a given position longitudinally of the slots **21**, depending on the previous setting, after the passage of both of the cams **45***m* and **60***m*, the selective elements will be ready for a subsequent setting by a second pattern wheel or by a second rotation of the same pattern wheel. In order for the actuators to meet the selective elements in a position for proper setting action, regardless of the longitudinal position of the individual selective element, each selective element is formed with relatively inclined edge portions **220** and **221** at its upper part and **222** and **223** at its lower part, and the longer and shorter actuators are provided with actuating edges in a plane nearer the vertical center of the pattern wheel than the actuating edges on

the actuators of intermediate length. If it is desired to move a selective element into either of its intermediate positions regardless of the position from which it may be moved, an actuator 218*b* may be positioned at one end of the rotary element and an actuator 218*a* positioned at the other end of the rotary element, these being disposed at the top and bottom, or bottom and top, respectively, depending upon which of the two intermediate positions it is desired to move the selective element to.

Accordingly, movements of the selective elements from one position to the desired position may be properly caused by the actuators.

As will be apparent, any desired type of knitting element in any desired position with respect to the horizontal may be utilized instead of the jacks 22*m*. For instance, a latch needle 224 such as exemplified in Fig. 29 may be utilized. The construction illustrated is well adapted for the provision of stitches of various lengths in the fabric, as well as for a variety of other types of knitting movements.

In Figs. 30 thru 33 there is shown an arrangement for operating spring needles; the mode of operation, as particularly exemplified, being such that "interlock fabric" may be produced if desired. In these figures there is shown a needle cylinder 20*n* carrying a series of selective elements 27*n* similar to the members 27 in Fig. 1, and a pattern wheel 33*n* similar to the pattern wheel 33. A lifting cam 45*n* is provided. The knitting elements 22*n* in the present instance consist of spring or beard needles provided with butts 225 adapted to be operated on by a stitch cam 226. Beard pressers 227, operated by a cam 228, are adapted to be in place to close the beards if the needles are retracted by the stitch cam, but not to close the beards if the needles are retracted at a later point. The needles are adapted to receive yarn from a yarn carrier 26*n*, thru the medium of sinkers 229, when they are either in an uppermost or in an intermediate position. The stitch cam is so disposed that it will operate on the butts 225 of the needles when the needles are in an intermediate position, but will permit the butts to pass above it when the needles are in the uppermost position. Beyond the stitch cam at a point such that the beard pressers will not be operative upon the beards of needles, is a further retracting cam 230 which depresses those needles which are in an uppermost position. Accordingly, it will be seen that if a needle is in a lowermost position, it will not receive the yarn; if the needle is in an intermediate position, it will receive the yarn and be caused by the stitch cam and the beard presser to cast a previously knitted yarn; but if the needle is in an uppermost position, it will pass the stitch cam and be retracted by the cam 230 in such manner that the previously received yarn will not be cast. The arrangement is, therefore, adapted for the production of a wide variety of patterns, and is also adapted for the production of interlock fabric by beard needles. To effectuate this it is merely necessary to have certain needles, for instance, alternate needles, in a lowermost position and intermediate needles in an uppermost position at one yarn feed, as shown in the center of Fig. 33, and to have all these needles in an intermediate position at the succeeding yarn feed. Claims directed to constructions such as here exemplified are included in my co-pending application, Serial No. 758,177, filed December 19, 1934, which is a continuation in part of the present case.

There is also exemplified in connection with Fig. 30 a form of mechanism adapted for use in machines of such fine gage that it is impractical to provide the configurations about the pattern wheel at a single plane. In this exemplification alternate ones of the selective elements 27*n* are formed with protuberances 29*a* at a lower point and the intermediate selective elements 27*n* are provided with protuberances 29*b* at an upper point. The pattern wheel 33*n*, which is driven through the medium of an element having a toothed periphery 35*n* meshing with the selective elements, is formed with a row of upper slots 37*a* and a row of lower slots 37*b*, the slots being staggered to correspond with the positioning of the protuberances 29*a* and 29*b*. In each series of slots there are selectively-disposed actuators 38' and 38'' of different lengths, certain of the slots being left without actuators, and the arrangement of actuators being such that the rockers 27*n* will be set in the desired position just as if actuators on a single plane were used. Claims to constructions such as here exemplified, and to other features, are included in my co-pending application, Serial No. 5,216, filed February 6, 1935, which is a continuation in part of the present case.

