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March 5, 1946.

T. S. HAYHURST

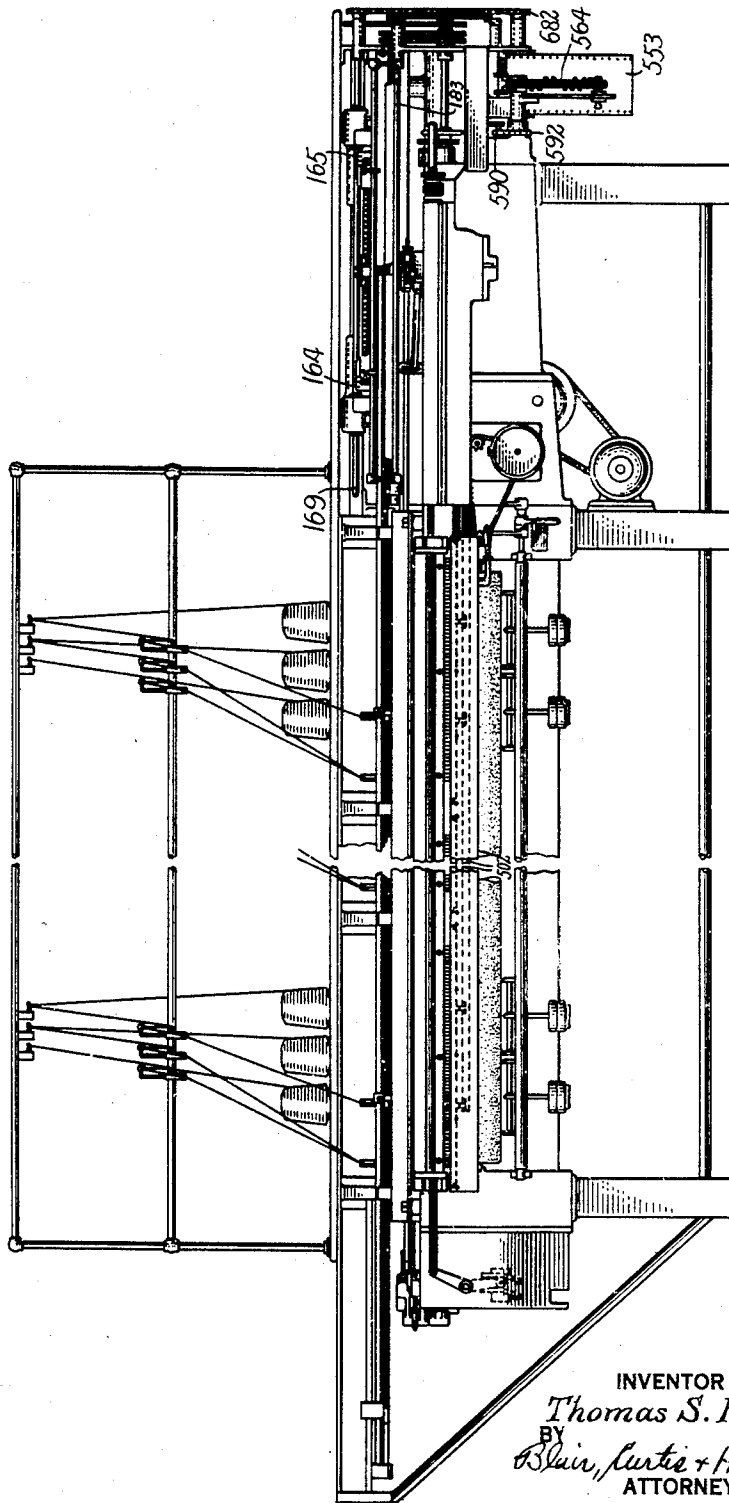
2,395,823

KNITTING MACHINE

Filed April 13, 1944

25 Sheets-Sheet 1

Fig. 1.



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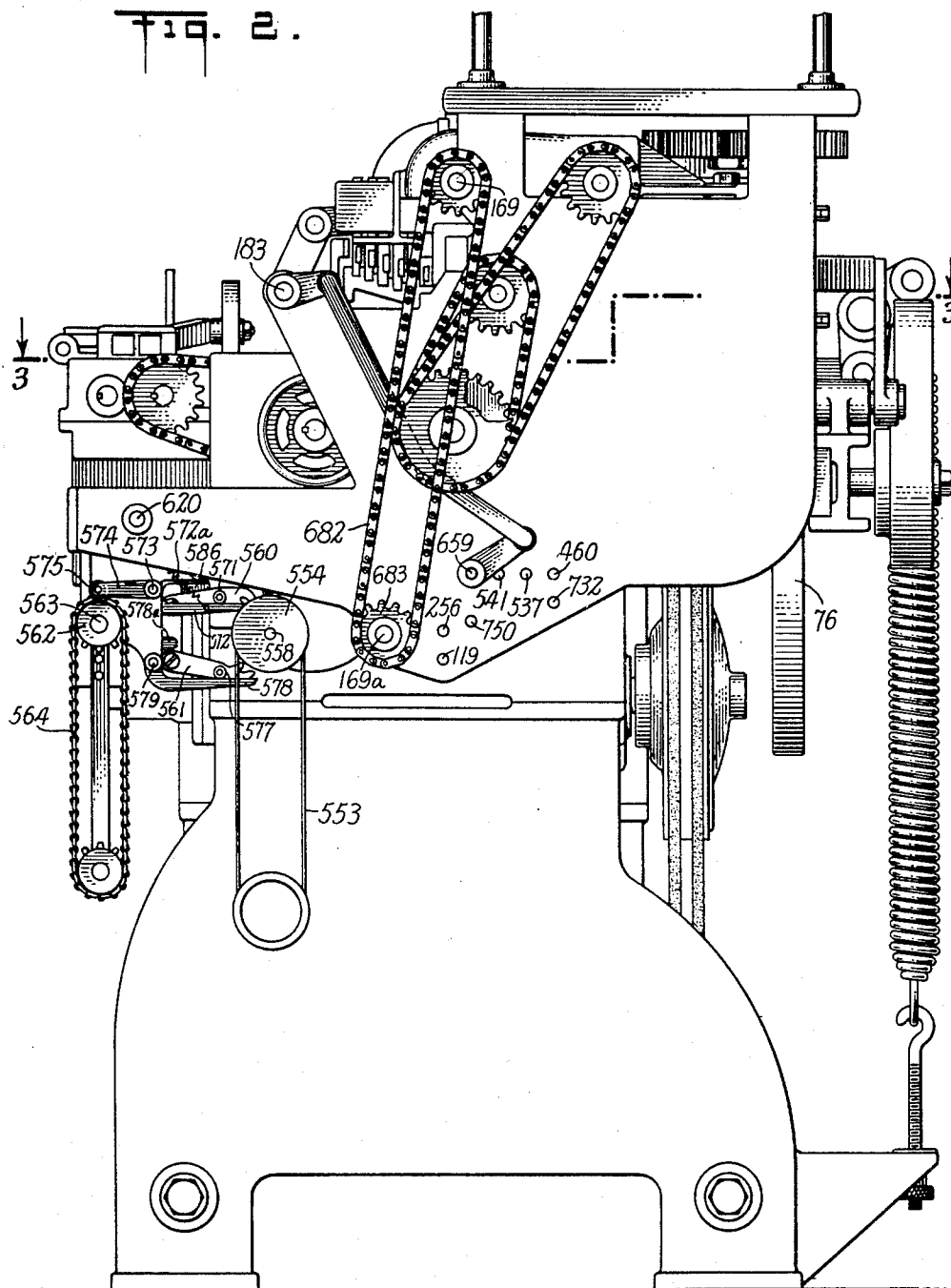
2,395,823

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25 Sheets-Sheet 2

Fig. 2.



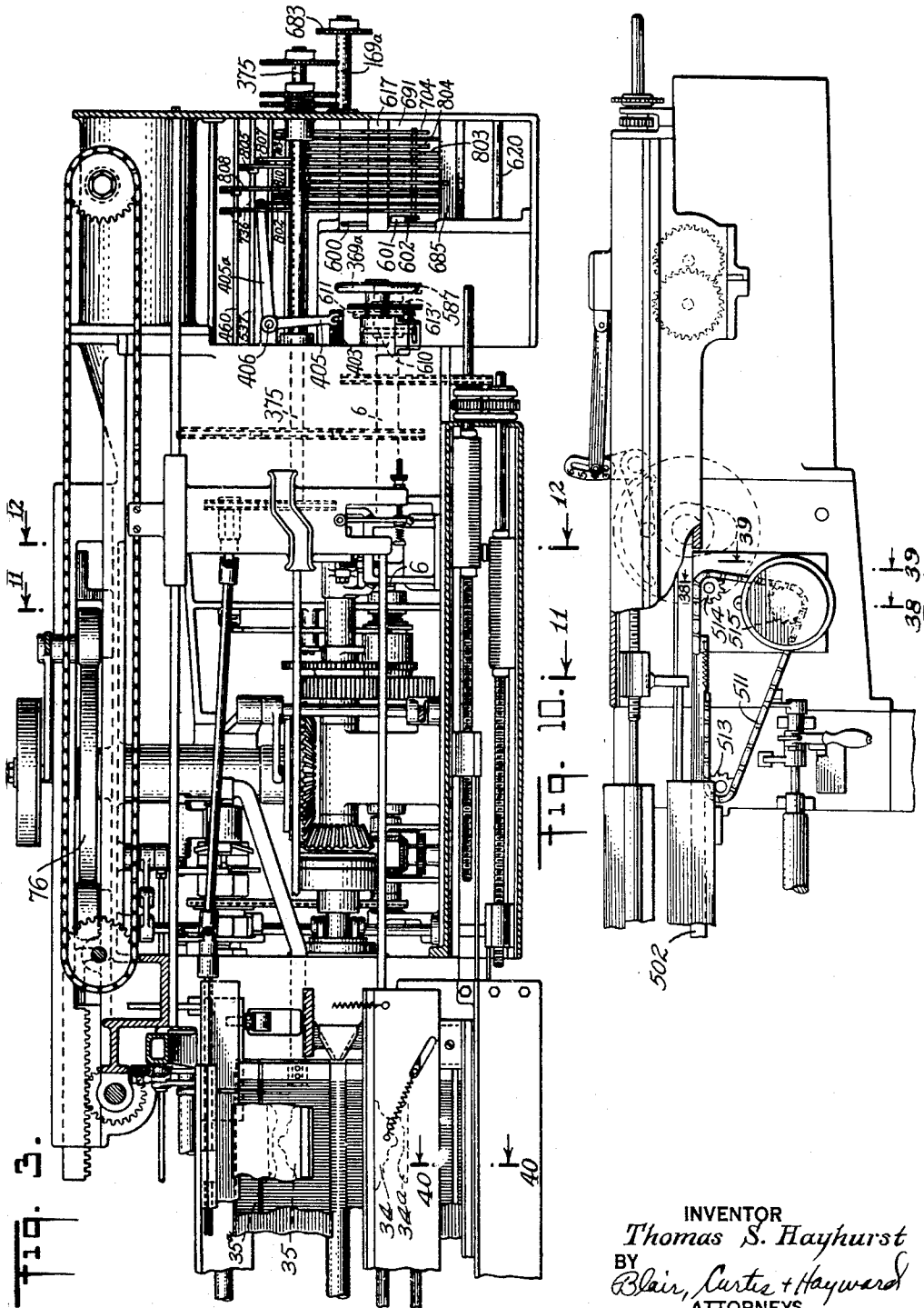
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25 Sheets-Sheet 3



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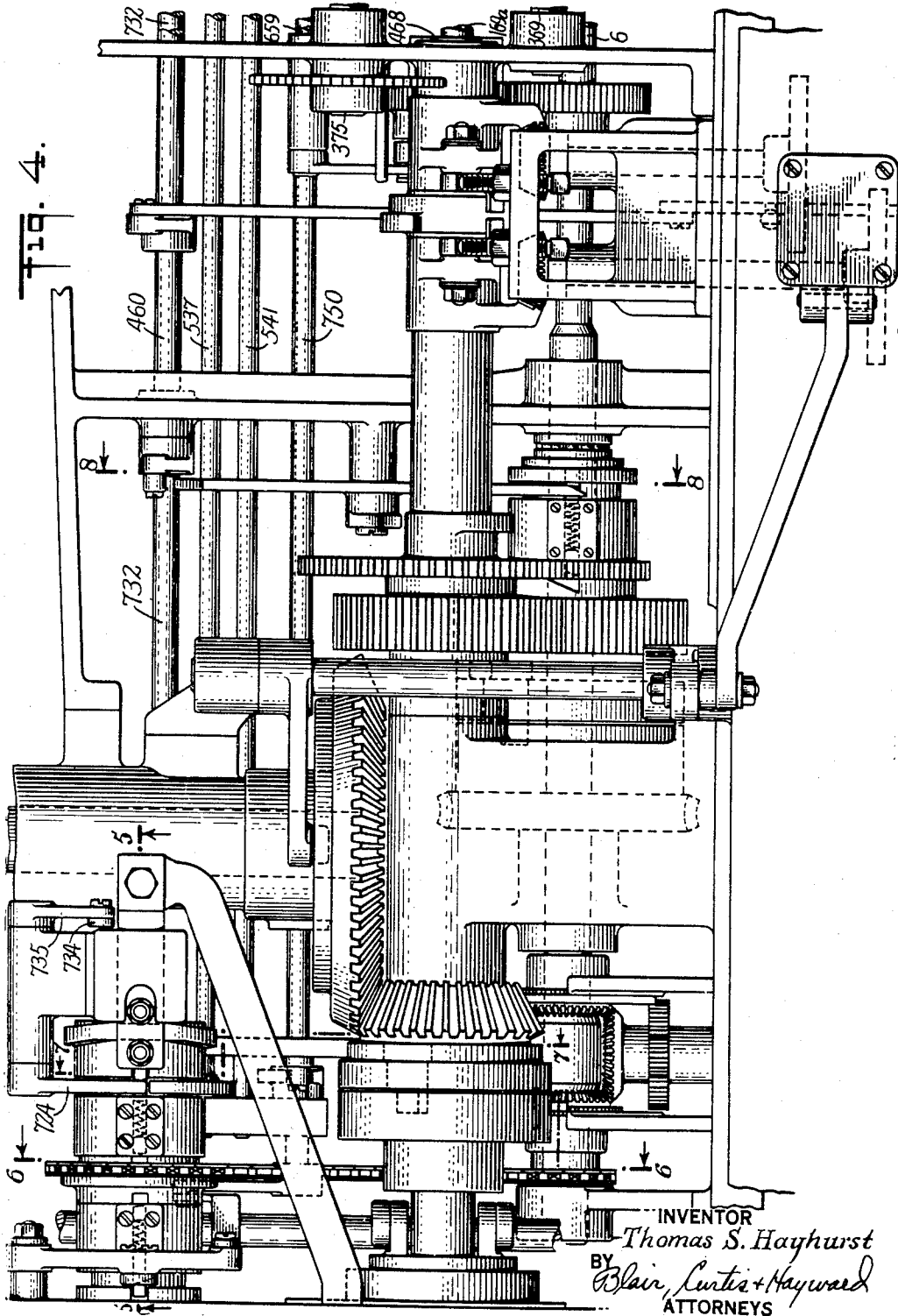
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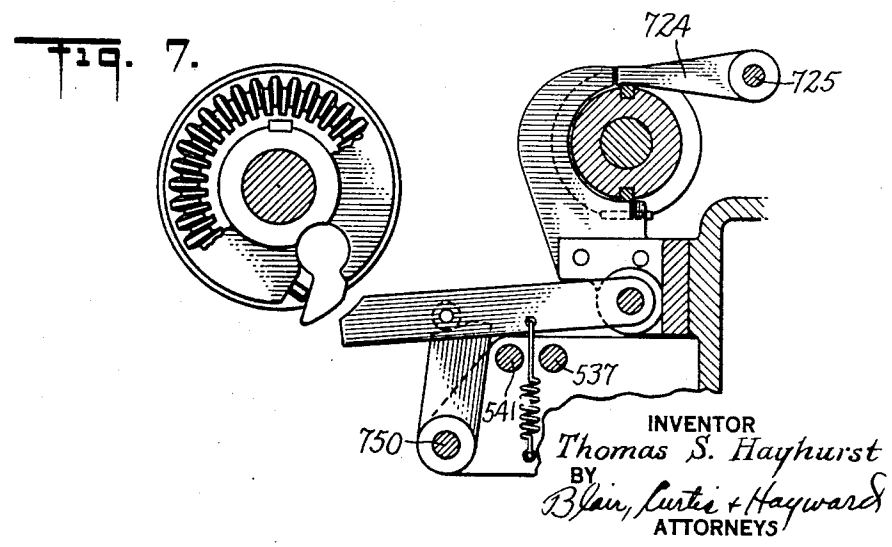
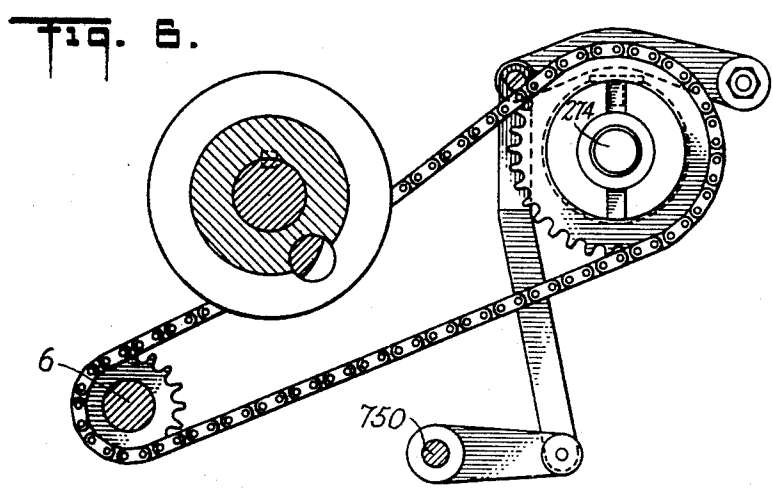
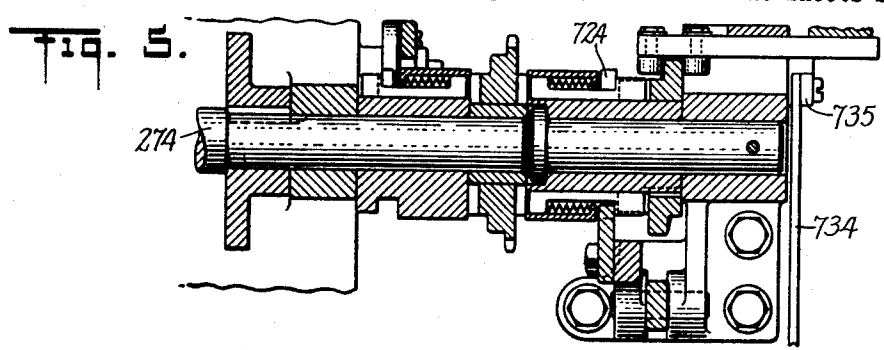
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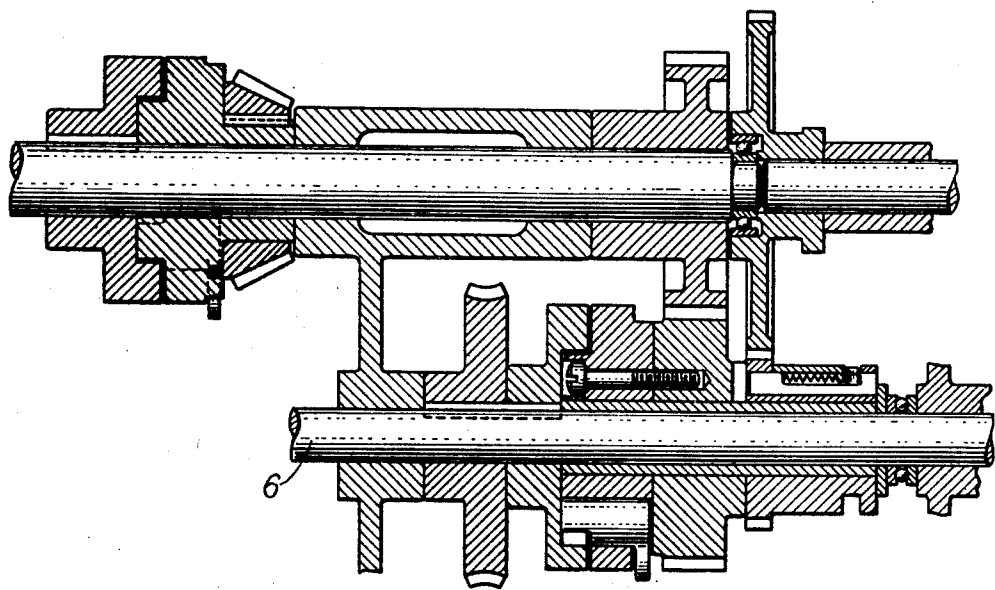
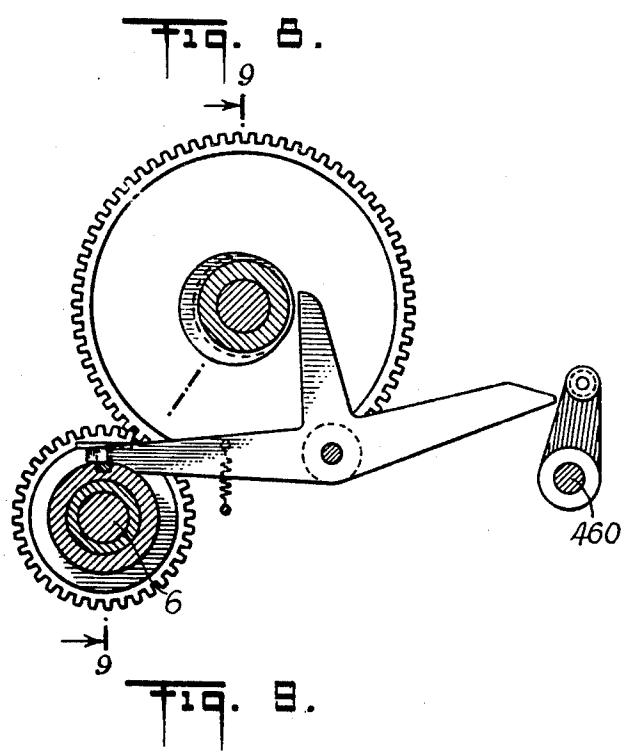
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25 Sheets-Sheet 6



