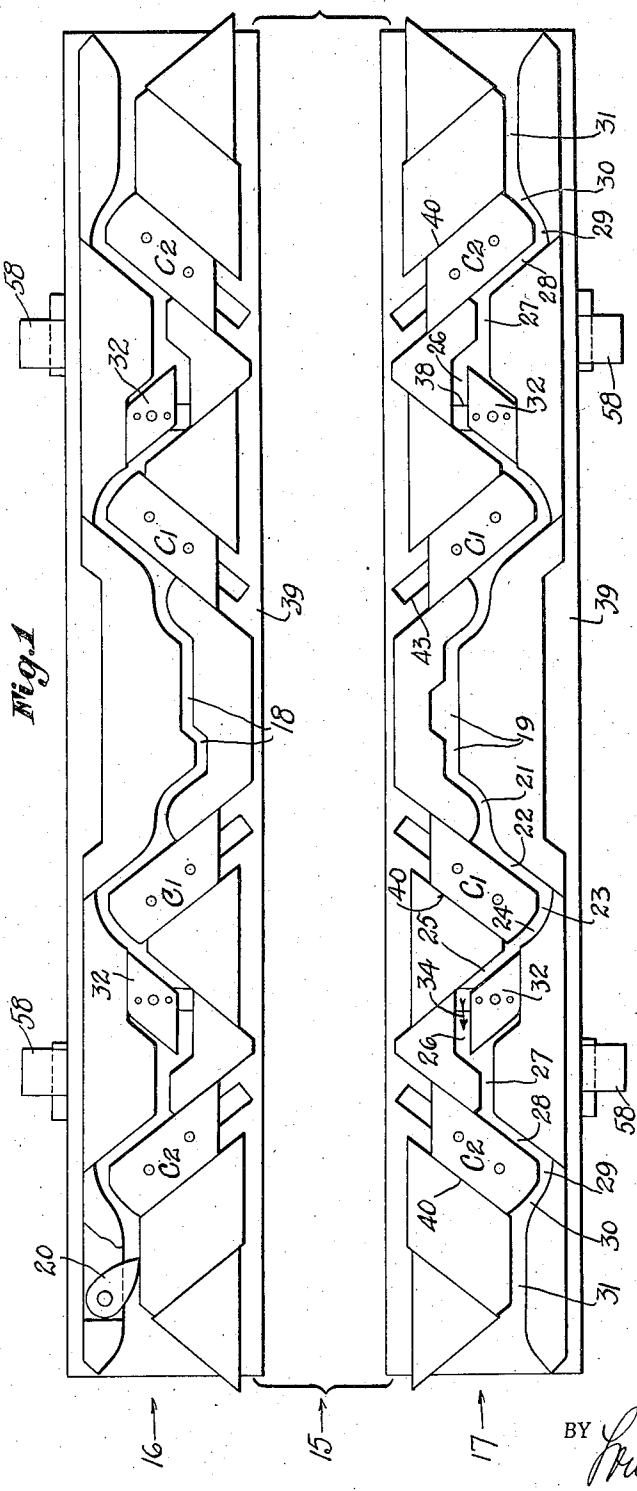
Dec. 13, 1938. F. J. KERN 2,139,756

SINGLE AND DOUBLE CAST-OFF KNITTING MACHINE

Filed March 11, 1938 2 Sheets-Sheet 1



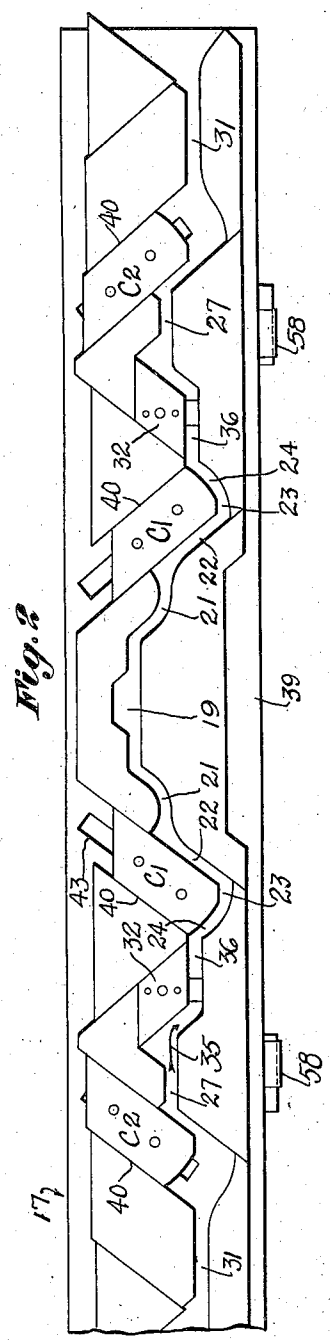


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Fig. 3

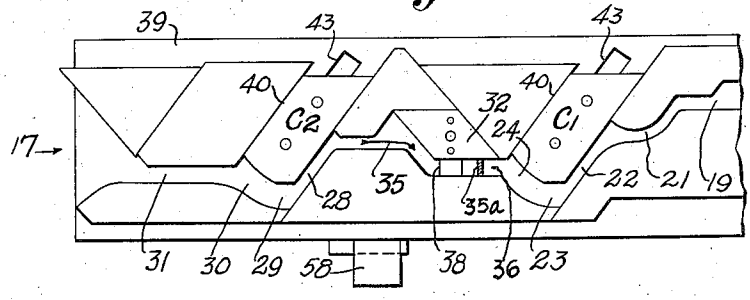


Fig. 4

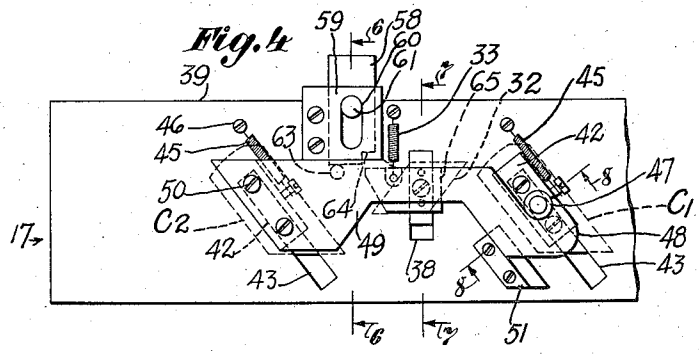


Fig. 6

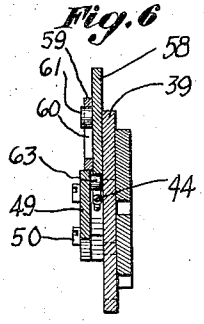