It will be appreciated that the invention in certain of its aspects is not limited to the use of a selective element formed with a plurality of shoulders. For instance, a plurality of stepped cam surfaces may be utilized to act upon a single shoulder of the selective element. Mechanism of this nature is exemplified in Figs. 34 thru 37, wherein there is exemplified a needle bed 20*p* carrying a series of knitting elements 22*p* and associated selective elements 27*p* arranged to be set selectively by a pattern wheel 33*p*. Each selective element is formed with a single shoulder 231 upon which an upper surface 232 of a cam 45*p* is adapted to act when the shoulder 231 has been swung to an outermost position, and upon which a lower surface 233 of this cam is adapted to act when the shoulder 231 is in an intermediate position. The shoulder 231 will be acted on by neither surface when it is in an innermost position. Separate cams may be, of course, employed, if desired. In these figures there is also exemplified a form of pattern wheel in which the actuators, although of the same length, act differently upon the selective elements, the actuators having bent ends which are turned in different directions, and the selective element being provided with a properly sloped surface. As exemplified, the upper disc of the pattern wheel is provided with a groove 234 and the lower disc with an opposite groove 235. Actuators 236, each having a turned end 237 and having a projection 239 are provided at desired points. As will be seen, if no actuator is provided at a point, the selective element 27*p* will be in the position shown in Fig. 34; if an actuator is in position with its operative end turned upwardly, the selective element will be in the position shown in Fig. 35, and if the actuator is in position with its operative end turned downwardly, the selective element will be in the position shown in Fig. 36. A roller 42*p* is provided for aligning the actuators. The pattern wheel 33*p* is driven by a member 34*p* having a toothed periphery 35*p*. In the present instance, the member 34*p* fits in a slot 240 in an annulus 241 which is stationary with respect to the axis of the pattern wheel and movable with respect to the needle bed. This annulus serves as a holding member whereby the rockers

are held securely within the slots 21*p* in the needle bed.

As above indicated, the knitting element and the selective element may be unitary, if desired, although the provision of separate elements gives a greater degree of control and, as a rule, greater permanence of construction. From the standpoint of simplicity, however, and for other reasons, it is sometimes desirable to make the two elements unitary. An arrangement of this nature is found in Fig. 38 wherein there is exemplified a needle bed 20*q* formed with slots 21*q*. In each slot there is disposed a member 242 having a needle portion 22*q* and a swingable portion 27*q* providing a selective element. The members 242 are held in place, and vertical movement of the latched portion 243 assured, by an annular spring 244. A pattern wheel 33*q* is arranged to act on portions 245 of the elements 27*q* in a desired selective manner, the pattern wheel being provided with a gear portion 246 meshing with projections 247 on the cylinder. The portions 27*q* are provided with stepped shoulders 248 and 249 adapted to be operated by a cam 45*q*. In order to align the portions 27*q* for operation by the pattern wheel there is provided a cam 42*q* within the cylinder acting on an inturned portion 250 at the lower end of the member 242 prior to the operation of the pattern wheel. The members 242 are each provided with bends 251 so that they will be frictionally held in the position into which they are moved in the slots. Claims directed specifically to constructions such as here exemplified are included in my co-pending application, Serial No. 8,256 filed February 26, 1935, which is a continuation in part of the present case; and in my co-pending application, Serial No. 42,368, filed September 27, 1935, which is a continuation in part of the latter case.

In Fig. 39 there is exemplified an arrangement for operating the sinkers in accordance with the invention. This exemplification includes a needle bed 20*r* formed with slots 21*r* each containing a sinker 22*r*. Associated with each sinker is a selective element 27*r* adapted to be set by a pattern wheel 33*r* and to be operated upon selectively by a cam 45*r*. Gearing 35*r* and an aligning roller 42*r* are provided.

In certain instances it is desirable to avoid inaccuracies by providing means for compensating for irregularities in the circumference of a needle cylinder. In Figs. 40 and 41 there is shown such an arrangement. As exemplified, this comprises a needle cylinder 20*s* carrying knitting elements 22*s* and also selective elements 27*s* adapted to be set by a pattern wheel 33*s*, and to be operated on by a cam 45*s*. The pattern wheel 33*s* is mounted in the present instance on an arm 252 pivoted at 253. Also pivoted at 253 is an arm 254 carrying a spacer roller 255 which is pressed constantly against the periphery of the cylinder by a spring 256. The arm 252 is held in a given position from the arm 254 by means of a set screw 257 and the spring 258. Accordingly, any variations in the periphery of the cylinder will be compensated for by the pattern wheel positioning. In the present instance also, the selective elements 27*s* are provided with outwardly-extending turned-over arms 259 upon which they pivot, and which hold them in a fixed position with respect to the periphery of the cylinder. Accordingly, if a bulge in the cylinder occurs at one side of the machine, both the selective elements 27*s* and the pattern wheel 33*s* will be at a somewhat greater distance from the axis than the selective elements and the pattern wheel in other positions, but the pattern wheel and the selective elements will at all times be at the same position with respect to each other. A spring-pressed member 260 moving below the pattern wheel is provided to hold the selective elements firmly against the periphery of the cylinder as the pattern wheel is passing, and guide annuli 261 are provided to retain the selective elements in the slots 21*s* in the cylinder.