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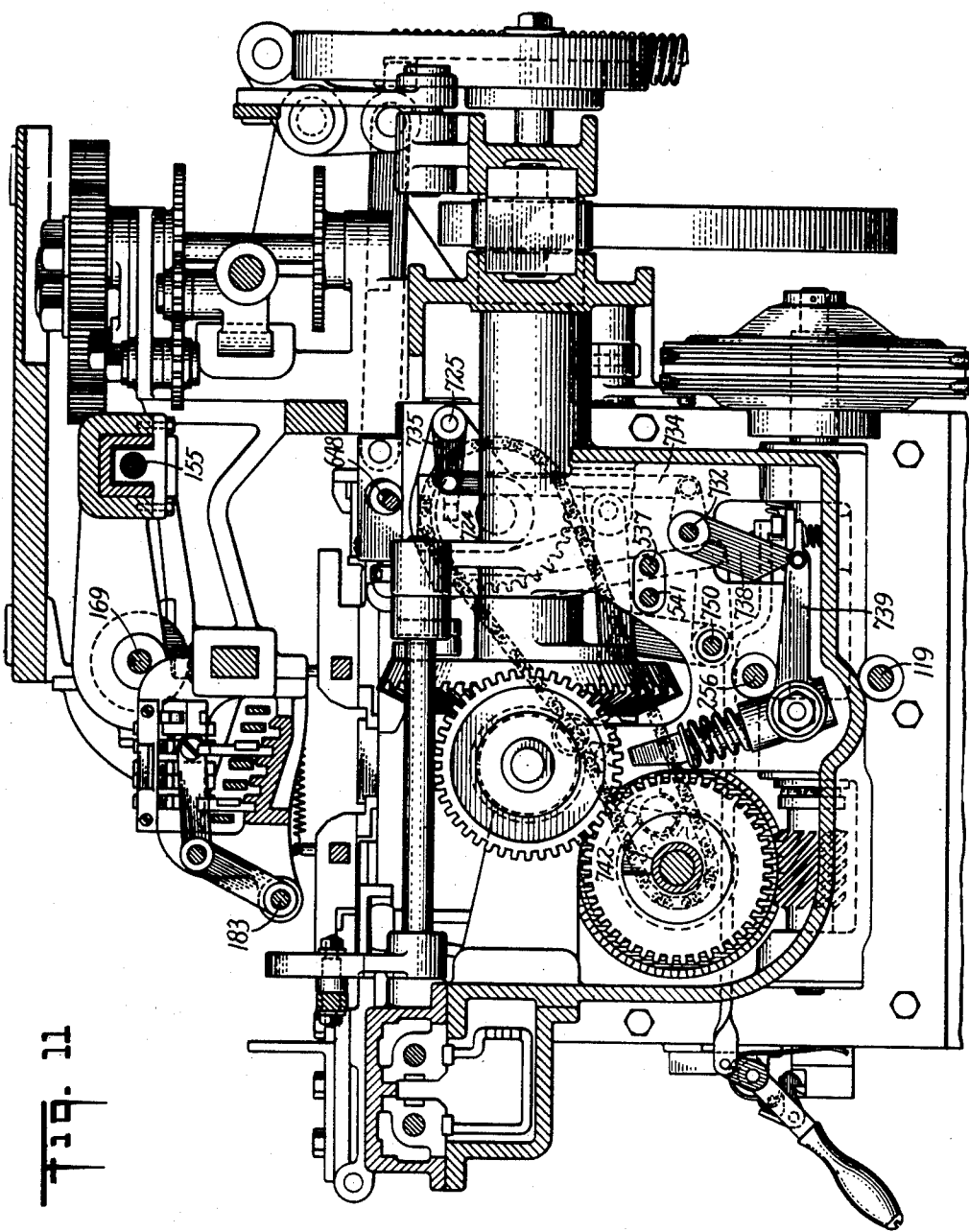


Fig. 11

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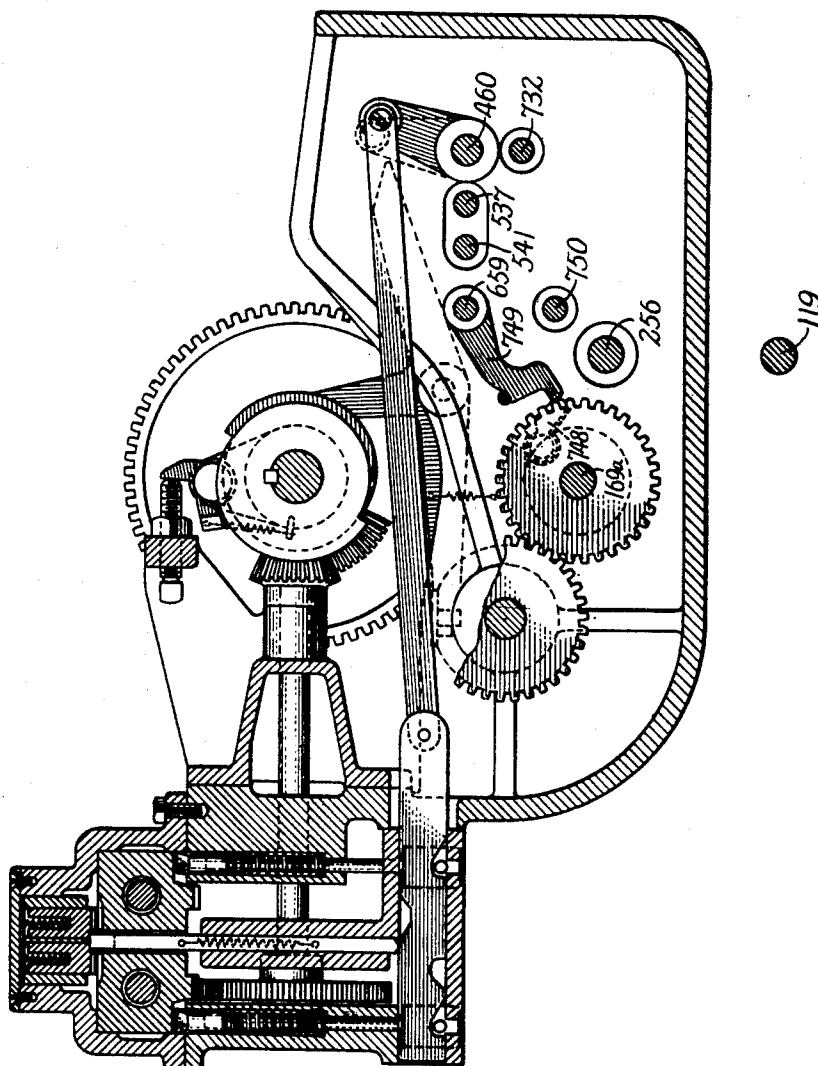
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Fig. 12.



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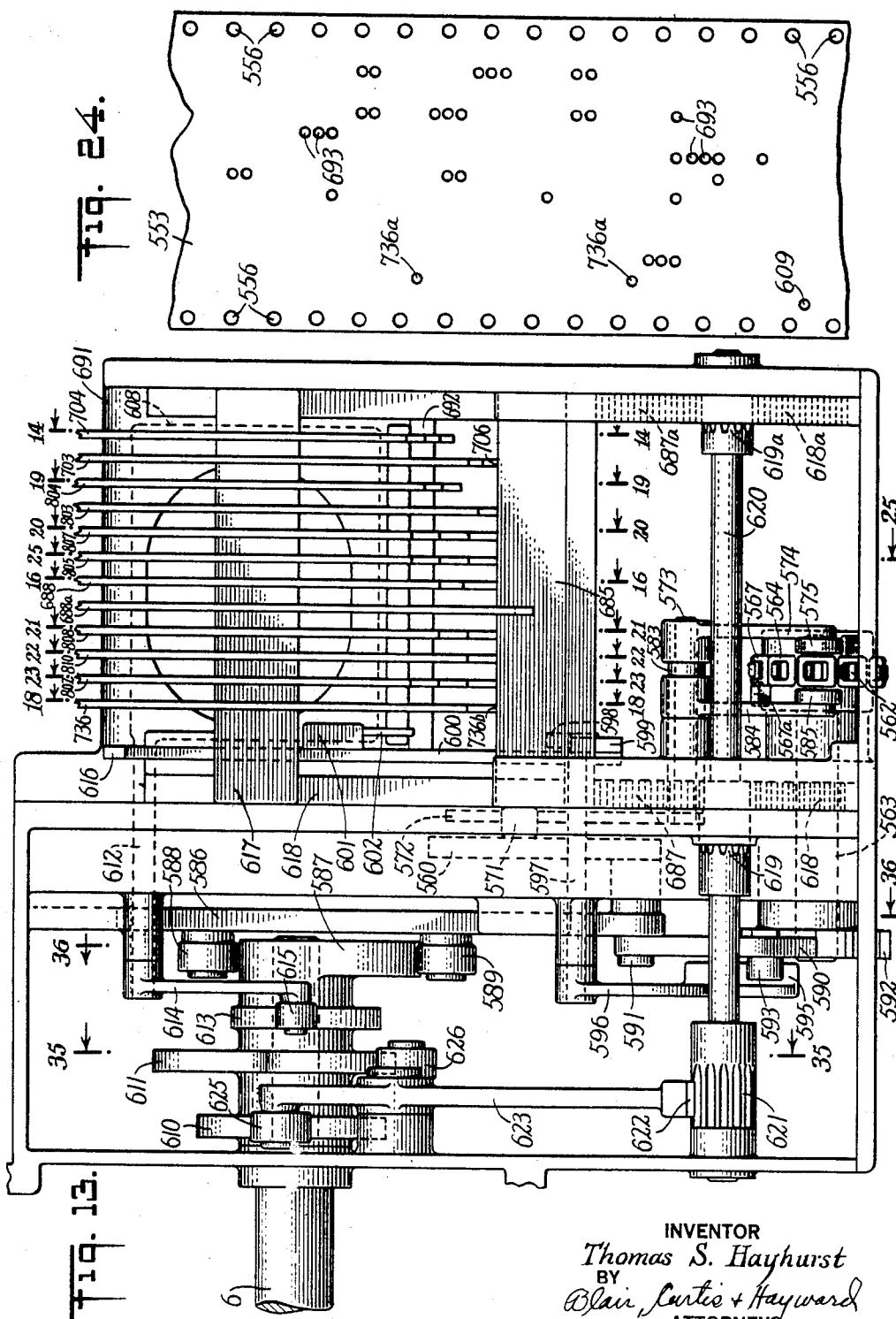
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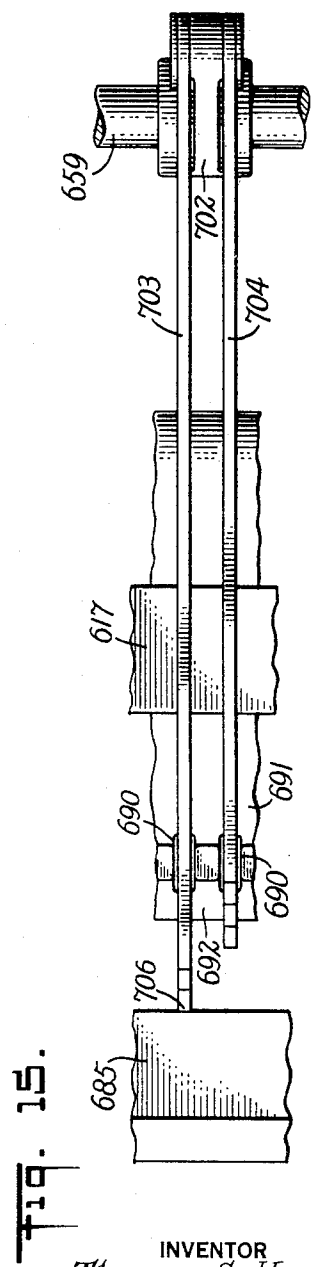
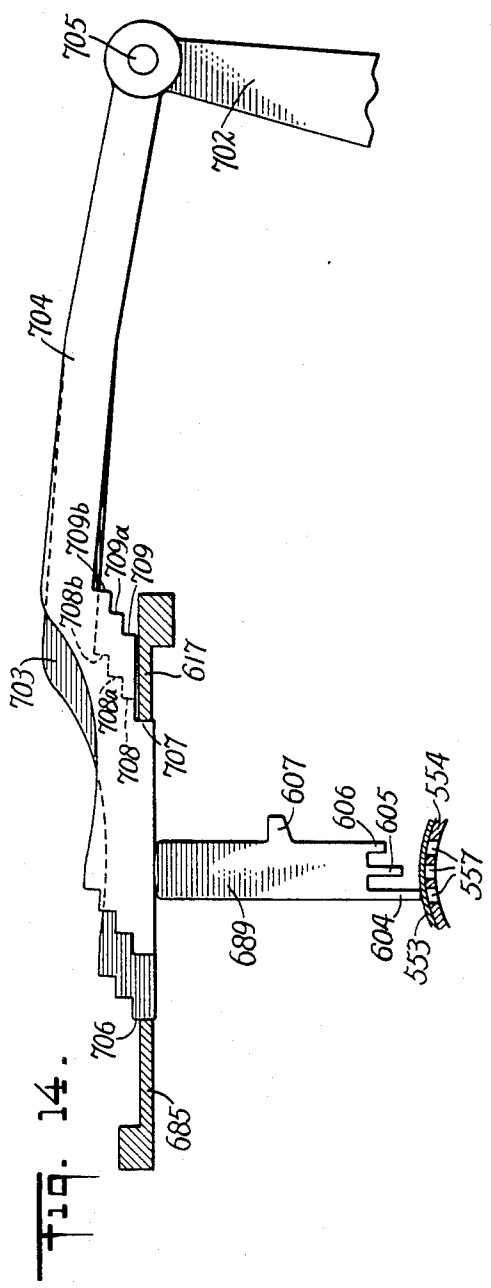
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25 Sheets-Sheet 10