Fig. 5

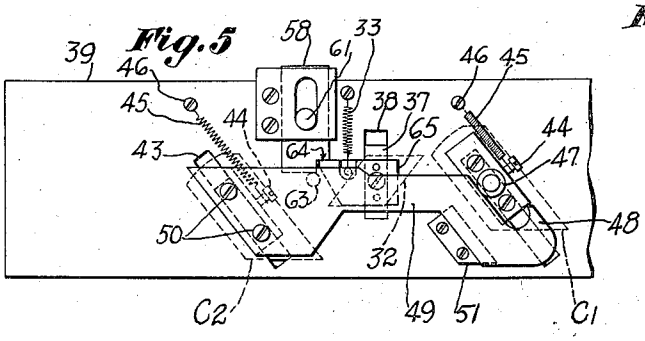


Fig. 7

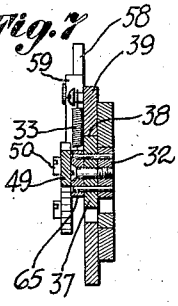


Fig. 8

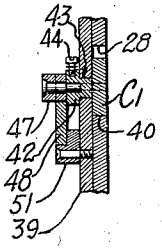
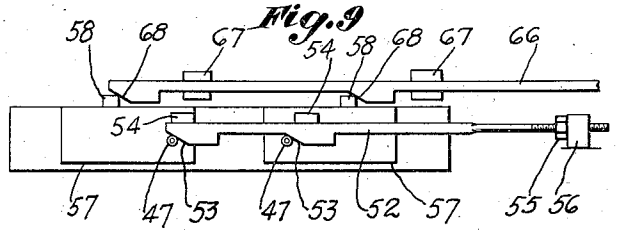


Fig. 9



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UNITED STATES PATENT OFFICE

2,139,756

SINGLE AND DOUBLE CAST-OFF KNITTING MACHINE

Frank J. Kern, Brooklyn, N. Y.