It is not essential that the pattern wheel be formed with individually removable actuators. It has been found that in many instances, as where a considerable number of various stock patterns are to be produced, it is advantageous to utilize pre-formed discs which may be pressed or stamped from metal, fibre, or other suitable material, to provide configurations for the pattern wheel. In Fig. 42 there is shown an arrangement embodying this feature. A needle cylinder 20*t* carries selective elements 27*t* arranged to be set by a pattern wheel 33*t* mounted on an annulus 30*t*. The annulus 30*t* and the cylinder are mounted for relative movement about the axis of the cylinder. The pattern wheel 33*t* includes a rotatably-mounted member 262 on a shaft 263. A pre-formed disc 264 having in the present instance three types of configurations, as shown at 265, 266 and 267, is removably held upon the member 262 by a disc 268 held in place by screws 269. The disc 264 may be stamped out of metal or otherwise suitably formed. Desirably, a second disc 270 having a toothed periphery 271 is provided for driving the pattern wheel. This disc 270 may be suitably held in place against the lower surface of the member 262 by means of a lower member 272 into which the screws 269 extend. As will be apparent all that is necessary for a change of pattern is to remove the screws 269 and to lift off the disc 264 and then to replace this disc with another disc having a different series of configurations stamped therefrom. As will be apparent such discs formed with two, three, four or more types of configurations may be provided, depending upon the type of machine in which they are used.

While in instances where simplicity is desired the preferred embodiments of the invention are found in mechanism wherein selective elements are operated by a rotating pattern element wherein the actuators are permanently in place throughout the knitting of a single piece of fabric, or wherein the setting of the actuators is controlled by means which move with the rotating element relatively to the needle bed; the invention is also adapted for embodiment in mechanism wherein the rotating pattern element consists of a pattern drum, the setting of the actuators of which is controlled by a pattern web mounted on a stationary support at a remote point. One form of construction is illustrated in Figs. 44 thru 53. It is to be noted that Fig. 53 shows mechanism beyond the left-hand end of Fig. 44. As exemplified, the construction comprises a stationary needle cylinder 300 carrying about its periphery a series of latch needles 301 each formed at its lower end with a pivot point 302 on which is swingingly mounted a selective element 303, which may be of the character shown in my said co-pending application Serial No. 680,168. Each selective element carries at its upper end an outwardly-extending lug 304 beneath which one end of a sliding lever 305, fric-

tionally mounted within a slot **306**, is adapted to be moved. The slot **306** is formed in a piece **307** which is stationary with respect to the needle cylinder. Revolubly mounted with respect to the needle cylinder is an annulus **308** carrying a pattern drum **309** and also carrying yarn feeds (not shown) and a guide **310** for sinkers **311**.

Mounted at a point remote from the cylinder on a stationary base is a roller **312** (Fig. 51) carrying a pattern web **313**. The roller is arranged to have a suitably-timed stepped motion imparted to it by any suitable mechanism, as for instance a pattern chain, and the web is formed with a series of pattern indicia **314**. These indicia are made up of large holes **315**, small holes **316** and solid spaces **317** selectively arranged. The roller **312** is formed with hollows **318** beneath each point where a hole might appear in the web. Above the cylinder are a series of pickers **319**, pivoted at **320**, and normally pressed downwardly by a spring **321**. The operating end of each picker is formed with a projection **322**, the lower end **323** of which is smaller than the body of the projection. The projection is of such size that it passes through the holes **315**, but that only the lower end **323** thereof will pass through the holes **316**. A suitable cam member **324** is arranged to press the free end of each picker downwardly each time the web is to be moved. Transmitter members **325** pivoted at **326** and formed with stepped shoulders **327**, **328** and **329** at its upper end are arranged to contact the free ends of the individual pickers when their free ends are respectively in a lower, an intermediate, and an upward position. The lower end of each member **325** embraces a resilient rod or heavy wire **330** and is held between a head **331** fixed on the rod and a washer **332** pressed by a spring **333**. The free end of each rod is fastened to a slider **334** mounted in one of a series of parallel slots in a stationary support **335**.