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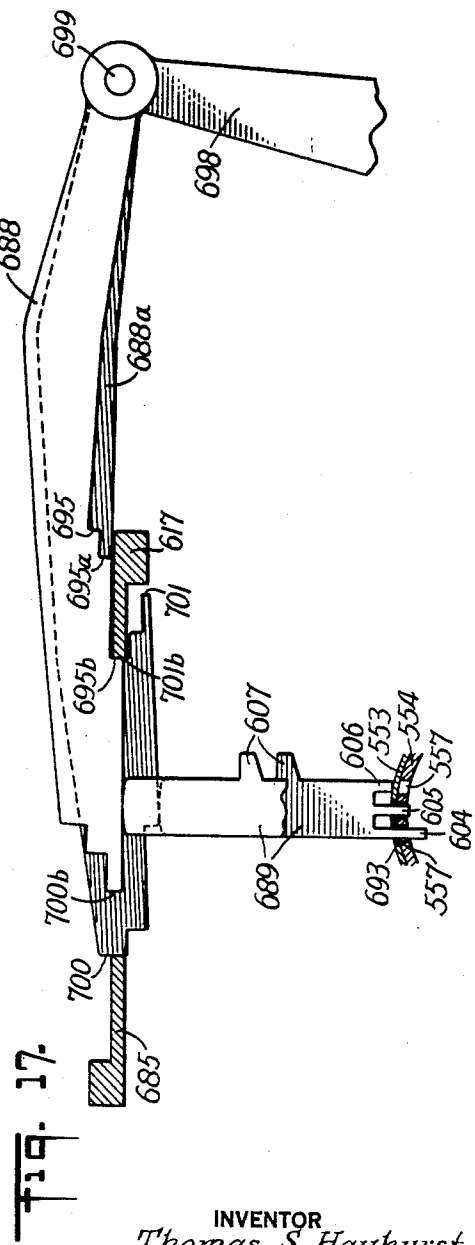
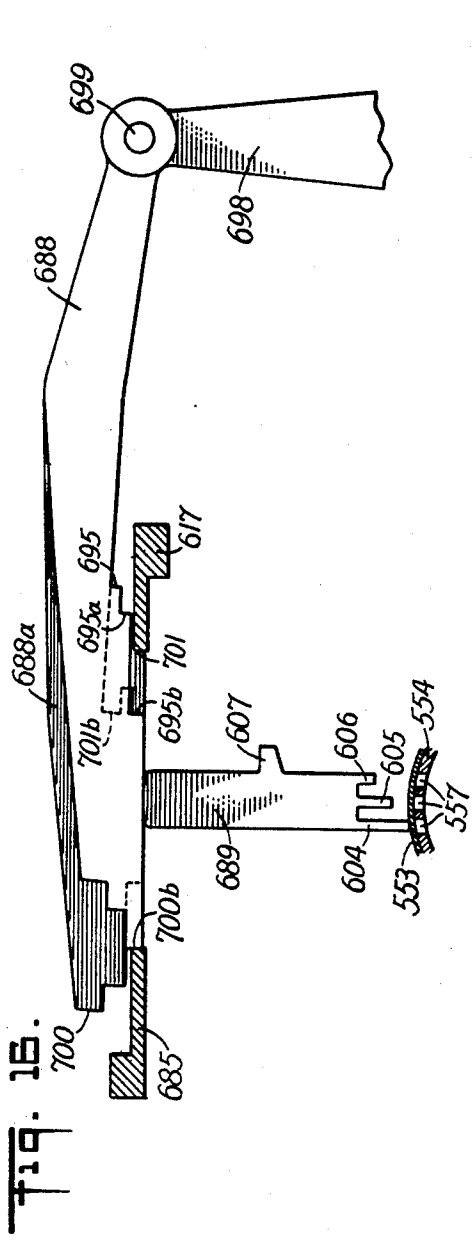
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25 Sheets-Sheet 11



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Fig. 18.

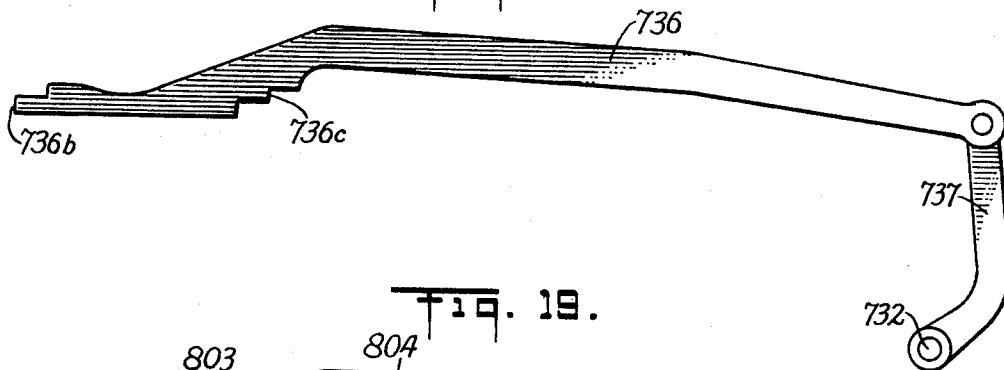


Fig. 19.

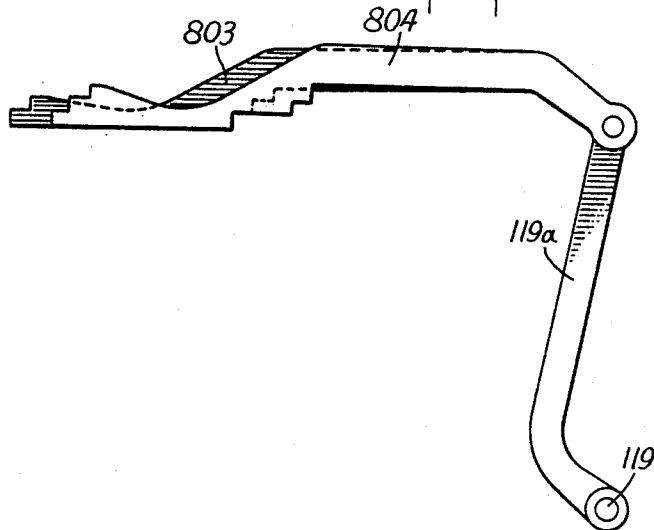
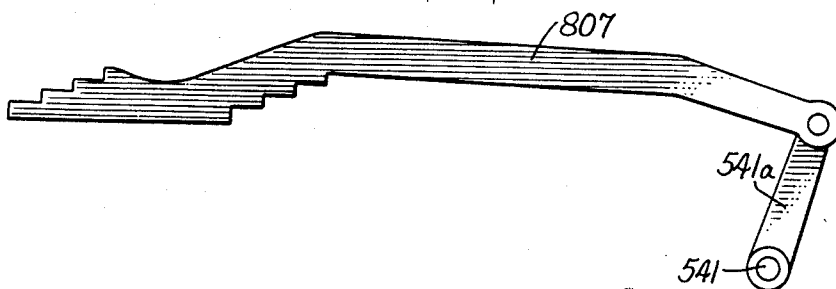


Fig. 20.



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Fig. 21.

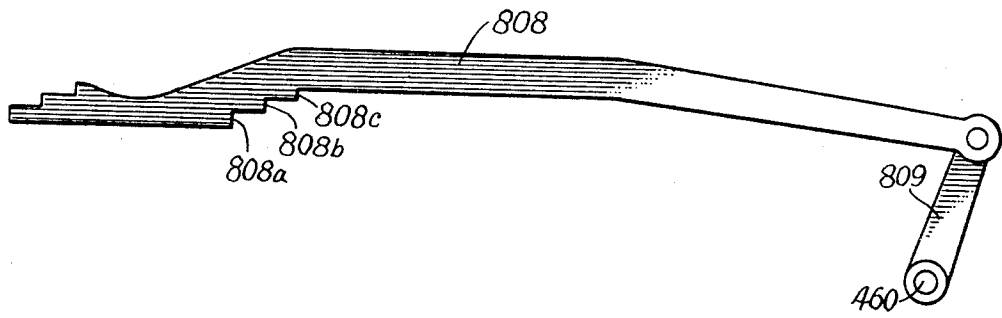


Fig. 22.

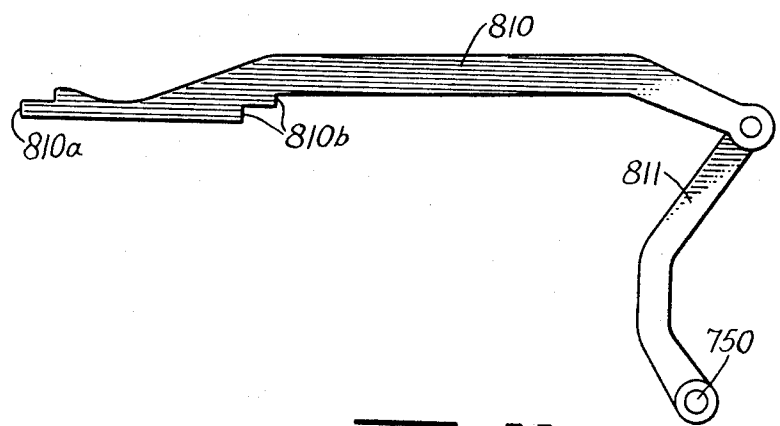
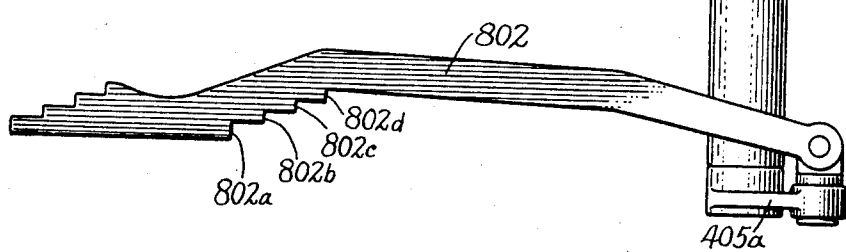


Fig. 23.



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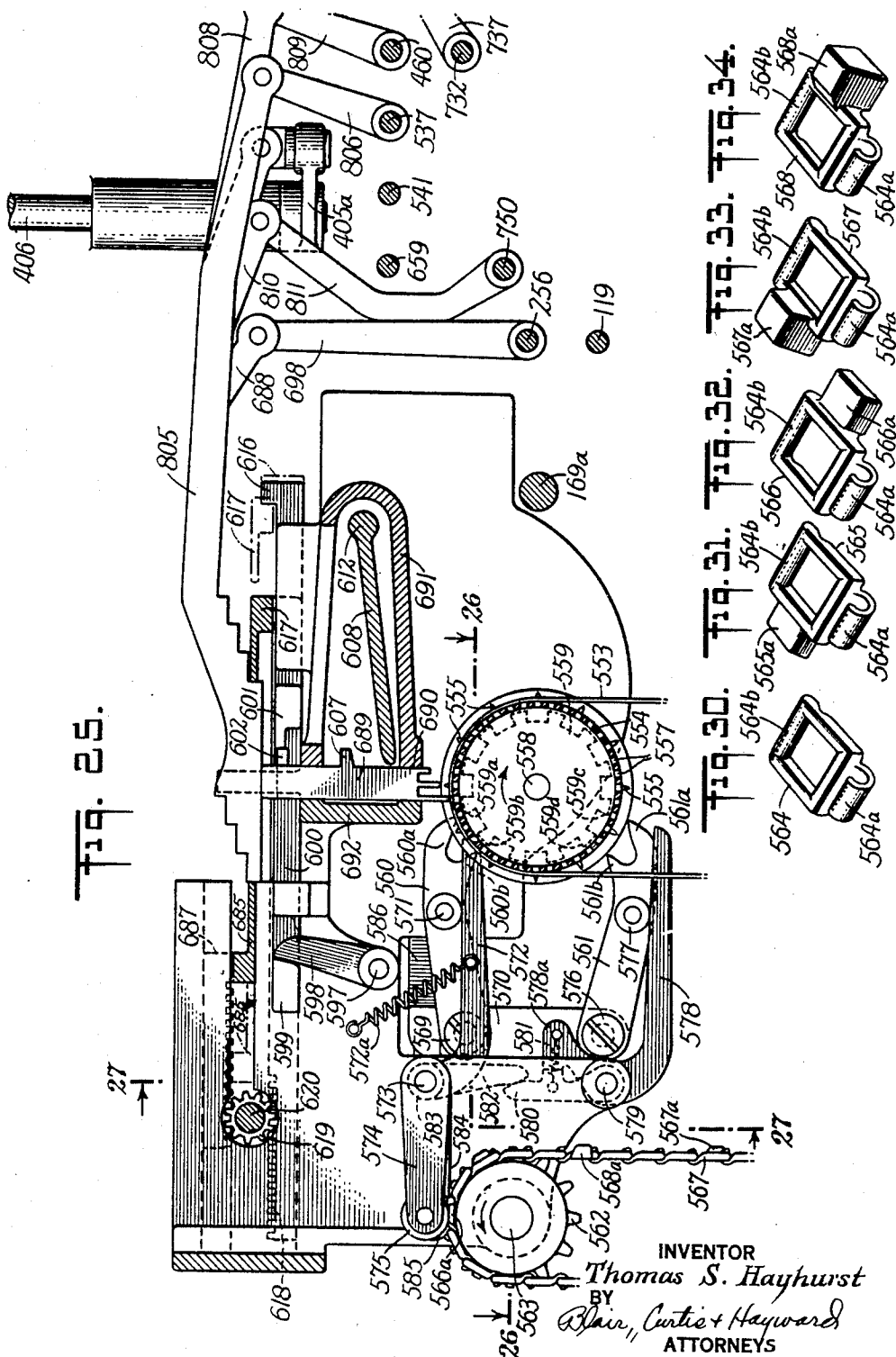
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Fig. 26.

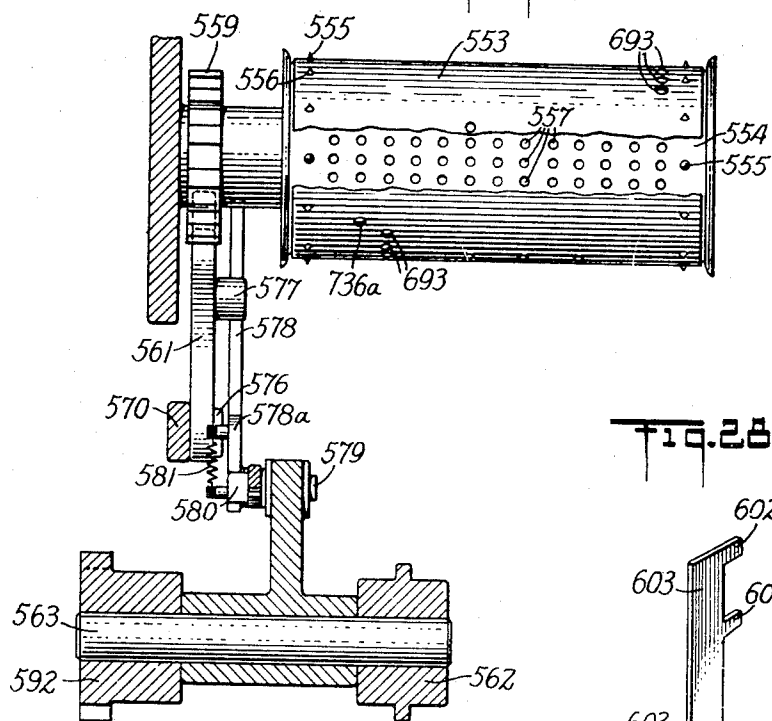


Fig. 28. Fig. 29.

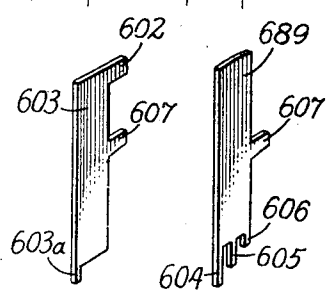
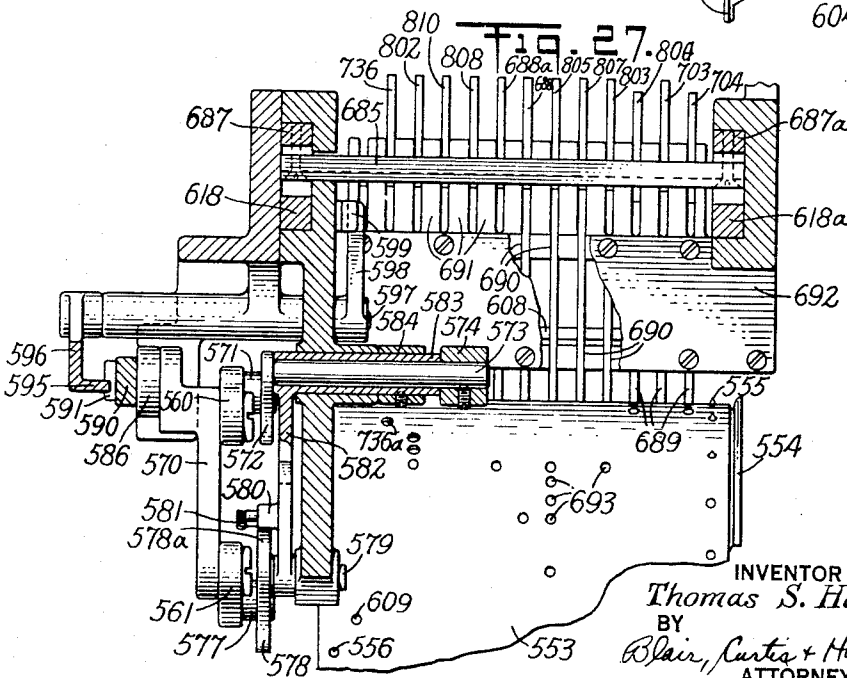


Fig. 27.