Each slider **334** carries a butt **336** having an extension **337** and there is provided on the member **308** a plurality of cams for amplifying the movements of the slider **334**. These cams comprise a cam **338** operative on the butt portions **337** to move the sliders to "casting position" when they have been moved fully to the left by the member **325**, and a cam **339** acting on the butt portion **337** to move the sliders to "tucking position" when they have been moved partially to the left by the member **325**. Those of the sliders **334** which have been moved to the right remain in that position and are guided between the cam **339** and an aligning cam **340**. An aligning cam **341** is also provided. The sliders **334** continue to the right as indicated in Fig. 44, and are formed with upward projections **342** disposed under a portion of the pattern drum **309** and arranged to operate upon selective members **343** pivotally carried on elements **344** which are slidably mounted in longitudinal slots **345** in the drum. As will be seen, if the slider **334** is at the right, the member **343** will be swung in a counter-clockwise position; if the slider is at the left, the member **343** will be swung in a clockwise position, and if the slider is in "tucking position", the member **343** will be moved into an intermediate position; such movements occurring unless the member **343** is already in position indicated. The support **335** carries a sufficient number of sliders **334**, so that each of the members **343** on the drum will be set once in the revolution of the drum about the needle cylinder. If desired, several series of sliders may be provided at different points about the needle cylinders, or the drum may be controlled by sliders arranged about the entire periphery of the needle cylinder; but ordinarily a single setting of the drum in each revolution is sufficient, and after the setting of the sliders will be changed only after several revolutions. As will be seen, the members **343** are formed with shoulders **346** and **347** at one end and with shoulders **348** and **349** at the other end, and there are provided upon the drum cams **350** and **351** carried on an arm **352** which revolves with the drum but does not rotate therewith, for acting on the shoulders at either end of the member **343** similarly to the action of the cams **45***f* and **60** on the element **27***f* in Fig. 9. The rotation of the pattern drum **309** is assured by gearing **353** on the drum meshing with gearing **354** on the annulus **308**. Each slidable element **344** on the drum carries an actuator **355** formed with a series of downward protuberances **356** and **357**, and the lever **305** is formed with a cooperating upward protuberance **358**. The protuberance **358** is so positioned that when a selective member **343** has been swung in a counter-clockwise direction and is consequently moved to the right by the cam **350**, the projection **356** will press downwardly on the protuberance **358** and will swing the lever **305** all the way down. When the member **343** is in an intermediate position and is centered by the cams **350** and **351** acting on the shoulders **347** and **349**, the projection **357** which extends only part way down will act on the protuberance **358** to swing the lever **305** partially down. When the member **343** has been swung to a position wherein the cam **351** acts against the shoulder **348** to move the selective member fully to the left, the member **355** will clear the protuberance **358** and accordingly will not swing the lever **305** down. A cam **359** acting in advance of the drum serves to move the levers to the left before the passage of the drum. A cam **360**, acting after the passage of the drum, serves to move fully to the right those levers whose protuberances are fully up, and a cam **361** serves to move partially to the right those levers whose protuberances are part way down. A cam **362** serves to align the selective elements **303**, and a cam **363** acts selectively to advance these elements **303** depending upon the position in which they are swung, this action being like that of action of the cams **45**, **45***e*, **45***f*, etc. As will be seen, therefore, once the members **343** have been set and positioned by the cams **350** and **351**, a pattern arrangement of the members **355** is provided which will repeat itself unless the setting of the members **343** is altered. Accordingly, in an arrangement wherein the number of sliders **334** corresponds to the number of selective members **343**, a given pattern may be repeated in stripes about the periphery of a needle cylinder. As will also be seen the projections **342** are long enough so that the proper setting of the selective members **343** will be caused, regardless of the longitudinal position of the member **344**.

It will accordingly be apparent that the invention provides highly advantageous machines for the efficient and effective production of knitted fabrics embodying a wide variety of complicated designs.

Since certain changes in carrying out the above method and in the constructions set forth, which embody the invention may be made without departing from its scope, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be inter-

preted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which as a matter of language might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A knitting machine comprising a bed, a series of slots in said bed, knitting-element and selective-element means individual to said slots and each having a portion formed with a plurality of cam-engaging surfaces facing in substantially the same direction, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, cam means forming a part of said actuator mechanism and adapted selectively to act on said portions in accordance with the setting thereof to cause the first-mentioned means to be in various ones of a multiplicity of positions longitudinally of said slots, and a rotatable element forming a part of said actuator mechanism and providing about its periphery a series of configurations of a multiplicity of types for effectuating a selective setting of said portions in a multiplicity of different positions laterally of said slots.

2. A knitting machine comprising a bed, a series of slots in said bed, a series of knitting elements carried in said slots and movable longitudinally thereof, a series of selective elements individual to said knitting elements carried in said slots and formed with a plurality of cam-engaging surfaces facing in substantially the same direction, said selective elements being adapted when moved longitudinally of the slots to impart longitudinal movement to said knitting elements under given conditions, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, cam means forming a part of said actuator mechanism and adapted selectively to act on the various selective elements in accordance with the setting thereof to cause them to be in a given one of a multiplicity of positions longitudinally of said slots, and a rotatable element forming a part of said actuator mechanism and providing about its periphery a series of configurations of a multiplicity of types for effectuating a selective setting of said setting elements in a multiplicity of different positions laterally of said slots.

3. A knitting machine comprising a bed, a series of slots in said bed, knitting-element and selective-element means individual to said slots, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, means forming a part of said actuator mechanism and adapted selectively to act on a portion of the various first-mentioned means in accordance with the setting thereof to cause said first-mentioned means to be in various ones of a multiplicity of positions longitudinally of said slots, a rotatable element forming a part of said actuator mechanism and providing about its periphery a series of configurations of a multiplicity of types for effectuating a selective setting of said portions in a multiplicity of different positions laterally of said slots, and means for effectuating a re-setting of said portions when desired, said last-mentioned means being arranged for operation after the operation of said rotatable element and before the operation of said means for effectuating longitudinal movement.

4. A knitting machine comprising a bed, a series of slots in said bed, knitting-element and selective-element means individual to said slots, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, means forming a part of said actuator mechanism and adapted selectively to act on a portion of the various first-mentioned means in accordance with the setting thereof to cause said first-mentioned means to be in various ones of a multiplicity of positions longitudinally of said slots, a rotatable element forming a part of said actuator mechanism and providing about its periphery a series of configurations of a multiplicity of types for effectuating a selective setting of said portions in a multiplicity of different positions laterally of said slots, and means for imparting a uniform setting to all of said portions when desired, said last-mentioned means being arranged for operation after the operation of said rotatable element and before the operation of said means for effectuating longitudinal movement.

5. A knitting machine comprising a bed, a series of slots in said bed, knitting-element and selective-element means individual to said slots, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, means forming a part of said actuator mechanism and adapted selectively to act on a portion of the various first-mentioned means in accordance with the setting thereof to cause said first-mentioned means to be in various ones of a multiplicity of positions longitudinally of said slots, a rotatable element forming a part of said actuator mechanism and providing about its periphery a series of configurations of a multiplicity of types for effectuating a selective setting of said portions in a multiplicity of different positions laterally of said slots, and means for imparting to said portions when desired a setting wherein alternate ones thereof are in one position and wherein intermediate ones thereof are in another position, said last-mentioned means being arranged for operation after the operation of said rotatable element and before the operation of said means for effectuating longitudinal movement.

6. A knitting machine comprising a bed, a series of slots in said bed, knitting-element and selective-element means individual to said slots, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, means forming a part of said actuator mechanism and adapted selectively to act on a portion of the various first-mentioned means in accordance with the setting thereof to cause said first-mentioned means to be in various ones of a multiplicity of positions longitudinally of said slots, a rotatable element forming a part of said actuator mechanism and providing about its periphery a series of configurations of a multiplicity of types for effectuating a selective setting of said portions in a multiplicity of different positions laterally of said slots, means for effectuating a re-setting of said portions when desired, said last-mentioned means being arranged for operation after the operation of said rotatable element and before the operation of said means for effectuating longitudinal movement, and pattern-controlled mechanism for controlling the operation of said re-setting means.

7. A knitting machine comprising a bed, a series of slots in said bed, knitting-element and selective-element means individual to said slots and each having a portion formed with a plurality

of cam-engaging surfaces facing in substantially the same direction, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, means forming a part of said actuator mechanism and adapted selectively to act on said portions in accordance with the setting thereof to cause said first-mentioned means to be in various ones of a multiplicity of positions longitudinally of said slots, and a pattern wheel forming a part of said actuator mechanism and providing about its periphery a series of configurations spaced correspondingly to the spacing of said slots and arranged for effectuating a selective setting of said selective-element portions in a multiplicity of different positions laterally of said slots.

8. A knitting machine comprising a bed, a series of slots in said bed, knitting-element and selective-element means individual to said slots, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, means forming a part of said actuator mechanism and adapted selectively to act on a portion of the various first-mentioned means in accordance with the setting thereof to cause said first-mentioned means to be in various ones of a multiplicity of positions longitudinally of said slots, a rotatable element forming a part of said actuator mechanism and providing about its periphery a series of configurations of a multiplicity of types for effectuating a selective setting of said portions in a multiplicity of different positions laterally of said slots, and pattern-controlled mechanism operative from time to time in the operation of the machine for causing a series of configurations of different effect to be provided.

9. A knitting machine comprising a bed, a series of slots in said bed, knitting-element and selective-element means individual to said slots, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, means forming a part of said actuator mechanism and adapted selectively to act on a portion of the various first-mentioned means in accordance with the setting thereof to cause said first-mentioned means to be in various ones of a multiplicity of positions longitudinally of said slots, and a rotatable element forming a part of said actuator mechanism and providing about its periphery a series of configurations of a multiplicity of types for effectuating a selective setting of said portions in a multiplicity of different positions laterally of said slots, said rotatable element comprising a series of configuration-providing elements each having variously arranged configuration-controlling surfaces at a plurality of planes and selectively-operable means acting against the surfaces in one or another of said planes to control the character of said configurations.

10. A circular knitting machine comprising a needle cylinder formed with a series of generally axial slots about its periphery, knitting element and selective-element means individual to said slots and each having a portion formed with a plurality of cam-engaging surfaces facing in substantially the same direction and being similar one to another, actuator mechanism revoluble about said cylinder, cam means forming a part of said actuator mechanism and adapted selectively to act on said portions in accordance with the setting thereof to cause them to be in various ones of a multiplicity of positions longitudinally of said slots, and a rotatable element forming a part of said actuator mechanism and formed about its periphery with a series of configurations arranged in a multiplicity of positions for effectuating a selective setting of said portions in a multiplicity of different positions.

11. A circular knitting machine comprising a needle cylinder formed with a series of generally axial slots about its periphery, needle-element and selective-element means individual to said slots, actuator mechanism revoluble about said cylinder, means forming a part of said actuator mechanism and adapted selectively to act on the various first-mentioned means in accordance with the setting of a portion thereof to cause them to be in various ones of a multiplicity of positions longitudinally of said slots, a rotatable element forming a part of said actuator mechanism and formed about its periphery with a series of configurations arranged in a multiplicity of positions for effectuating a selective setting of said selective-element portions in a multiplicity of different positions, means for selectively re-setting the first-mentioned means so that all of them are in one position, or so that all of them are in another position, or so that alternate ones are in one of said positions, and intermediate ones are in still another position, said means being arranged to operate intermediate the operation of said rotatable element and said means for effectuating longitudinal movement, and means for causing said re-setting means to operate in different ones of said ways at different times when a re-setting operation is desirable.