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Fig. 35.

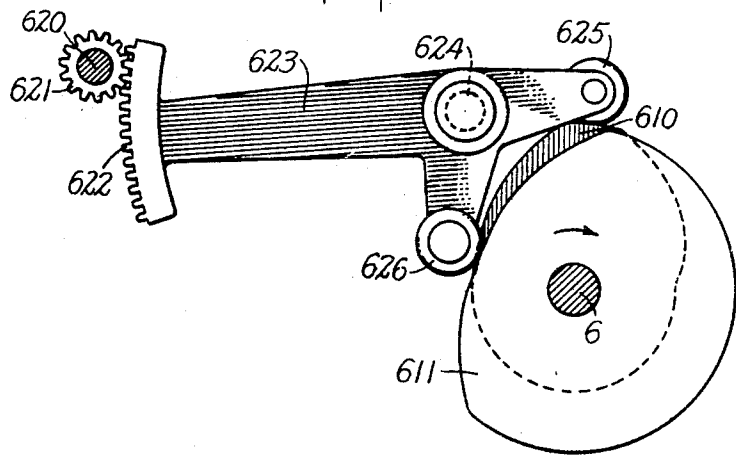
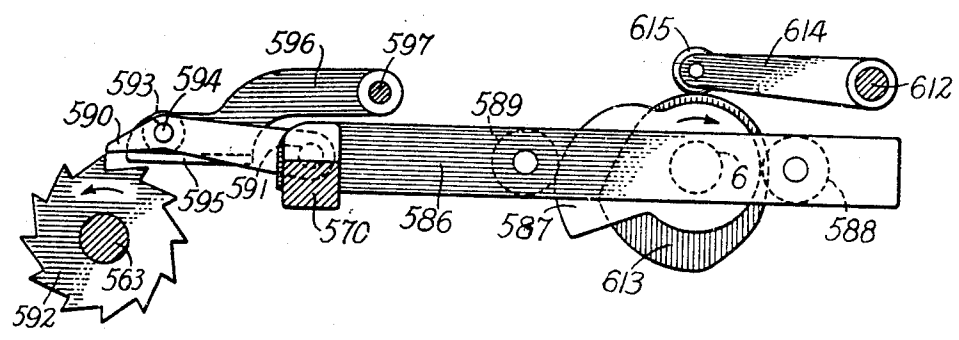


Fig. 36.



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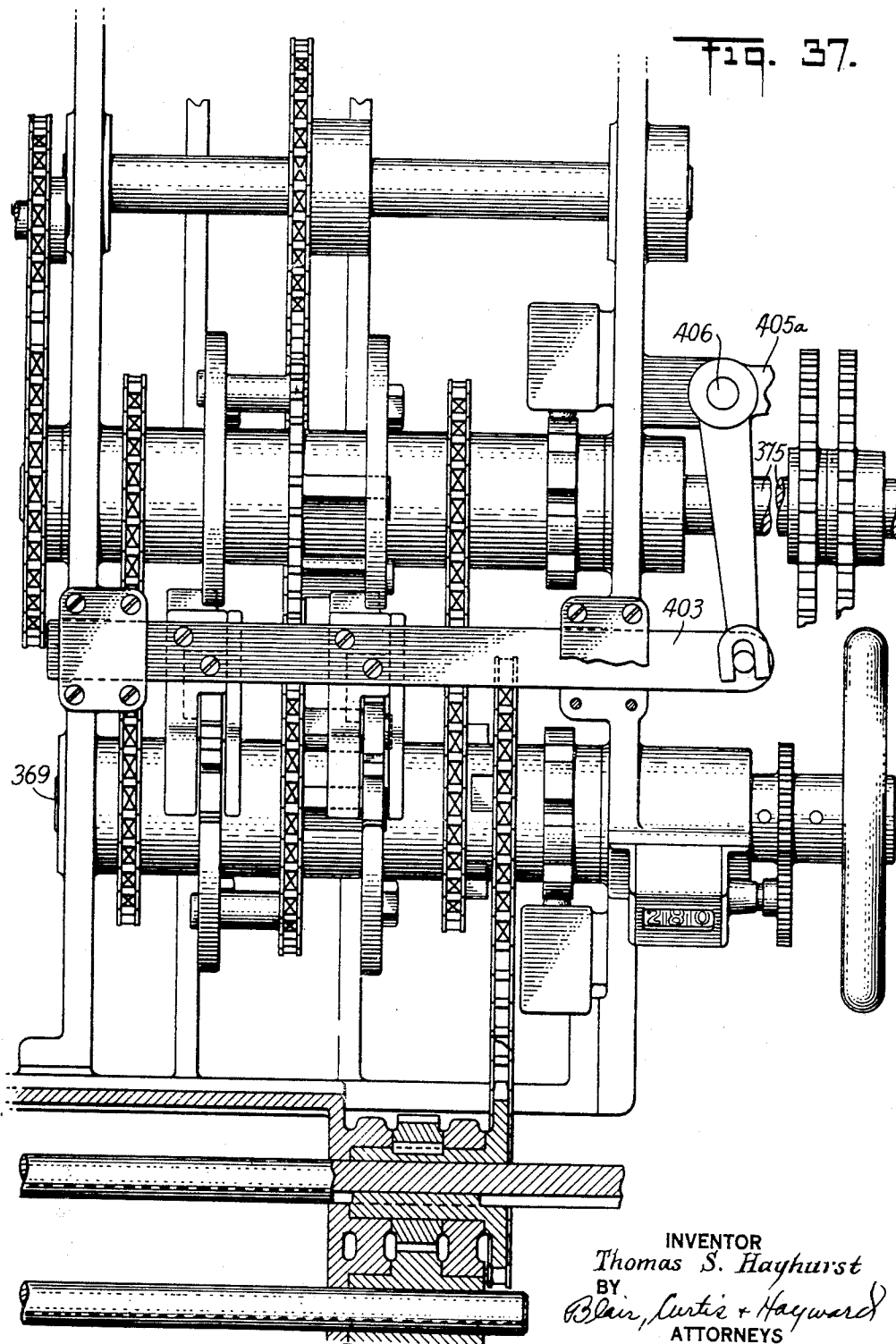
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Fig. 37.



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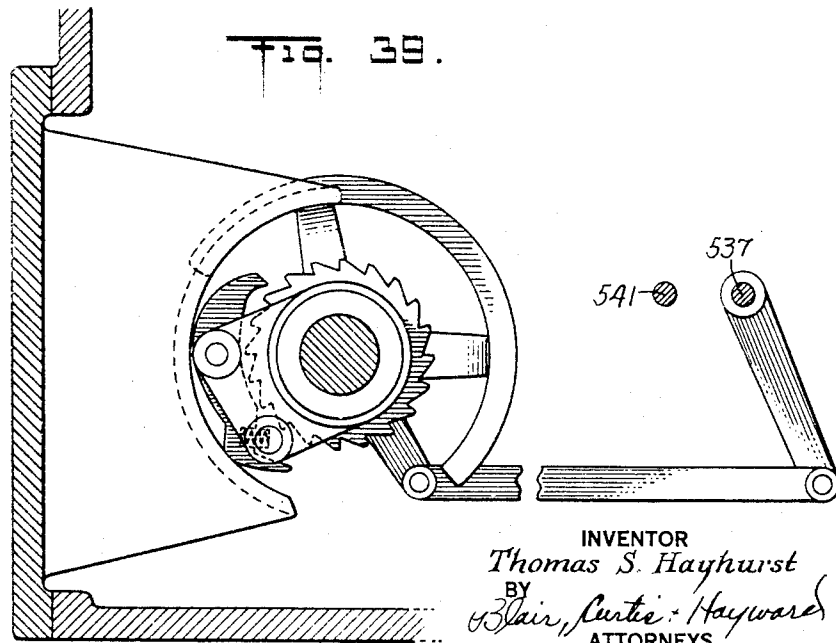
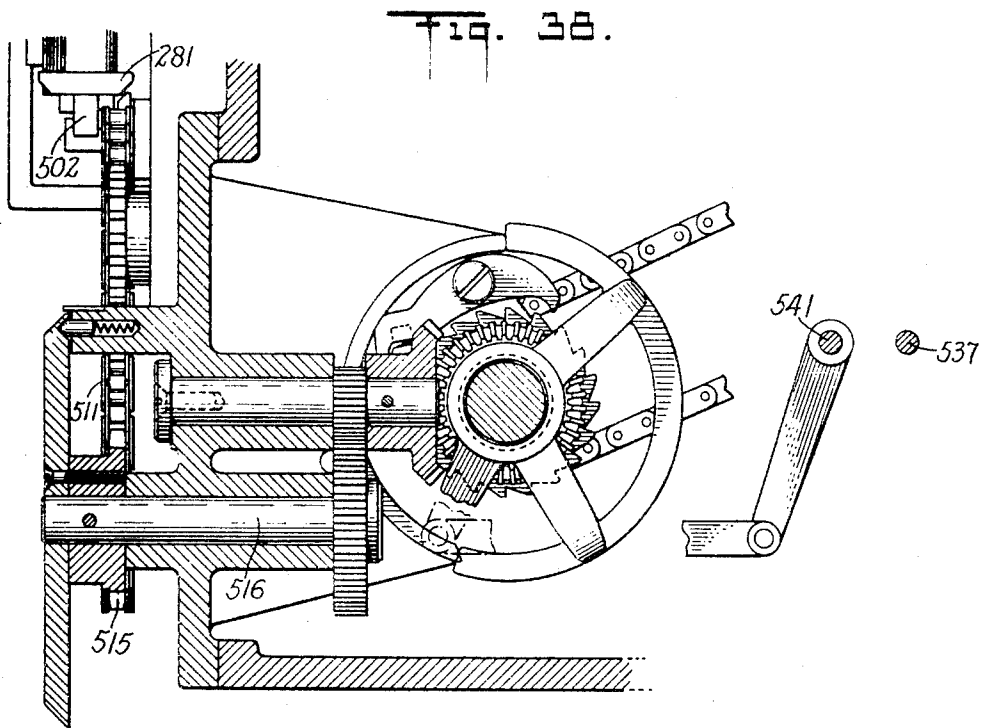
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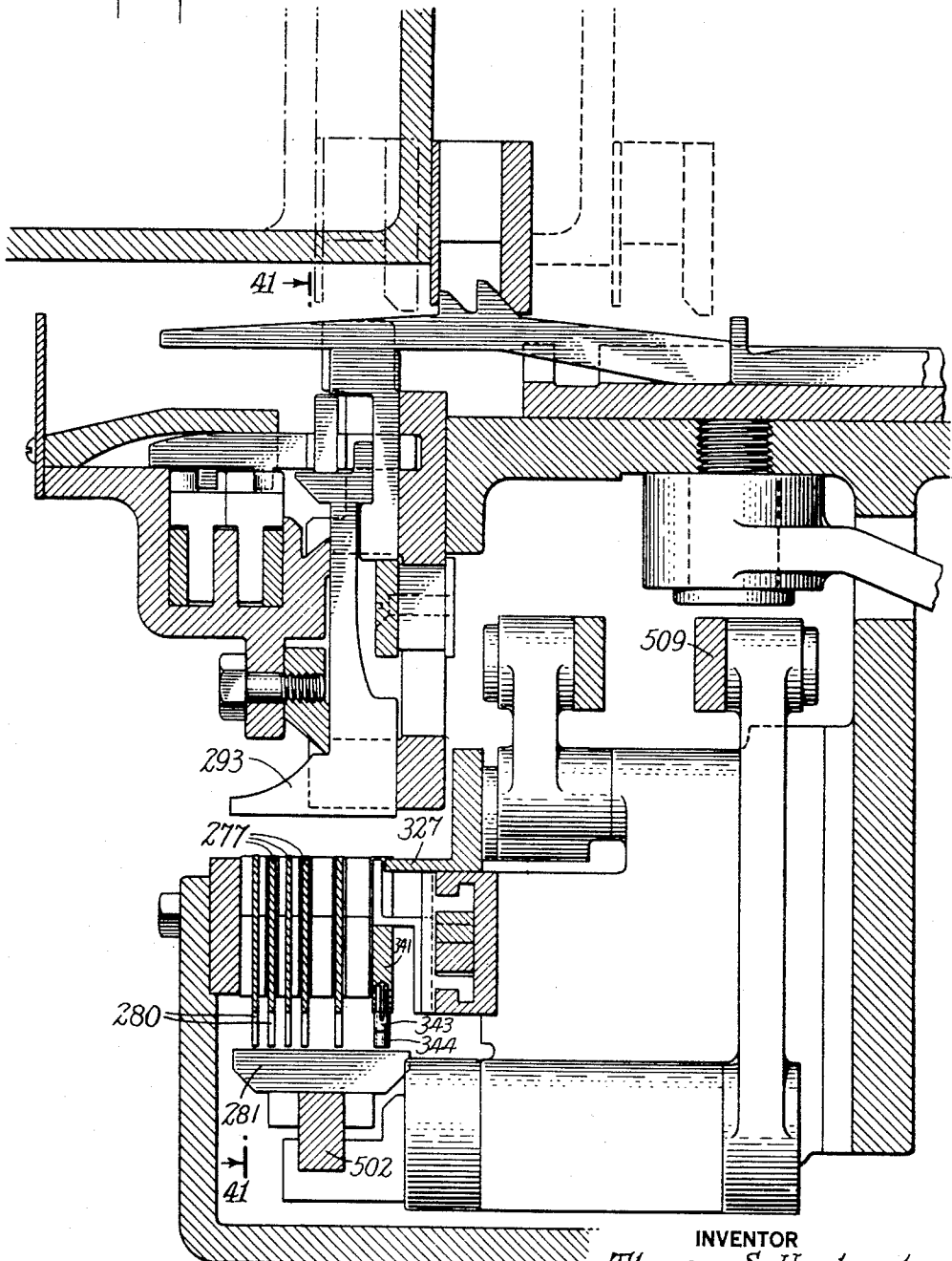
2,395,823

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Fig. 40.