12. A circular knitting machine comprising a needle cylinder formed with a plurality of generally axial slots about its periphery, a series of latch needles longitudinally movable in said slots, a series of swingable members in said slots beyond the end of the needles remote from the latches, said swingable members being formed with a plurality of cam-engaging surfaces facing in substantially the same direction and being adapted to be swung into any of a multiplicity of positions, cam means adapted to pass said swingable members when in one of said positions and to engage one or another of said cam-engaging surfaces to move the swingable members and the needles with them to different longitudinal extents when in others of said positions, an actuator unit revoluble about said cylinder and carrying a member rotatable during such revolution, the periphery of said member being formed with means individual to said swingable members for passing the same or acting on the same to cause the same to be in a particular one of said multiplicity of positions after the passage of said rotatable member.

13. A rotatable pattern member adapted for use in a knitting machine and formed with a plurality of evenly-spaced radial slots at its periphery, a non-rotating portion of said pattern member providing a closed cam track arranged to have an outward bend at one side of the pattern member, and a plurality of actuator members selectively disposed in said slots and engaging the inside and outside of said track so that they will be projected and retracted as the rotation of the pattern member brings them toward said side.

14. In a knitting machine, a needle bed formed with a series of slots, selectively-movable elements carried in said slots, a pattern wheel geared to said needle bed and formed with a plurality of radial slots at its periphery, a non-rotating portion of said pattern wheel providing a closed cam track arranged to have an outward bend adja-

cent said needle bed, and a plurality of actuator members selectively disposed in a portion of said radial slots and having a plurality of different extents and engaging the inside and outside of said track so that they will be projected and retracted as the rotation of the pattern member brings them into slots in said needle bed.

15. A knitting machine comprising a bed; a series of swingable selective elements arranged along said bed; knitting-element means associated with individual selective elements; actuator mechanism, said actuator mechanism and said bed being mounted for relative movement; cam means forming a part of said actuator mechanism and adapted to act on portions of selective elements at a given position with respect to said bed; said selective elements being formed with a plurality of shoulders adapted to be selectively moved into said position by a setting operation; and means also forming a part of said actuator mechanism for selectively setting the various selective elements, so that certain of them will have no shoulders in said position, so that others will have one of said shoulders in said position, and so that others will have another of said shoulders in said position.

16. A knitting machine comprising a bed, a series of slots in said bed, knitting-element and selective-element means individual to the slots of said series and each having a portion formed with a plurality of cam-engaging surfaces facing in substantially the same direction, the means individual to one slot being similar to the means individual to the other slots, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, cam means forming a part of said actuator mechanism and adapted selectively to act on said portions in accordance with the setting thereof to cause said portions to be in various ones of a multiplicity of positions longitudinally of said slots, and a rotatable element forming a part of said actuator mechanism and providing about its periphery actuator portions so arranged and spaced that after the passage of said rotary element the portions of the first mentioned means will be in a multiplicity of different positions laterally of said slots.

17. A knitting machine comprising a bed, a series of slots in said bed, knitting-element and selective-element means individual to the slots of said series and each having a portion formed with a plurality of cam-engaging surfaces facing in substantially the same direction, the means individual to one slot being similar to the means individual to the other slots, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, cam means forming a part of said actuator mechanism and adapted selectively to act on said portions in accordance with the setting thereof to cause said portions to be in various ones of a multiplicity of positions longitudinally of said slots, and a rotatable element forming a part of said actuator mechanism and providing about its periphery actuator portions so arranged and spaced that after the passage of said rotary element the portions of the first mentioned means will be in a multiplicity of different positions laterally of said slots, said selectively acting cam means being spaced from said rotary element in the direction of said relative movement.

18. A rotatable pattern member adapted for use in a knitting machine and formed with a series of generally radial slots about its periphery, actuator elements of a plurality of different characters selectively disposed in said slots, and non-rotating means on said pattern member to project said actuator elements in a given direction as they reach an actuating position during the rotation of said pattern member.

19. A rotatable pattern member for use in a knitting machine and having a number of actuator-receiving portions arranged thereabout, actuator elements selectively arranged in said portions, each of certain of said actuator elements being so arranged as to impart a setting movement of one character to a part of a knitting mechanism, and each of other of said actuator elements being arranged to impart a setting movement of another character to a part of a knitting mechanism, the arrangement being such that at certain of said actuator-receiving portions there will be no actuator adapted to impart a setting movement to a part of a knitting mechanism, and mutually abutting means on said pattern wheel and on said actuator elements to assure that each of said certain of said actuator elements will be arranged for similar action and that each of said other of said actuator elements will be arranged for similar action, said mutually abutting means including non-rotating means on said pattern member to project said actuator elements in a given direction as they reach an actuating position during the rotation of said pattern member.