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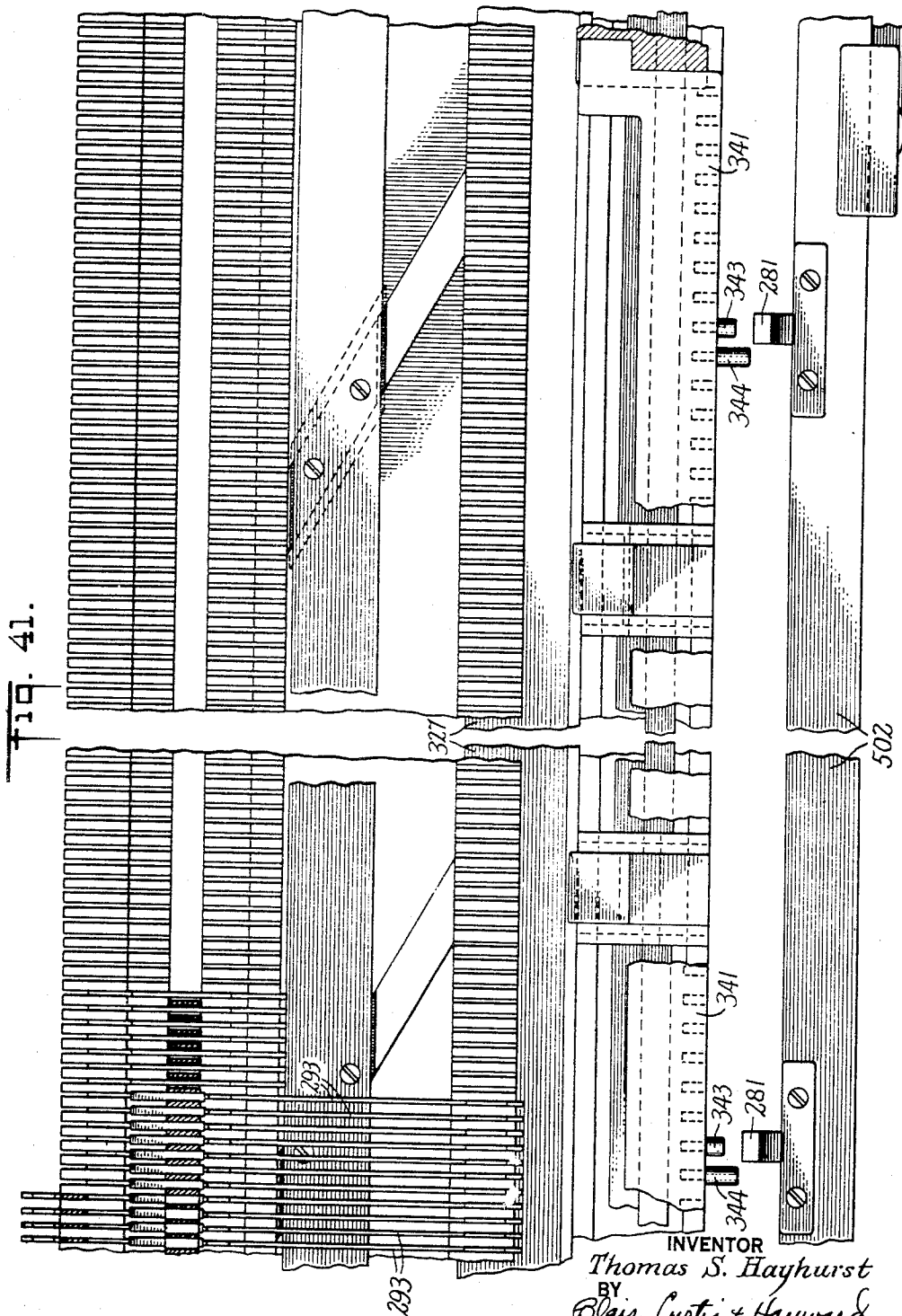
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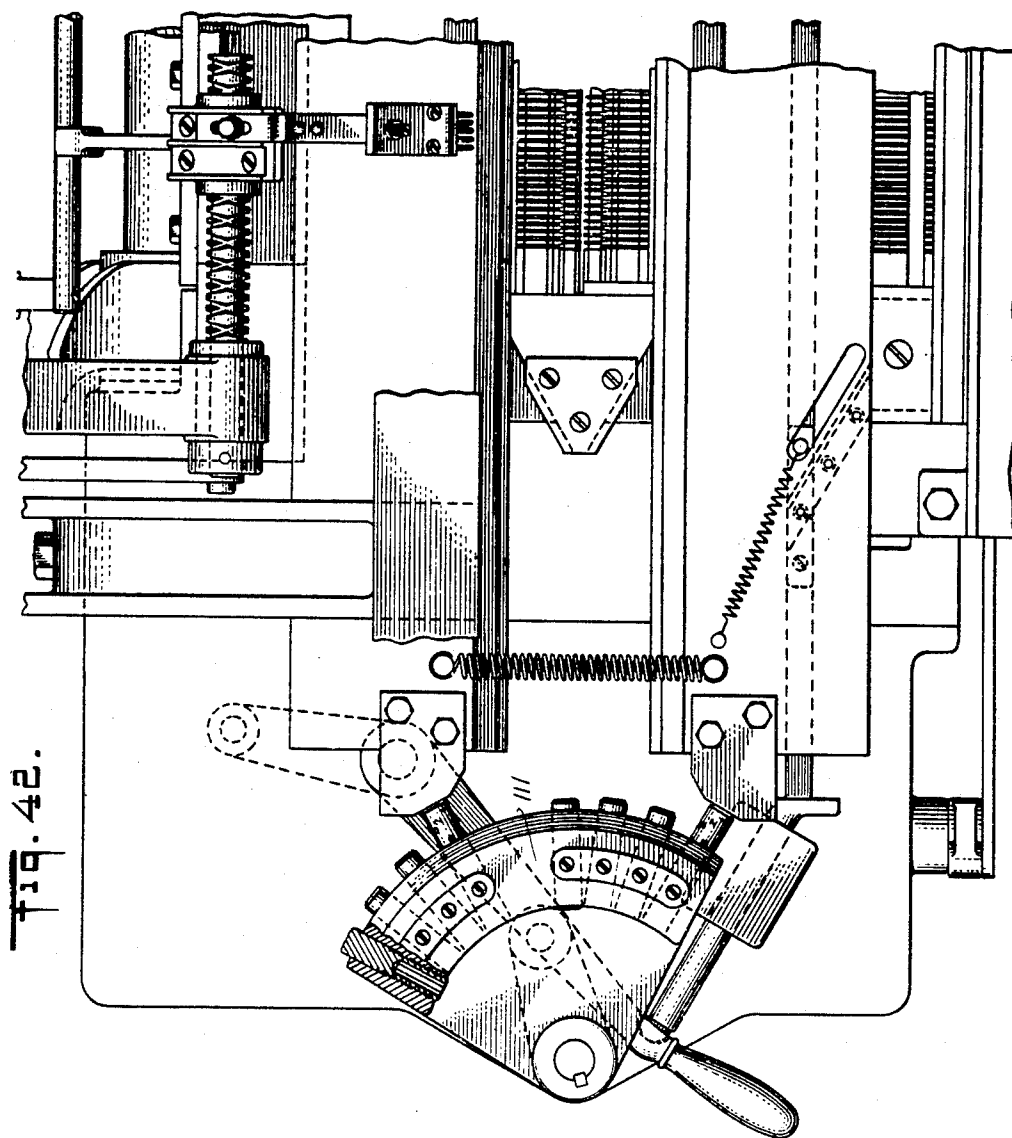


Fig. 42.

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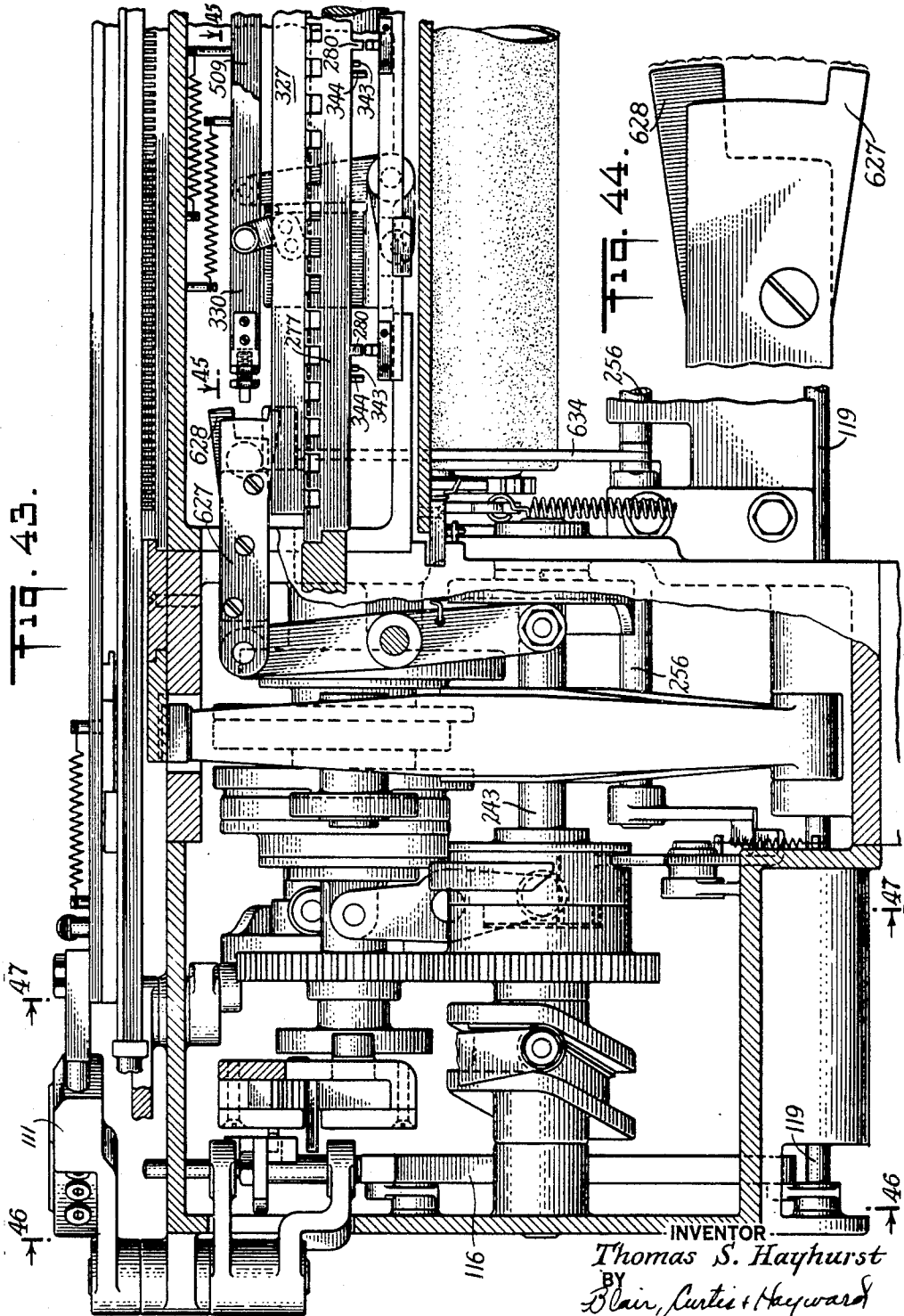
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Fig. 46.

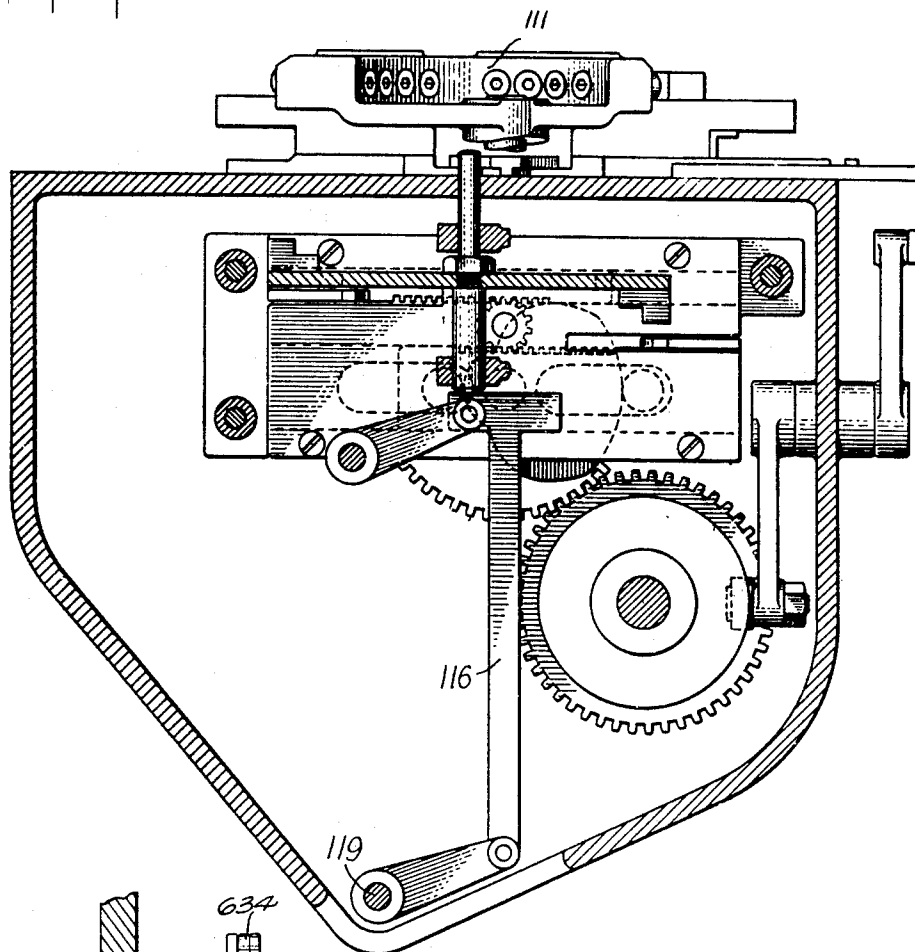
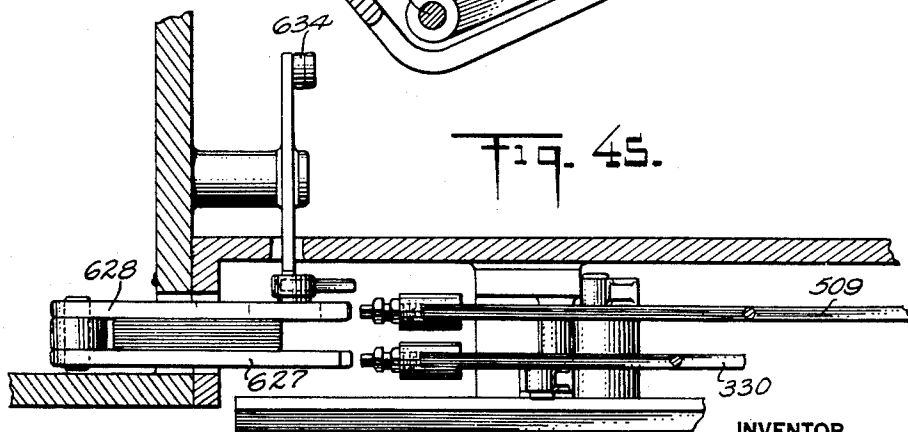


Fig. 45.



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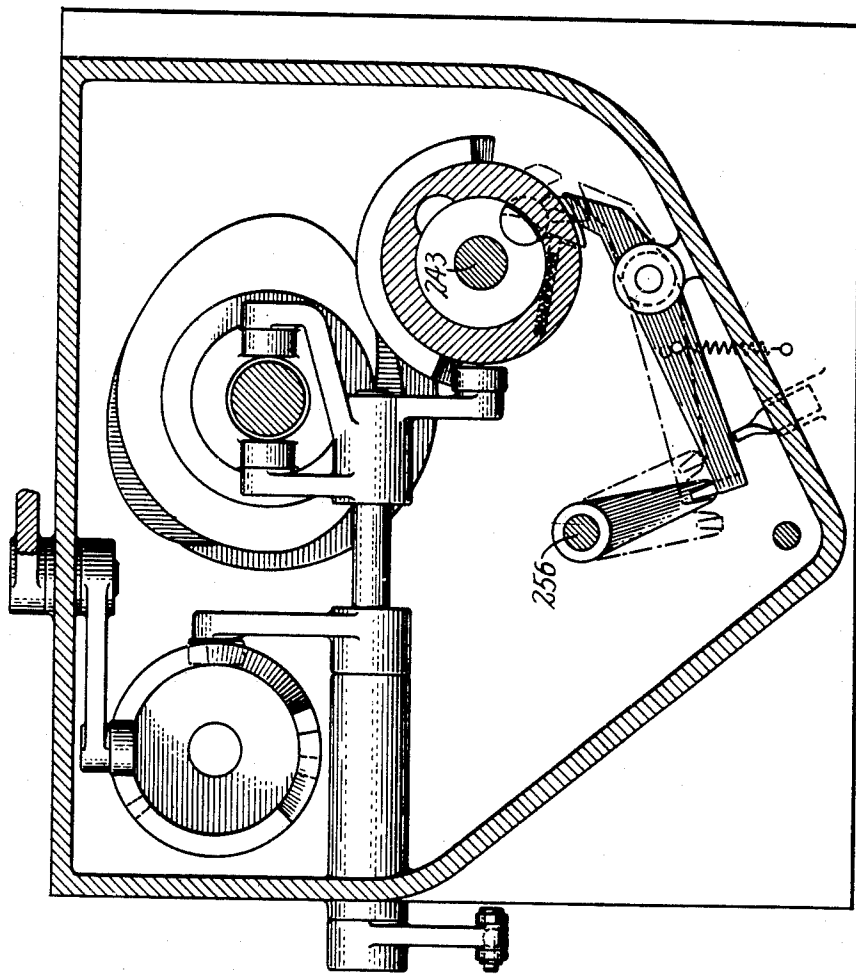


Fig. 47.

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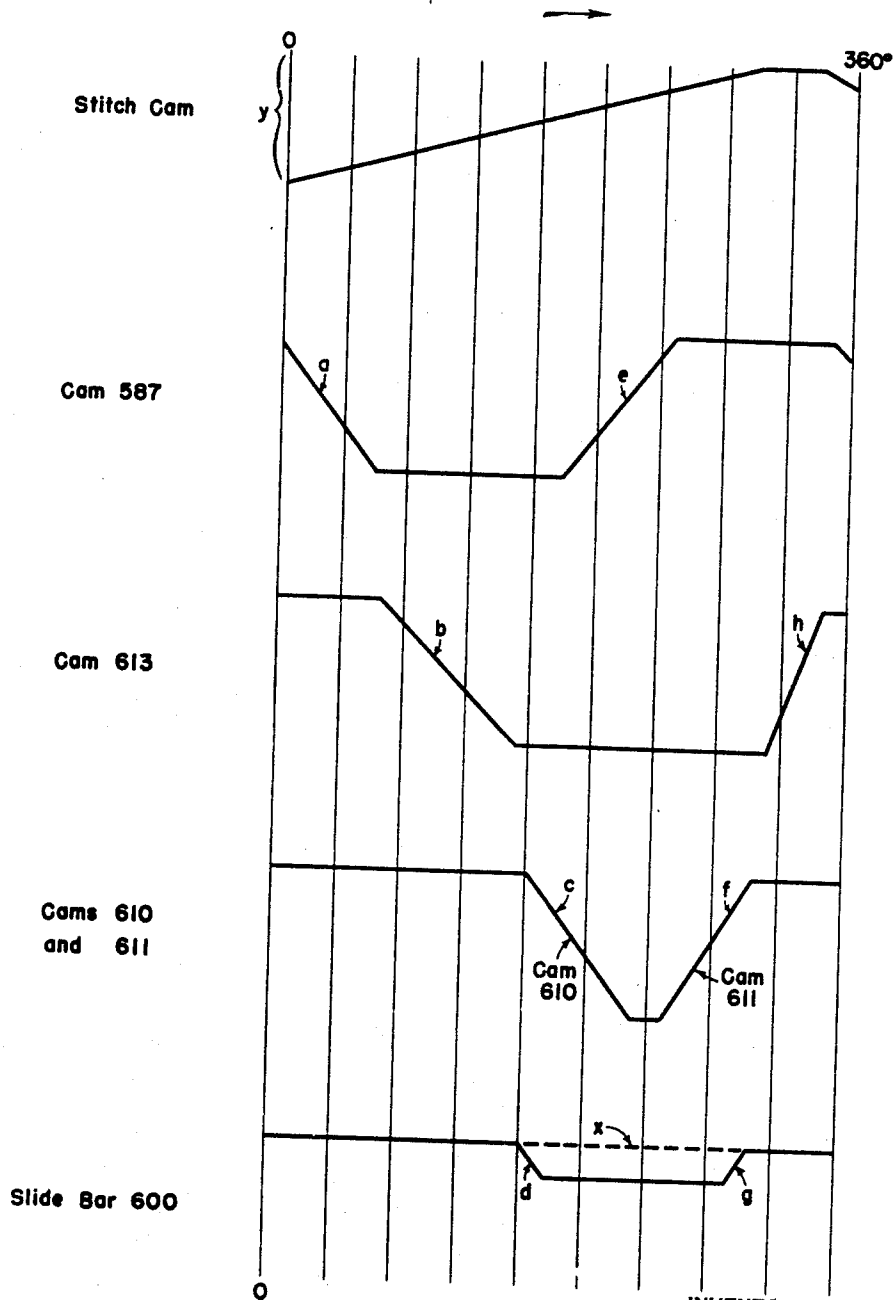
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Fig. 4B.



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Patented Mar. 5, 1946

2,395,823

UNITED STATES PATENT OFFICE

2,395,823

KNITTING MACHINE

Thomas S. Hayhurst, Belle Harbor, N. Y., assignor
to Max Nydegger, Summit, N. J.

Application April 13, 1944, Serial No. 530,770

15 Claims. (Cl. 66-155)

The present invention relates to an improvement in knitting machines. Objects of said invention have been to provide an improvement in pattern change control mechanism for knitting machines; to provide such control mechanism capable of being operated from a continuous pattern band or the like; to provide means whereby a pattern band or sheet of relatively short length may be effectively employed to repeat the effect of its pattern features thus avoiding the need for a relatively or unduly long strip or band with all the pattern change indicia arranged in the actual sequence of their occurrence in knitting; and to provide pattern change control mechanism which shall be positive and dependable for automatically controlling operation of all the instrumentalities employed in producing a wide range of knitted products.

One embodiment of said invention in a form adapted for use in connection with an automatic multiple flat links knitting machine is described in the following specification and shown in the appended drawings, in which—

Figure 1 is a front elevation of a knitting machine embodying the improved automatic control mechanism;

Figure 2, an end elevation of the right end of the machine as shown in Figure 1;

Figure 3, a horizontal section on the line 3—3 of Figure 2;

Figure 4, a plan view, enlarged, of portions of Figure 3 and with parts removed to disclose devices connected with the automatic control mechanism;

Figure 5, a fragmentary view in vertical section on the line 5—5 of Figure 4 and showing portions of the decker and racking control devices;

Figure 6, a fragmentary view partly in vertical section on the line 6—6 of Figure 4 and showing portions of the decker and racking control devices;

Figure 7, a fragmentary view partly in vertical section on the line 7—7 of Figure 4 and showing portions of the decker and racking control devices;

Figure 8, a fragmentary view partly in vertical section on the line 8—8 of Figure 4 showing a portion of the devices for effecting rapid return from gusset forming or shoulder slant narrowing;

Figure 9, a fragmentary view in vertical section on the line 9—9 of Figure 8;

Figure 10, an enlarged view in front elevation and with parts broken away of a portion of the machine at the right-hand end of Figure 1;

Figure 11, an enlarged transverse vertical section on the line 11—11 of Figure 3;

Figure 12, an enlarged transverse vertical section on the line 12—12 of Figure 3;

Figure 13, an enlarged fragmentary view in plan of a portion of automatic operation and pattern control devices indicated generally at the right end of Figure 3;

Figure 14, a fragmentary view partly in section on the line 14—14 of Figure 13 showing a portion of the thread change control mechanism including the control links in neutral position;

Figure 15, a top plan view of the devices shown in Figure 14;

Figure 16, a fragmentary view on the line 16—16 of Figure 13 showing a portion, including the control links, of the jacquard operating shaft control mechanism in neutral position;

Figure 17, a view similar to Figure 16 but with one control link in a jacquard change effecting position;

Figure 18, a fragmentary view on the line 18—18 of Figure 13 showing the control link associated with the automatic rack control mechanism;

Figure 19, a fragmentary view on the line 19—19 of Figure 13 showing the control link associated with the automatic stitch length control mechanism;

Figure 20, a fragmentary view on the line 20—20 of Figure 13 showing the control link which cooperates with another similar link in the automatic control of selector bar positioning devices;

Figure 21, a fragmentary view on the line 21—21 of Figure 13 showing the control link associated with the automatic widening and narrowing devices employed in gusset forming operations or the like;

Figure 22, a fragmentary view on the line 22—22 of Figure 13 showing the control link associated with the automatic decker control mechanism;

Figure 23, a fragmentary view on the line 23—23 of Figure 13 showing the control link associated with the automatic widening and narrowing control device employed in fashioning;

Figure 24, an enlarged fragmentary view in elevation of a portion of a typical perforated operation and pattern control band;

Figure 25, a transverse vertical section on the line 25—25 of Figure 13;

Figure 26, a fragmentary plan view partly in horizontal section on the line 26—26 of Figure 25 showing pattern band advancing portions of the control devices;

Figure 27, a fragmentary view partly in vertical section on the line 27—27 of Figure 25 showing

pattern band advancing portions of the control devices;

Figure 28, a view in perspective of a feeler for controlling advance of the pattern control chain;

Figure 29, a view in perspective of a modified form of feeler for controlling various pattern changes;

Figure 30, a plain link of pattern control chain;

Figure 31, a low left lug link of pattern control chain;

Figure 32, a low right lug link of pattern control chain;

Figure 33, a high left lug link of pattern control chain;

Figure 34, a high right lug link of pattern control chain;

Figure 35, a transverse vertical section on the line 35—35 of Figure 13;

Figure 36, a transverse vertical section on the line 36—36 of Figure 13;

Figure 37, an enlarged fragmentary view in plan of a portion of Figure 3 and with parts broken away to show portions of automatic widening and narrowing control devices employed in fashioning and for decker point carrier, rack skip, and thread carrier adjustment;

Figure 38, an enlarged fragmentary transverse vertical section on the line 38—38 of Figure 10;

Figure 39, an enlarged fragmentary transverse vertical section on the line 39—39 of Figure 10;

Figure 40, an enlarged fragmentary view in transverse vertical section on the line 40—40 of Figure 3;

Figure 41, a view partly in longitudinal vertical section on the line 41—41 of Figure 40 and with portions broken away and with some parts removed;

Figure 42, an enlarged plan view of parts of the left end portion of the machine with some parts removed and some broken away;

Figure 43, an enlarged front elevation with parts in longitudinal vertical section and other parts broken away to show more clearly pattern control, stitch length control, and jacquard shaft actuating devices at the left end of the machine;

Figure 44, a fragmentary enlarged view of a portion of the free end of the rod pusher for selectively actuating the profile and fashioning bars and the gathering bar;

Figure 45, a fragmentary plan view partly in horizontal section on the line 45—45 of Figure 43;

Figure 46, a transverse vertical section on the line 46—46 of Figure 43;

Figure 47, a transverse vertical section on the line 47—47 of Figure 43; and

Figure 48, a graph showing the timing of movements of the pattern band or sheet, the change and pattern control feelers, the push bars for actuating the stop or control links and the chain drive control pawl adjusting slide bar in the pattern control mechanism as shown in Figures 13, 25, 35 and 36, in relation to movement of the stitch cams in a left to right knitting course.

Pattern control

Operation of an automatic multiple knitting machine, such as that illustrated generally in Figure 1, is conveniently regulated by pattern change control devices of which details of one embodiment are shown more clearly in Figures 13 to 36 inclusive.

In that embodiment, a pattern sheet of suitable material, as paper, is perforated at predetermined places to effect, with other instrumentalities including a cooperating pattern chain,

different operating results in predetermined timed relation and thus cause the machine to automatically knit a product or plurality of products incorporating desired characteristics of design, construction and size.

Pattern sheet

Said pattern sheet, here shown in the form of an endless band, presents in effect a plurality of parallel longitudinally extending zones arranged one after another across the band and each corresponding to some function or set of instrumentalities as to which operating changes occur to effect various pattern modifications. Said band also presents in effect a plurality of transversely disposed sections each comprising laterally adjacent portions of all of said zones and each supplying all the pattern change indicia, as perforations, effective in a single pattern change cycle.

Perforations made at predetermined places in said band are co-related with devices, including a set of feelers, for controlling the different operating mechanisms, as racking, thread change, narrowing and widening, etc. Accordingly, in a typical pattern band, as 553, Figure 24, (Sheet 10) the location of one or more perforations, as 693, 736a etc., in one zone or another determines which operative function or instrumentality is to be changed. The location of such perforations in one section or another not only determines which of the several operational changes shall become effective in the same given course; but also, in part, determines the timing or order of occurrence of said changes in relation to others effective in different courses, this timing being modified by operation of the pattern chain to be described.

As seen in Figures 24, 25, 26 and 27, the pattern band 553 of paper, or other suitable material, is supported over a portion of the periphery of a hollow drum 554 provided with radially extending pins 555 for engaging parallel rows of opposed drive perforations 556, Figure 24, arranged at the opposite edge portions of said band. Each pair of opposed drive perforations 556, in effect, also marks the median line of one of said transverse change sections of said band 553.

The relative locations of the perforations in each pattern change entry or record on the band depend on the extent and/or direction of movement desired from the devices controlled by said perforations when the change section containing said entry is brought by rotation of said drum 554 into operative pattern change controlling relation thereto.

Pattern drum

Said pattern perforations in band 553, when at zenith or operative control position, are in register with suitably spaced holes 557 which extend through the peripheral wall of said drum 554, Figures 25 and 26, and permit the passage of feeler pins through said perforations. Said holes 557 are provided in sets of three or other suitable number for each feeler or for each zone of the band 553. Said sets are disposed in a transversely extending group across drum 554 for each change position thereof. One such complete group of sets of holes 557 is shown in detail, Figure 26, to illustrate the arrangement here described. In the embodiment shown in Figure 25, there are twelve such equi-angularly spaced groups, one for each of the twelve stopping or change positions of drum 554 which are 30°

apart. Each such group consists of a transverse middle row of radially directed holes and, at each side thereof, a parallel row of holes, the central axes of which are parallel with the central axes of the radially directed holes.

Control of rotation of pattern drum

Suitable devices cooperating with drum 554 control the time and extent of its rotation to bring one or another of said groups of holes 557 therein into registering relation with the pattern perforations, as 693, Figure 26, in one or another of the transverse sections of pattern band 553 and into operative relation to certain selecting devices, including suitable feelers of which portions engage with said holes and said perforations when the latter are in register.

Drum actuating pawls

Drum 554 is mounted on a shaft 558 and rotated through an index wheel 559, clockwise or counterclockwise, Figure 25, and at times depending on the operation of actuating and controlling devices cooperating in a predetermined manner with said band 553 and said drum 554. Thus, index wheel 559 is actuated at predetermined occasions if desired to rotate drum 554 clockwise, Figure 25, by means of an upper or clockwise pawl 560; and at other predetermined occasions to rotate said drum counterclockwise, Figure 25, by means of a lower or counterclockwise pawl 561. Said pawls 560 and 561 are bifurcated at their index wheel engaging ends to form, respectively, a long finger 560a, a short finger 560b, and a long finger 561a, and a short finger 561b.

Means are provided for selectively adjusting the angular position of said drum rotating pawls so that a short finger thereof will engage and actuate the index wheel 559 to rotate it and drum 554 one notch, 30°; or, so that a long finger and a short finger thereof will together rotate said drum two notches, or a total of 60°. This feature permits frequently repeated use of any section of the pattern sheet and, to that extent, renders the selective control mechanism more effectively elastic. Accordingly, to produce an article of a given pattern, the number of pattern determining sections and, therefore, the length of the pattern band employed is reduced to a minimum.

Pattern chain for drum control

Devices for selectively adjusting the angular position of said pawls 560 and 561 in preparation for controlling the direction and extent of rotation of the drum 554 include a sprocket 562 on a shaft 563 and a suitable pattern control chain mounted to advance with rotation of said sprocket 563, counterclockwise, as seen in Figure 25.

For use in connection with a given pattern sheet or band, said chain is made up to include in proper order different forms of a conventional type of link, such for example as those shown in Figures 30 to 34 inclusive. Figure 30 illustrates a plain link 564; Figure 31, a low lug link 565 having a low lug 565a extending laterally to the left; Figure 32, a low lug link 566 having a low lug 566a extending laterally to the right; Figure 33, a high lug link 567 having a high lug 567a extending laterally to the left; and Figure 34, a high lug link 568 having a high lug 568a extending laterally to the right.

When a chain, comprising links like those above described, is advanced by sprocket 562 to bring said links one after another into operative

position in relation to parts to be described, the plain links 564 so positioned cause no rotation of drum 554; the right lug links 566 and 568 cooperating with the upper pawl 560 cause drum 554 to rotate clockwise, Figure 25; the left lug links 565 and 567 cooperating with the lower pawl 561 cause drum 554 to rotate counterclockwise, Figure 25. The low lug links 565 and 566 cause one notch, 30°, (i. e. on index wheel 559) rotation of drum 554; and the high lug links 567 and 568 cause a two notch, 60°, rotation of drum 554.

Each of the links employed in forming the pattern chain has a hook portion 564a which is releasably interlocked with a cross piece 564b of another link when the chain is assembled. Thus, the same links may be used repeatedly in assembling different pattern chains.

Upper drum pawl

The upper pawl 560 which rotates index wheel 559 and drum 554 clockwise, Figure 25, is mounted on a stud shaft 569 carried at an upper portion of a reciprocable bracket 570 which is moved periodically toward and away from drum 554 by means to be described. Pawl 560 carries at one side a roller 571 which rides on the upper edge of an upper pawl positioning lever 572 secured at one end of a rock shaft 573, and normally biased toward neutral position by a spring 572a, Figure 25.

An arm 574, secured at the opposite end of said rock shaft 573 has a roller 575 at its outer end in position to ride yieldingly on the right side, Figure 13, of the periphery of the hub of sprocket 562. With a plain link 564, or a left lug link 565 or 567, at zenith position on sprocket 562 and with said roller 575 riding on the hub thereof at the right of said link, the free end of the positioning lever 572, through arm 574 and rock shaft 573, is tilted to "up," or neutral position. This raises the inner end of upper pawl 560 sufficiently for its terminal fingers to clear the index wheel 559 on the next periodic thrust of bracket 570 toward said index wheel; and no rotation of drum 554 is effected through arm 574 and lever 572.

If a right lug link, as 566 (low) or 568 (high) shall have reached zenith or operative position on sprocket 562 so that a right lug, as 566a or 568b is interposed between the hub of said sprocket and said roller 575, arm 574 is tilted clockwise, Figure 25; and the free end of positioning arm 572 is thereby lowered to one or another of its two operative positions.

If the interposed right lug is low, at 566a, Figure 25, upper pawl 560 will thereby be tilted to such position in relation to index wheel 559 that, on the next periodic advance of bracket 570 and the consequent endwise thrust of pawl 560, the end of short finger 560b of the latter will engage a tooth, as 559a, of index wheel 559 and rotate said wheel one notch, 30°, clockwise. If a high lug, as 568a is operative, pawl 560 is tilted farther than before and, at the next periodic endwise thrust thereof, index wheel 559 and consequently drum 554 will be rotated two notches, or 60°, of which the first notch, or 30°, is effected by long finger 560a engaging tooth 559a, and the next notch, or an additional 30°, by short finger 560b engaging tooth 559b.

Lower drum pawl

The lower pawl 561 pivoted at 576 on said bracket 570 has a roller 577 riding on the upper edge of a lower pawl positioning and guiding

lever 578 secured on a rock shaft 579 journaled in a portion of the frame of the machine. Said lever is rocked to and from different angular positions by means including an arm 580 which is loosely mounted on said rock shaft 579, Figure 25, adjacent to an upwardly extending arm portion 578a, Figure 26, of said lever 578 and connected thereto by a spring 581.

An upper end portion of said arm 580 is constantly engaged by the depending end of an arm 582, dotted, Figure 25, secured to a sleeve 583 loose on rock shaft 573, Figure 27. An arm 584, Figure 13, having a roller 585 at its outer end is also secured to sleeve 583, Figure 27. Roller 585 is positioned to engage and ride on the periphery of that portion of the hub of sprocket 562 at the left of the sprocket teeth, Figure 13, or upon any left lug of a chain link at zenith position thereon.

When a plain link or a right lug link is at zenith position on sprocket 562, arm 584 is in down, or "neutral" position, i. e. as shown in Figure 25. The depending arm 582 thereby maintains lower lever 578 in the down or neutral position shown. Therefore, on the next periodic thrust of bracket 570 toward drum 554, both fingers of pawl 561 will clear the teeth of index wheel 559; and drum 554 is not rotated through arm 584 and lever 578.

If, in the advance of the pattern chain, a left lug link 565 or 567 reaches operative (zenith) position, a low lug 565a or a high lug 567a, as the case may be, will be interposed between said hub of the sprocket and said roller 585. The effect of the resulting tilting of arm 584 is transmitted through arm 582, arm 580, and spring 581, to lever 578 and thence to pawl 561. If a low lug 565a is operating, the pawl 561 will be raised, and therewith short finger 561b to operative position opposite a tooth 559c of index wheel 559; and, on the next periodic inward thrust of bracket 570, short finger will rotate said wheel 30° counterclockwise. If a high lug 567a is operating, long finger 561a of pawl 561 will engage said tooth 559c of index wheel 559 and advance said wheel and drum 554 30° counterclockwise; and short finger 561b will engage the next succeeding tooth 559d of said index wheel and rotate said wheel and drum 554 another or additional 30° counterclockwise.

Drive for pattern chain and sprocket

The periodically reciprocable bracket 570 previously referred to and upon which pawls 560 and 561 are pivotally mounted is secured to and extends downwardly from an outer end portion of a sliding pawl carrier bar 586, Figures 13 and 36, periodically reciprocated endwise by a cam 587 on main shaft 6. Said cam 587 engages cam rollers 588 and 589 journaled at one side of an inner end portion of carrier bar 586. The effect of one cycle of operation of cam 587 on said carrier bar 586 and connected devices in relation to movement of the stitch cams or of the stitch cam operating cam 76, Figure 3, in one course, as left to right, Figure 1, is illustrated in Figure 48.