20. A rotatable pattern member for use in a knitting machine and formed to provide a plurality of actuator-receiving portions at points adapted to be juxtaposed with a series of actuable elements during the rotation of the member, and having selectively disposed in said actuator-receiving portions actuator elements projecting in a plurality of different manners and adapted to selectively move the actuable elements in a direction generally radial of the pattern member to impart a selective setting to the actuable elements, an actuator element projecting in one manner being disposed at each of certain of said actuator-receiving portions, an actuator element projecting in another manner being disposed at each of other of said actuator-receiving portions, and still other of said actuator-receiving portions having disposed thereat neither an actuator element projecting in said one manner nor an actuator element projecting in said other manner, and said certain of said actuator-receiving portions and said other of said actuator-receiving portions and said still other of said actuator-receiving portions being disposed in various relationships one to another to provide a varied arrangement of actuator elements whereby design formations may be obtained.

21. A rotatable pattern member for use in a knitting machine and formed to provide a plurality of actuator-receiving portions at points adapted to be juxtaposed with a series of actuable elements during the rotation of the member, and having selectively disposed in said actuator-receiving portions actuator elements projecting in a plurality of different manners and adapted to selectively move the actuable elements in a direction generally radial of the pattern member to impart a selective setting to the actuable elements, an actuator element projecting in one manner being disposed at each of certain of said actuator-receiving portions, an actuator element projecting in another manner being disposed at each of other of said actuator-receiving portions, and still other of said actuator-receiving portions having disposed thereat neither an

actuator element projecting in said one manner nor an actuator element projecting in said other manner, and said certain of said actuator-receiving portions and said other of said actuator-receiving portions and said still other of said actuator-receiving portions being disposed in various relationships one to another to provide a varied arrangement of actuator elements whereby design formations may be obtained, and non-rotating means on said pattern member to project said actuator elements in a given direction as they reach a given position during the rotation of said pattern member.

22. A rotatable pattern member for use in a knitting machine and formed to provide a plurality of actuator-receiving portions at points adapted to be juxtaposed with a series of actuable elements during the rotation of the member, and having selectively disposed in said actuator-receiving portions actuator elements projecting in a plurality of different manners and adapted to selectively move the actuable elements in a direction generally radial of the pattern member to impart a selective setting to the actuable elements, an actuator element projecting in one manner being disposed at each of certain of said actuator-receiving portions, an actuator element projecting in another manner being disposed at each of other of said actuator-receiving portions, and still other of said actuator-receiving portions having no actuator element disposed thereat, and said certain of said actuator-receiving portions and said other of said actuator-receiving portions and said still other of said actuator-receiving portions being disposed in various relationships one to another to provide a varied arrangement of actuator elements whereby design formations may be obtained.

23. A rotatable pattern member for use in a knitting machine and formed to provide a plurality of actuator-receiving portions at points adapted to be juxtaposed with a series of actuable elements during the rotation of the member, and having selectively disposed in said actuator-receiving portions actuator elements projecting in a plurality of different manners and adapted to selectively move the actuable elements in a direction generally radial of the pattern member to impart a selective setting to the actuable elements, an actuator element projecting in one manner being disposed at each of certain of said actuator-receiving portions, an actuator element projecting in another manner being disposed at each of other of said actuator-receiving portions, and an actuator element projecting in still another manner being disposed at each of still other of said actuator-receiving portions, and said certain of said actuator-receiving portions and said other of said actuator-receiving portions and said still other of said actuator-receiving portions being disposed in various relationships one to another to provide a varied arrangement of actuator elements whereby design formations may be obtained.

24. A rotatable pattern member for use in a knitting machine and formed to provide a plurality of actuator-receiving portions at points adapted to be juxtaposed with a series of actuable elements during the rotation of the member, and having selectively disposed in said actuator-receiving portions actuator elements projecting in a plurality of different manners and adapted to selectively move the actuable elements in a direction generally radial of the pattern member to impart a selective setting to the actuable elements, an actuator element of one length being disposed at each of certain of said actuator-receiving portions, actuator elements of another length being disposed at each of other of said actuator-receiving portions, and still other of said actuator-receiving portions having disposed thereat actuator elements of neither of said lengths, and said certain of said actuator-receiving portions and said other of said actuator-receiving portions and said still other of said actuator-receiving portions being disposed in various relationships one to another to provide a varied arrangement of actuator elements whereby design formations may be obtained.

25. A rotatable pattern member adapted for use in a knitting machine and comprising actuator-receiving means and actuator means, said actuator-receiving means being adapted to receive a number of actuator elements at evenly spaced points about the periphery of the rotatable pattern member, and said actuator means comprising a number of similar actuator elements selectively disposed in said positions, one of said means being formed with actuator-retaining portions at one position thereon, and the other of said means being formed with actuator-retaining portions at a plurality of positions thereon and each adapted for cooperation with the actuator-retaining portion on the said one of said means so that the outer ends of said actuator elements will extend a plurality of different effective distances from the periphery of a pattern member depending upon the manner in which each actuator element is placed in the pattern member, actuator elements extending one effective distance being adapted to impart a setting movement of one character to a part of a knitting mechanism and actuator elements extending another effective distance being adapted to impart a setting movement of another character to a part of a knitting mechanism.