A pawl 590, Figure 36, is pivoted to an outer end portion of carrier bar 586 at 591, and with its free end movable into and out of position to engage the teeth of an index wheel 592 on the sprocket shaft 563. Means are provided whereby said pawl 590 is periodically advanced by endwise thrusts of carrier bar 586 sufficiently to rotate index wheel 592 and therefore sprocket 562 one notch, 30°, counterclockwise, Figure 36, during each complete rotation or cycle of main shaft 6.

However, whether or not such rotation of said sprocket 562 takes place during a given cycle of main shaft 6 depends on the angular position of pawl 590 when carrier bar 586 is advanced by cam 587, i. e. whether the free end of said pawl 590 is in down or up position by operation of devices to be described.

Control for chain and sprocket drive

As shown in Figure 36, pawl 590 on bar 586 is provided with a roller 593 journaled on a laterally extending stud 594. The periphery of said roller rides on the laterally extending flange portion 595 of an arm 596 secured at one end of a rock shaft 597, Figure 13. A detent arm 598, Figure 25, is secured to and extends upwardly from the other end of said rock shaft 597. Said pawl 590 is biased toward operative position in relation to index wheel 592 and the free end of said detent arm 598 is biased toward and bears against a stop lug 599 extending laterally from an outer end portion of a slidable bar 600. This bias is produced by the weight of free end portions of said arm 596 and of pawl 590 which bears thereon and causes said arm 596 and pawl 590 to swing downwardly, Figure 36, when arm 598 is released by outward endwise movement of said slide bar 600 which carries stop lug 599 outwardly, left Figure 25, under circumstances to be described.

Pattern chain control slide bar and feeler

Means for controlling endwise pawl releasing movement of said slide bar 600 include a laterally extending stop plug 601 thereon, Figure 13, positioned to be intercepted by a detent 602 at the upper end of a vertically slidable chain control feeler 603, Figure 28, when the latter is in "up" position, as shown in Figure 25. With detent 602 intercepting lug 601, said feeler 603 thus prevents the previously described outward or pawl releasing movement of slide bar 600. Means are provided for dropping said feeler to release pawl 590 and for thereafter returning said feeler and said pawl to "up" position.

At its lower end, said feeler 603, has a feeler pin 603a. Between its ends is an inwardly extending re-setting lug 607, arranged to be engaged by a feeler resetting bar 608, Figure 25, which, when in "up" position, holds said feeler pin 603a above pattern band 553, and when in down position, permits said pin 603a to drop through a chain control perforation 609 if one is presented.

In operation, the chain control perforations, as 609 in pattern band 553, Figure 24, are brought one at a time in predetermined sequence as required, between said chain control feeler pin 603a and one of the holes 557 in the drum 554, so that said feeler pin 603a can engage and drop through one of said perforations. This occurs as resetting bar 608, controlled by cam 613, Figure 36, is lowered, line b, Figure 48. At that time, the inner push bar 617, Figure 13, is in its extended dwell position, broken line, Figure 25, thereby holding bar 600 retracted and lug 601 thereon at one side of detent 602.

If no chain control perforation 609 is at zenith position when bar 608 is dropped, the lower end of chain control feeler pin 603a merely drops against and onto the web of the pattern band. Thereupon inner push bar 617 moves toward outer push bar 685, line c, Figure 48. Slide bar 600 cannot advance because stop 601 thereon is intercepted by detent 602 on feeler 603. This condition is illustrated by the dotted line X in Figure 48.

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However, when feeler 603 is dropped the full distance, as when a chain control perforation 609 is at zenith position, detent 602 thereon is thus displaced downwardly and out of the path of outward movement of stop lug 601 on slide bar 600. Said slide bar 600 thereupon slides endwise to the left, Figure 25, (line *d*, Figure 48) impelled by the weight of arm 596 and pawl 590, as above noted. With the resulting rocking movement of shaft 597, the outer end of flange 595 of said arm 596 and the free end of pawl 590 swing downwardly.

In this lowered position, the free end of said pawl 590 is moved forward, left Figure 36, with the next periodic forward movement of carrier bar 586, line *e*, Figure 48, to engage and rotate said chain driving index wheel 592 one notch. This brings the next link of the pattern chain into operative (zenith) position on the sprocket 562 and thereby determines the extent and direction of the next rotation, if any, of drum 554 and equivalent movement of pattern band 553 supported thereon.

The rotation of drum 554 and advance of the pattern sheet, if any, occur on the next stroke (right, Figure 25), line *a*, Figure 48, of said carrier bar 586 which carries with it the depending bracket 570 and the previously described drum actuating pawls 560 and 561. But before that stroke and in the preceding cycle, slide bar 600 has been returned, line *g*, Figure 48, to retracted (inoperative or neutral) position by outward movement of inner push bar 617, line *f*, Figure 48, (to the right, Figure 25); and feeler 603 has been restored by bar 608 to its "up" (inoperative or neutral position), line *h* Figure 48.

Returning slide bar to neutral

Devices for effecting the return movement of slide bar 600, line *g*, Figure 48, and the lifting of pawl 590 therewith and for holding the same in neutral or retracted position include a lug 616 at the inner end, right, Figure 25, of said bar 600 and means for engaging and pushing said lug.

For this purpose, and for another purpose to be described, the inner transversely extending push bar 617 is mounted at the inner ends of spaced lower rack bars 618 and 618*a* slidably supported in the frame and each having a series of upwardly exposed teeth at its outer end. Said rack bars 618 and 618*a* are periodically reciprocated endwise by rotation of pinions 619 and 619*a* secured on a shaft 620, Figures 13 and 35, which also carries another pinion 621. The latter engages and is driven by the teeth of a curved rack 622 mounted at the outer end of a rocker arm 623 pivoted at 624.

A cam roller 625 is pivoted at an inner end portion of said rocker arm 623 and in position to ride on the periphery of cam 610 on main shaft 6. Another cam roller 626 is pivoted at the lower end of a depending branch of rocker arm 623 and in position to ride on the periphery of cam 611 on said shaft 6, Figure 35.

Cams 610 and 611, as indicated by the arrow on the latter in Figure 35, rotate clockwise with main shaft 6. With said cams disposed as shown in said figure, lower rack bars 618 and 618*a* and inner push bar 617 carried thereon occupy substantially the relative positions shown in solid lines, Figure 25, said lower rack bars being then approximately at their outermost limit of travel. Upon further rotation of main shaft 6, cam 611 causes arm 623 to swing upwardly and thus to rotate shaft 620 counterclockwise, Figures 25 and

35. This drives lower rack bars 618 and 618*a* and inner cross bar 617, inwardly (right, Figure 25) with a rear edge portion of the latter bearing against lug 616 of slide bar 600. At the end of this movement, line *f*, Figure 48, stop 601 on slide bar 600 has moved beyond the vertical path of detent 602 on feeler 603 which is now returned to "up" or locking position, line *h*, Figure 48. This is closely followed by the rotation, if any in the next cycle, of drum 554 effected in the manner heretofore described by one of the pawls 560 and 561 and devices connected therewith.

Returning chain control feeler to neutral

The lifting or return of chain control feeler 603, line *h*, Figure 48, to the initial position wherein it may block slide bar 600 against forward endwise movement (i. e. when no chain control perforation comes to zenith position) and thus hold pawl 590 inoperative is effected by means including said raising bar 608 secured on shaft 612 which is periodically rocked by operation of a cam 613 through an arm 614 secured to said shaft 612 and having a cam roller 615, Figures 13 and 36. Thus, when the arm lifting portion of cam 613 engages said roller 615, shaft 612 is rocked and thereby swings an outer edge portion of raising bar 608 upwardly against resetting lug 607 on the chain control feeler 603 and simultaneously against similar lugs 607 on other or pattern control or change feelers to be described, line *h*, Figure 48.

Operation of control links

An outer transverse push bar 685, Figure 25, which, with inner transverse push bar 617, cooperates with the various stop or control links as hereinafter more specifically described, is carried between and actuated by spaced parallel upper sliding rack bars 687 and 687*a* which engage and are driven by said pinions 619 and 619*a* on shaft 620. Thus, when said pinions are rotated by cams 610 and 611, as previously indicated, to operate inner push bar 617, outer push bar 685 periodically reciprocates simultaneously and co-extensively with said inner push bar 617 but in opposite directions, to and from the relative positions thereof shown in full lines in Figure 25.

The periodic movement of inner push bar 617 as said bar and outer push bar 685 are moved away from each other, line *f*, Figure 48, by cam 611, is employed to effect the return movement of slide bar 600 above referred to.

The periodic reciprocal movement of said bars toward each other, effected by cam 610, line *c*, Figure 48, which follows dropping of the pattern change feelers 689, Figure 29, line *b*, Figure 48, effects endwise positioning movement of variously shaped control links, as 805, Figure 25, under certain conditions to selectively control the direction and extent of movement of pattern change devices operatively connected thereto.

Pattern change feelers

An outer end portion of each pattern control link rests freely on the top end of one of said vertically adjustable pattern change feelers 689 and is conditioned for subsequent movement to and from different pattern control positions by vertical adjustment of its supporting feeler.

In the embodiment shown, Figure 29, each of said link conditioning or pattern change feelers 689 comprises a flat body portion having three downwardly extending feeler pins 604, 605 and 606, or more or less depending on the number of

changes required. These pins are of different lengths, as 604 long, 605 medium, and 606 short, and cooperate with perforations in the pattern band to determine the several different operative control positions taken by said feelers. The position taken by any feeler in each pattern change operation depends on whether the pattern sheet brings one, two, three or other number of perforations into register with the pins of said feeler.

Said pattern change feelers 689 and chain control feeler 603, are mounted to slide vertically in slots 690 formed in a guide member 691 positioned above the drum 554, Figures 25 and 27; and are retained in said slots by a face plate 692. Means including said raising bar 608 and connected devices are provided for dropping all of said feelers simultaneously toward the pattern sheet and for simultaneously raising said feelers therefrom.

The several control links conditioned by said feelers 689 are formed with variously arranged pairs of cooperating stops. Each pair consists of one of a series of one or more stepped or offset vertically disposed outer faces and one of a series of one or more cooperatively arranged inner faces. An outer face of one pair is adapted to be selectively engaged by said outer cross bar 685, and the corresponding inner face of said pair, by inner cross bar 617, each time said bars are moved toward each other, line c, Figure 48. If the free end of any one or more of said links has been raised or lowered from its previous condition, said movement of bars 617 and 685 toward each other will move the corresponding control link or links endwise to a different control position.

Where a control link is provided with two pairs of stops or faces representing two control positions, as one neutral and one operative, for example, the corresponding link conditioning feeler need be equipped to take only one lower or operative change position, i. e. with only one feeler pin. In the form shown, however, the pattern change feelers 689 are adapted to provide three different conditioning positions, i. e. one for each pin of different length.

Jacquard shaft operating and needle position selecting control

As seen in Figures 16 and 17, the jacquard shaft and needle position control links 688 and 688a each have opposed sets of three outer and three inner stepped faces which, in the embodiment shown, provide the number of pairs of faces or stops required to perform the functions herein-after described. One or another of said pairs comes into operation depending on which, if either, of their supporting feelers is moved and to what position of vertical adjustment said feeler is brought by the pattern control devices. Both of said control links 688 and 688a are pivoted to one end of an arm 698 at 699. The other end of said arm is secured to the jacquard and profile and gathering bar control shaft 256, Figures 43 and 47, said shaft being thereby rotated to and from positions which determine five corresponding positions of the pusher arms 627 and 628, Figure 45. Said shaft 256 and other control shafts actuated or utilized in a similar manner, but for different operative effects, are mounted along with suitable friction or retaining devices to hold them releasably in the several angular positions to and from which they are rotated by selective operation of their respective control links.

It has previously been noted that each pattern change feeler, as 689, is provided with the feeler pins 604, 605, 606 of different lengths at its lower end to produce different control effects. Thus, if both the links 688 and 688a are initially in the "up" or neutral position shown in Figure 16 and, if, on the next pattern change operation, the pattern sheet presents no perforation beneath either of the feelers which support said links, when resetting bar 608 is dropped, line b, Figure 48, both said links remain in neutral or "up" position, Figure 16. The next periodic motion, therefore, of the push bars 617 and 685 toward each other, line c, Figure 48, again brings bar 617 into engagement with rear face 701 of link 688a and bar 685 into engagement with front face 700b of link 688 and produces no movement of arm 698 from the assumed initial neutral position.

When two perforations, as 693, in pattern band 553 come between pins 604 and 605 of feeler 689, Figure 17, and the corresponding holes 557 in drum 554, said feeler 689 which supports link 688a takes the intermediate lower position, as shown, with a corresponding conditioning or adjustment of the stop carrying end of said link. This brings outer face or stop 700 at the outer end of link 688a to operative position opposite the inner edge of outer push bar 685. Said bar, on its periodic return inwardly toward bar 617, line c, Figure 48, engages said stop 700 and thereby pushes links 688a and 688 endwise to the position shown in Figure 17 and effects corresponding angular movement of arm 698 and jacquard control shaft 256. The simultaneous periodic inward movement of inner push bar 617 brings its outer edge into engagement with inner faces 701b of 688a and 695b of 688 at the end of said endwise movement of said links.

A different angular position of arm 698 and consequently of shaft 256 is effected when, by reason of the incidence of suitably placed perforations in pattern sheet 553, link 688 is conditioned by its feeler to bring one of the stops or faces 695 or 695a opposite the outer edge of inner push bar 617.

In general, the arrangement of the sets of stop faces on the several control links is such that the lever arms, as 698, controlled thereby may be deflected from any angular control position directly to any other angular control position. The same observation applies to control movements of the other links, lever arms, and control shafts hereinafter more specifically referred to.

Any deflection of jacquard control shaft 256 in either direction by said arm 698 starts operation of jacquard shaft 243, Figure 47. As seen in Figure 43, said jacquard control shaft 256 also actuates intermediate selective devices including the parts shown in Figure 44. The portion 627 thereof is related to operation of the gathering bar 327 and the portion 628 to operation of the profile bars 277, Figure 40, through selector bar 502.

Control devices including the links 688 and 688a and other instrumentalities arranged and connected as above described provide a neutral angular position of arm 698 and two positions of angular adjustment at each side of neutral to produce, through jacquard control shaft 256, as many different operative control conditions.

Thread change control

The mechanism for thread change control, Figures 14 and 15, provides for the neutral position of certain of its parts, as shown, and six

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operative positions reached by adjustment of said parts in one direction from their neutral position. For this purpose, an arm 702 is secured at one end to thread change control shaft 659, Figure 2, which actuates rock shaft 183, and the devices connected thereto. Said arm 702 is moved to one or another of various angular control positions by endwise movement of a pair of control links comprising a long link 703 and a short link 704 pivotally connected to said arm 702 at 705. The neutral position of said links and arm 702, Figure 14, is determined by the step face or stop 706 on long link 703 and the step face 707 on short link 704, when the feelers 689 supporting said links are both in raised position.

Shaft 659 also carries an arm 749, Figure 12, which controls rotation of shaft 169a through a clutch including the rolling key 748. Shaft 169a, Figure 2, actuates shaft 159 through chain 682 and thus produces a forward and back movement of the latch carrying brackets 164 and 165, Figure 1, incident to each thread change operation.

Three of the six operative angular control positions of said arm 702 are determined by the inner stops or step faces 708, 708a and 708b on long link 703 and the other three by the inner stops or step faces 709, 709a, and 709b on short link 704. When one of said first three operative positions is required, short link 704 remains at the level shown in Figure 14, while long link 703 is conditioned by its feeler 689 to bring the proper one of the step faces 708, 708a, 708b into line with the front edge of inner push bar 617. As said inner push bar 617 moves toward outer push bar 685, line c, Figure 48, and bears against the selected one of said step faces, the lever arm 702 is brought to the corresponding intermediate position. When one of the second three operative positions is required, short link 704 is dropped to a lower position with its feeler 689 thus bringing one of the step faces 709, 709a, 709b in line with the front edge of inner push bar 617. Long link 703, in such case, is also dropped to its lowest position to permit movement of its outer end beneath and past the edge of outer push bar 685 when inner push bar 617 moves toward said outer push bar 687, line c, Figure 48, and bears against a selected one of the step faces 709, 709a and 709b of short link 703.

Stitch length change control

As seen in Figures 3, 19, 25 and 46, the stitch length control links 803 and 804 are adapted to rock shaft 119 through lever arm 119a to which both of said links are pivotally connected. Said links are of the same type as links 703 and 704, Figures 14 and 15 but provide an aggregate of five operative stops which produce one neutral position of shaft 119 and four operative positions all at one side of said neutral position. When shaft 119 is rocked to one or another of said four positions, it actuates the stitch length selecting devices shown in part in Figures 42, 43 and 46 and including the vertical T bar 116, the plunger carrier 111 and connected mechanism.

Selector bar control

In conditioning the control jacks as 293, Figure 40, for certain pattern changes, the selector bar 502, Figures 10, 40 and 41, is moved endwise to various positions to bring the lift lugs 281 thereof into and out of position beneath one or another of the sets of depending lugs 343, 344

on fashioning bar 341 or beneath one or another of the sets of depending lugs 280 on the profile bars 217. When in one of these positions, said selector bar 502 is lifted by operation of the push rod 509, Figures 40, 43 and 45, and connected parts including link 634 and the push members 627, 628 under conditions controlled by operation of the control links 688 and 688a previously described in connection with control of the operation of jacquard control shaft 256.

Automatic control of endwise positioning movement of said selector bar 502 is effected through the control link 805, Figure 25, and control link 807, Figure 20. As seen in Figure 25, link 805 is pivotally connected to a lever arm 806 on a shaft 537, and as seen in Figure 20, link 807 is pivotally connected to a lever arm 541a on a shaft 541. Shaft 537 actuates the devices shown in Figure 39 and shaft 541 actuates those shown in Figure 38 to effect endwise movement of selector bar 502 through shaft 516 and sprocket 515.

Each of said control links 805 and 807 has four steps which produce one neutral and three operative positions of each of said shafts 537 and 541, when said links are operated in connection with the feelers 689 and push bars 617, 685 previously described.

Narrowing and quick return control in gusset forming

Control of narrowing and quick return from narrowing in gusset forming is effected by link 808, Figures 13, 21 and 25. Said link is connected to shaft 460 by lever 809 which actuates the control devices shown in part in Figures 4, 8, 9 and 12. For this purpose, said link is provided with three pairs of step faces or stops of which the inner faces 808a, 808b and 808c cooperate with inner push bar 617 and the corresponding outer faces with the outer push bar 685 and the associated feeler devices, Figure 25. One pair of stops marks a neutral position; and the remaining two determine two different operative angular positions of shaft 460. One of said operative positions initiates narrowing; and the other starts the first half of the quick return which is completed by return of shaft 460 to neutral or initial angular position.

Decking control

Operation of the decking devices in the illustrated machine is controlled through link 810, Figures 13, 22 and 25, which is pivotally connected to lever arm 811 secured on decker control shaft 750. Rotation of said control shaft 750 effects operation of the decker shaft 274 and simultaneously arrests operation of the knitting cams. Connections for these purposes are shown in part in Figures 4, 5, 6 and 7.

Link 810 is provided with two pairs of step faces identified respectively by the outer face 810a and the inner face 810b, one of which, 810a produces the neutral positioning of decker control shaft 750 when link 810 is in "up" position and actuated by outer push bar 685 and the other of which produces operative movement and position thereof when said link is in "down" position and actuated by the inner push bar 617.

Widening and narrowing control in fashioning

Operation of the widening and narrowing devices, such for example as those parts thereof shown in Figure 37, and including shafts 369 and 375 and slide bar 403, are controlled through link

802, Figures 13, 23 and 25. Said link is connected to rotate upright shaft 406 which in turn operates the gate carrying slide bar 403, Figure 37.

The neutral and three operative positions of said slide bar 403 are produced by pairs of step faces including the inner step faces 802a, 802b, 802c and 802d respectively and the corresponding outer faces on link 802, Figure 23. One or another of said pairs is engaged by inner push bar 617 or by outer push bar 685 when the latter periodically move toward each other, line c, Figure 48, as previously described.

Racking control

As seen in Figures 4, 5, 11, 13, 18 and 25, automatic control of racking is effected through control or stop link 736 which is connected to rack control shaft 732 by lever arm 737, Figure 25. The connections by which racking is effected including link 734, finger 724, and shaft 725, Figure 5, and operation of the stitch cams is simultaneously arrested through arm 738, bell crank 739, and clutch including key 742, Figure 11, by rotation of said shaft 732 are shown in part in Figures 5, 7 and 11.

Control link 736 is provided with two pairs of step faces identified respectively by the outer step face 736b and the inner step face 736c. These provide one neutral and one operative position for said link when the latter is conditioned by the feelers and actuated by said push bars as previously described with other parts of the illustrated automatic control mechanism.

Operation of controls

The pattern sheet, as 553, Figure 24, is prepared in advance with perforations arranged to produce a given type and size of garment, or part thereof, or other article to be knitted. Also, a pattern chain having the proper number and sequence of the various types of chain links, Figures 30 to 34 inclusive, is prepared in advance for use with each such pattern sheet 553.

In operation, the chain driving sprocket 562 is actuated to advance the chain whenever a chain control perforation, as 609, is at the zenith position on drum 554. But said drum is rotated to move the pattern sheet and thus modify the effective pattern change setting only when a link lug is brought into operative position on the sprocket 562. Accordingly, where a given pattern change setting is to be repeated over a succession of courses, i. e. by holding the pattern sheet at a given change position, the corresponding section of chain is made up of the plain or filler links 564. These are advanced one after another, following a lug link, by rotation of said sprocket until a change is required. This is effected by another lug link interposed at the proper place in the chain and by which the drum is caused to rotate and thus move the pattern sheet into position to present the desired new section of pattern change perforations therein.

The sequence of operation of the several parts above described will be better understood by reference to Figure 48, wherein the graph *y* represents a half turn of the cam 76, Figure 3, which produces one stroke or knitting course, as left to right of the knitting cams as 34, 35, Figure 3, and the positioning cams 34a, 35a. During the operation represented by said graph *y*, cams 587, 613, 610 and 611 on shaft 6 make a full turn, Figures 35 and 36.

As the parts actuated by cam 76 leave one dwell position marking the end of a preceding right to

left course, for example, cam 587 actuates the bar 586, Figure 36, and connected parts in a direction to rotate the pattern drum and thus advance the pattern sheet, provided of course, that the last effective advance of the pattern chain has brought a lug link into zenith position. This movement of bar 586 is represented by the line *a* of Figure 48.

When the pattern drum reaches its new position by said thrust of bar 586, the chain control feeler 603 and the pattern change feelers 689 drop into any pattern sheet perforations presented between them and the drum. This drop is represented in effect by line *b* which also shows the corresponding drop of resetting bar 608, Figure 25, controlled by cam 613, Figure 36.

As the pattern change feelers reach their several lowered positions, cam 610, Figure 35, operates to move the push bars 617, and 685 toward each other, line c, Figure 48, to the position shown in Figure 25. This effects pattern changing movement or adjustment of those of the several control shafts which are to be actuated to produce changes in the next knitting course.

If the chain control feeler 603 has dropped, either alone or with other feelers, line *b*, Figure 48, and as the bar 617 moves toward bar 685, line c, Figure 48, the slide bar 600 is released and moves outwardly line *d*, Figure 48, to drop the pawl 590, Figure 36. Bar 586 is now moved in the opposite direction, right Figure 36, line *e*, Figure 48, to advance the pattern chain on sprocket 562.

Bars 617 and 685 are now moved away from each other by cam 611, line *f*, Figure 48; and substantially simultaneously therewith, slide bar 600 is returned to retracted position by said bar 617, line *g*, Figure 48.

The illustrated cycle is completed by cam 613, Figure 36, which actuates resetting bar 608 to lift all of the dropped feelers above the pattern sheet, line *h*, Figure 48, which is now free to be advanced in the next cycle.

It will be understood that in any cycle wherein no perforation is presented by the pattern sheet between the chain control feeler 603 and the drum, slide bar 600 will not move in the course including the lines *d* and *g*, Figure 48, but will be held in retracted position during the period represented by the dotted line *x*, Figure 48. Accordingly, when under these conditions, cam 587 produces the regular periodic movement of bar 586 also represented by line *e*, the pattern chain will not be advanced. As a practical matter, the control is set up to present either a chain control perforation in the pattern sheet or a lug on the pattern chain for effective operation in each cycle. In other words, either the chain will move or the pattern sheet will be advanced, or both will occur, in each cycle representing a single knitting course.

The above described mechanisms are also shown and described but not independently claimed in my co-pending application Serial No. 530,761 filed herewith and of which the present application is in effect a division.

I claim:

1. In pattern change control mechanism for knitting machines wherein a pattern sheet having perforations is movable to bring said perforations to and from operative relation to a chain controlling feeler having a portion which engages and disengages said perforations, the

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combination of a pattern chain support, a reciprocable carrier bar, means for imparting endwise reciprocating movement thereto, pawl means adjustably mounted on said carrier bar for actuating said pattern chain when the carrier is moved in one direction, pawl means adjustably mounted on said carrier bar for actuating said pattern sheet when the carrier bar is moved in the opposite direction, means operatively connected with said chain controlling feeler to adjust said chain actuating pawl means into and out of operative position, and means operatively related to portions of said pattern chain to adjust said pattern sheet actuating pawl means into one position to rotate the drum in one direction and into another position to rotate the drum in the opposite direction.

2. In pattern change control mechanism for knitting machines wherein a pattern sheet having perforations is movable to bring said perforations to and from operative relation to a chain controlling feeler having a portion which engages and disengages said perforations, the combination of a rotatable drum on which said pattern sheet is supported, a rotatable sprocket, a pattern chain mounted on said sprocket, a reciprocable carrier, means adjustably mounted on said carrier for actuating said sprocket when the carrier is moved in one direction, means operatively connected with said chain controlling feeler to adjust said sprocket actuating means into and out of operative position, a pawl adjustably mounted on said carrier to rotate said drum in one direction, a separate pawl adjustably mounted on said carrier to rotate said drum in the opposite direction, and means operatively connected to said chain and cooperating with one of said drum rotating pawls to adjust the latter into and out of position to rotate said drum.

3. In pattern change control mechanism for knitting machines wherein a pattern sheet having perforations is movable to bring said perforations to and from operative relation to a chain controlling feeler having a portion which engages and disengages said perforations, the combination of a rotatable drum on which said pattern sheet is supported, a rotatable sprocket, a pattern chain mounted on said sprocket, a reciprocable carrier, means adjustably mounted on said carrier for actuating said sprocket when the carrier is moved in one direction, means operatively connected with said chain controlling feeler to adjust said sprocket actuating means into and out of operative position, a pawl adjustably mounted on said carrier to rotate the drum in one direction, a separate pawl adjustably mounted on said carrier to rotate the drum in the opposite direction, and means operatively connected to said chain and cooperating with one of said drum rotating pawls to adjust the latter into and out of different positions to rotate said drum different angular distances.

4. In pattern change control mechanism for knitting machines wherein a pattern sheet having perforations is movable to bring said perforations to and from operative relation to a chain controlling feeler which is movable toward and from said pattern sheet to bring a portion of said feeler into and out of engagement with said perforations, the combination of a pattern chain, a sprocket on which said chain is engaged, a reciprocable pawl carrier, a pawl pivoted thereon and biased toward operative position to actuate said sprocket when said pawl carrier is

moved in one direction and movable to inoperative position, means for reciprocating said pawl carrier, a slidable bar operatively connected with said pawl and biased therewith in one direction and movable in the opposite direction to displace said pawl from said operative position, a stop member on said feeler normally positioned to prevent endwise movement of said bar in said pawl displacing direction, means for moving said pattern sheet to bring a perforation thereof into position to be engaged by said feeler and so to displace said stop member from intercepting position, and means for moving said slidable bar in said opposite direction and for holding said pawl out of operative position while said pattern sheet is moved and while said feeler is moved into engagement with said perforation.

5. In pattern change control mechanism for knitting machines wherein a pattern sheet having perforations is movable to bring said perforations to and from operative relation to a chain controlling feeler having a portion which engages and disengages said perforations, the combination of means for moving said pattern sheet, a rotatable sprocket, a pattern chain mounted on said sprocket, a reciprocable pawl carrier, a sprocket driving pawl pivoted thereon and adjustable into and out of position to drive said sprocket, means for reciprocating said pawl carrier, means for adjusting the position of said pawl including a slide bar biased toward one end position and movable to another end position and operatively connected to said pawl, means for moving said slide bar to said other end position to move said pawl out of sprocket actuating position, and means including a portion of said feeler for releasably intercepting said slide bar and preventing the same from moving into said first mentioned end position.

6. In pattern change control mechanism for knitting machines wherein a pattern sheet having perforations is movable in relation to a feeler having a portion which moves into and out of engagement with one or more of said perforations, the combination of spaced push bars, a link operatively engaging said feeler and including a portion having stop faces exposed in opposite directions, some toward one of said push bars and others toward the other push bar, those exposed in one direction being offset one from another and arranged and adapted to be engaged by one of said push bars and those exposed in the other direction being offset one from another and arranged and adapted to be engaged by the other of said push bars, said stop face portion of the link being movable with said feeler to bring different stop faces into and out of operative position simultaneously in relation to both said push bars, and means for moving said push bars simultaneously toward oppositely exposed stop faces of the link to move said link in the direction of movement of one of said push bars.

7. In pattern change control mechanism for knitting machines, the combination of a link having a stop portion provided with opposed sets of offset stop faces, opposed push bars each arranged and adapted to engage one of said sets of stop faces, means for actuating said push bars to move said link to and from different positions, and a link engaging feeler adjustably movable in a direction toward and from said link to effect the positioning of one or another of the faces of said stop portion thereof in the path of movement of said push bars.

8. In pattern change control mechanism for

knitting machines, the combination of a pattern chain, a pattern sheet having perforations, a plurality of feelers arranged and adapted to cooperate with perforations in said pattern sheet, a plurality of control links arranged and adapted to cooperate with said feelers, means movable in one direction to advance said pattern chain and in the opposite direction to advance said pattern sheet, means movable in one direction to bring said feelers into operative relation to said pattern sheet and in the opposite direction to move said feelers out of operative relation to said pattern sheet, means movable in one direction to disengage said control links and in the opposite direction to engage and move said control links, a shaft, and cam means mounted thereon for actuating said several means movable in opposite directions.

9. In pattern change control mechanism for knitting machines, the combination of a control link, a pair of link actuating push bars, and means movable in one direction to move said push bars away from each other, and in the opposite direction to move said push bars toward each other and into operating engagement with said control link.

10. In pattern change control mechanism for knitting machines wherein actuation of devices for effecting various functions such as fashioning, decking, racking, etc. is controlled by different rotatable control shafts, the combination of a link operatively connected to rotate each of said shafts and having a plurality of offset stop faces, a feeler having one portion arranged and adapted to engage and support a portion of each of said links and another portion presenting a plurality of feeler pins, a pattern supporting drum having holes disposed opposite said feeler pins, a pattern band mounted to engage said drum and having perforations in register with said holes and interposed between said holes and said feeler pins, means for moving said pattern band to bring perforations thereof opposite said pins, means engaging said feelers to hold the pins thereof out of contact with the pattern band during movement thereof, means for releasing said feelers to positions whereby pins thereof engage perforations in said band and enter corresponding holes in said drum to vary the angular position of the stop face portions of said links, a pair of opposed push bars arranged and adapted to engage said stop faces, and means for reciprocating said push bars toward and from each other to impart endwise movement to said links and thereby to rotate said control shafts to different control positions depending on which of said stop faces thereof are so engaged by said push bars.

11. In pattern change control mechanism for knitting machines wherein a pattern band having perforations is mounted on a support which is rotatable to bring perforations of said band into and out of operative relation to a feeler mounted to be moved toward and from said pattern band to engage and disengage perforations therein; and a pattern chain is controllably actuated from said pattern band and said feeler, and rotation of the pattern band support is controlled from the pattern chain, the combination of a reciprocable pawl carrier, pattern chain controlled means thereon arranged and adapted to rotate said pattern band support when said pawl carrier is moved in one direction, a pawl pivoted on said reciprocable carrier and biased toward operative position to actuate said pattern chain when said pawl carrier is moved in the opposite direc-

tion, a rockable lever movable in one direction to swing said pawl to inoperative position, a latch bar operatively related to said feeler and adapted, when in retracted position, to releasably hold said rockable lever in inoperative position, means for moving said latch bar to retracted position, and means for moving said feeler away from said pattern band and into position to retain said latch bar in pawl releasing position.

12. In pattern change control mechanism for knitting machines wherein a pattern sheet having perforations is movable to bring said perforations to and from operative relation to a chain controlling feeler having a portion which engages and disengages said perforations, the combination of a pattern chain, a reciprocable carrier, means adjustably mounted on said carrier for actuating said chain when the carrier is moved in one direction, means operatively connected with said feeler to adjust said chain actuating means into and out of operative position, means adjustably mounted on said carrier to move the pattern sheet in one direction, other means adjustably mounted on said carrier to move the pattern sheet in the opposite direction, and means operatively connected to said chain and cooperating with one of said pattern sheet moving means to adjust the latter into and out of position to move said pattern sheet.

13. In pattern change control mechanism for knitting machines wherein a pattern sheet having perforations is movable to bring said perforations to and from operative relation to a chain controlling feeler having a portion which engages and disengages said perforations, the combination of a pattern chain, a reciprocable carrier, means adjustably mounted on said carrier for actuating said chain when the carrier is moved in one direction, means operatively connected with said chain controlling feeler to adjust said chain actuating means into and out of operative position, means adjustably mounted on said carrier and operative when the latter is moved in the opposite direction from said chain adjusting motion to move the pattern sheet in one direction, other means adjustably mounted on said carrier to move the pattern sheet in the opposite direction, and means operatively connected to said chain and cooperating with one of said pattern sheet moving means to adjust the latter into and out of different positions to impart movements of different extent to said pattern sheet.

14. In pattern change control mechanism for knitting machines wherein a pattern having perforations is movable to bring said perforations to and from operative relation to a chain controlling feeler having a portion which engages and disengages said perforations, the combination of a rotatable pattern chain support, a pattern chain thereon, a reciprocable carrier, means adjustably mounted on said carrier for actuating said support when the carrier is moved in one direction, means operatively connected with said feeler to adjust said support actuating means into and out of operative position, means adjustably mounted on said carrier to move said pattern sheet in one direction, other means adjustably mounted on said carrier to move said pattern sheet in the opposite direction, and means operatively connected to said chain and cooperating with one of said pattern sheet moving means to adjust the latter into and out of position to move said pattern sheet.

15. In pattern change control mechanism for

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knitting machines wherein a pattern sheet having perforations is movable to bring said perforations to and from operative relation to a chain controlling feeler having a portion which engages and disengages said perforations, the combination of a rotatable pattern chain support, a pattern chain thereon, a reciprocable carrier, means adjustably mounted on said carrier for actuating said support when the carrier is moved in one direction, means operatively connected with said feeler to adjust said support actuating means into and out of operative position, means adjustably mounted on said carrier to move the pattern sheet in one direction, other means adjustably mounted on said carrier to move the pattern sheet in the opposite direction, and means operatively connected to said chain and cooperating with one of said pattern sheet moving means to adjust the latter into and out of different positions to impart movement of different extent to said pattern sheet.

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