26. A rotatable pattern member adapted for use in a knitting machine and comprising actuator-receiving means and actuator means, said actuator-receiving means being adapted to receive a number of actuator elements at evenly spaced points about the periphery of the rotatable pattern member, and said actuator means comprising a number of similar actuator elements selectively disposed in said positions, one of said means being formed with actuator-retaining portions at one position thereon, and the other of said means being formed with actuator-retaining portions at a plurality of positions thereon and each adapted for cooperation with the actuator-retaining portion on the said one of said means so that the outer ends of said actuator elements will extend a plurality of different effective distances from the periphery of a pattern member depending upon the manner in which each actuator element is placed in the pattern member, actuator elements extending one effective distance being adapted to impart a setting movement of one character to a part of a knitting mechanism and actuator elements extending another effective distance being adapted to impart a setting movement of another character to a part of a knitting mechanism, and an actuator element extending said one effective distance being disposed at each of certain of said evenly spaced points, and an actuator element extending said other effective distance being disposed at each of other of said evenly spaced points, and still other of said evenly spaced points having disposed thereat

neither an actuator element extending said one effective distance nor an actuator element extending said other effective distance.

27. A knitting machine comprising a bed, a series of swingable selective elements arranged along said bed, knitting-element means associated with individual selective elements, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, cam means forming a part of said actuator mechanism and adapted to act on portions of selective elements at a given position with respect to said bed, said selective elements being formed with a plurality of shoulders adapted to be selectively moved into said position by a setting operation, means also forming a part of said actuator mechanism for selectively setting the various selective elements, so that certain of them will have no shoulders in said position, so that others will have one of said shoulders in said position, and so that others will have another of said shoulders in said position, and means for effectuating a re-setting of said selective elements when desired, the last mentioned means being arranged for operation after the operation of the setting means and before the operation of the cam means.

28. A knitting machine comprising a bed, a series of swingable selective elements arranged along said bed, knitting element means associated with individual selective elements, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, cam means forming a part of said actuator mechanism and adapted to act on portions of selective elements at a given position with respect to said bed, said selective elements being formed with a plurality of shoulders adapted to be selectively moved into said position by a setting operation, means also forming a part of said actuator mechanism for selectively setting the various selective elements, so that certain of them will have no shoulders in said position, so that others will have one of said shoulders in said position, and so that others will have another of said shoulders in said position, said setting means comprising a rotatable pattern member formed to provide a plurality of actuator-receiving portions adapted to be juxtaposed with said selective means as the pattern member rotates during said relative movement and having selectively disposed in said actuator-receiving portions actuator elements projecting in a plurality of different manners and adapted to selectively move the selective elements in a direction generally radial of the pattern members to impart said selective setting thereto, an actuator element projecting in one manner being disposed at each of certain of said actuator-receiving portions, an actuator element projecting in another manner being disposed at each of other of said actuator-receiving portions, and still other of said actuator-receiving portions having disposed thereat neither an actuator element projecting in said one manner nor an actuator element projecting in said other manner, and said certain of said actuator-receiving portions and said other of said actuator-receiving portions and said still other of said actuator-receiving portions being disposed in various relationships one to another to provide a varied arrangement of actuator elements whereby design formations may be obtained.

29. A knitting machine comprising a bed, a series of slots in said bed, knitting-element and selective-element means individual to said slots, actuator mechanism, said actuator mechanism and said bed being mounted for relative movement, cam means forming a part of said actuator mechanism and adapted selectively to act on portions of the first-mentioned means in accordance with the setting thereof to cause the first-mentioned means to be in various ones of a multiplicity of positions longitudinally of said slots, and a rotatable pattern member forming a part of said actuator mechanism and providing about its periphery a series of configurations of a multiplicity of types for effectuating a selective setting of said portions in a multiplicity of different positions laterally of said slots, said rotatable pattern member being formed to provide a plurality of actuator-receiving portions at points adapted to be juxtaposed with the first-mentioned means during the rotation of the member, and having selectively disposed in said actuator-receiving portions actuator elements projecting in a plurality of different manners and adapted to selectively move the actuable elements in a direction generally radial of the pattern member to impart a selective setting to said portions of the first-mentioned means, an actuator element projecting in one manner being disposed at each of certain of said actuator-receiving portions, an actuator element projecting in another manner being disposed at each of other of said actuator-receiving portions, and still other of said actuator-receiving portions having disposed thereat neither an actuator element projecting in said one manner nor an actuator element projecting in said other manner, and said certain of said actuator-receiving portions and said other of said actuator-receiving portions and said still other of said actuator-receiving portions being disposed in various relationships one to another to provide a varied arrangement of actuator elements whereby design formations may be obtained.

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