Application March 11, 1938, Serial No. 195,212

17 Claims. (Cl. 66—63)

This invention relates to knitting machines of the double bed type having a row of double hooked needles reciprocable between the beds by jacks actuated by cams that reciprocate along the beds.

One object of the invention is to provide such a knitting machine having improved means for causing a single or double yarn loop cast-off by the needles, as desired, with the use of only a single head and a single jacquard for each row of jacks.

To endeavor to accomplish such results by the use of a double cam carrying head is not feasible. This would require eight latch openers for the needles as against four latch openers for a single head. In knitting machines, a minimum of latch openers is desirable because they are a primary cause of breakage of the needles. Moreover, in the double head, no unitary cam adjustments for the size of the yarn loops are available nor can movement or adjustment of the cams be accomplished with the high degree of accuracy required for knitting machines. Of course the cams are different in double as compared with the single head. In any event, the double head is not a practical means for obtaining the single and double cast-offs.

By providing a double cast-off for each run of the knitting machine, the speed of knitting is doubled as compared with the use of a single cast-off. But in all knitted goods, it is necessary to knit certain patterns. With a double cast-off machine, these patterns may be produced only of length or other dimension double that required, the pattern being so small that it can be produced only on a single cast-off machine. Hence it is desirable to be able to switch the machine from the single to the double cast-off and vice versa, using the single cast-off where a pattern is being knitted, and the double cast-off where the fabric is being knitted plain at the high speed.

To accomplish these results, there is a knitting machine having a double head, and eight latch openers, and operative only with the double cast-off, but having two jacquards for each row of jacks so as to more flexibly operate the jacks to transfer some of the needles from one bed to another, to thus produce any desired patterns. But this machine is exceedingly complicated and expensive and hence cannot fulfill the need for a knitting machine having a single head and only one jacquard for each row of jacks, and being in general like the ordinary single cast-off machine in construction.

It is therefore an object of the invention to provide a knitting machine which shall fulfill the objects and advantages referred to and avoid the drawbacks mentioned.

Another object of the invention is to furnish a knitting machine having improved means for instantly setting the same accurately for single or double cast-off, and for additionally setting the cams thereof to vary the sizes of the yarn loops irrespective whether the machine be changed from one kind of cast-off to another.

A further object of the invention is the provision of an improved knitting machine as described, which is inexpensive to make and assemble, durable, reliable and efficient to a high degree in use.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in view, the invention consists in the novel combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated in the annexed drawings, wherein like parts are designated by the same reference characters throughout the several views.

In the drawings:

Figure 1 is a bottom plan view showing a single head embodying the invention with the cams set for a double cast-off.

Fig. 2 is a similar view of one section of said head with the cams set for the single cast-off.

Fig. 3 is a similar fragmentary view showing the cast-off cams in a different position of adjustment relative to the position of Fig. 1.

Fig. 4 is a top plan view of the portion shown in Fig. 3, showing the setting and adjusting mechanism.

Fig. 5 is a similar view showing the mechanism actuated to move one of the cast-off cams into inoperative position.

Figs. 6, 7 and 8 are sectional views taken on lines 6—6 and 7—7 and 8—8, respectively, of Fig. 4.

Fig. 9 is a diagrammatic plan view showing the means for adjusting and setting all the cams of one section of the head.

The advantages of the invention as here outlined are best realized when all of its features and instrumentalities are combined in one and the same structure, but, useful devices may be produced embodying less than the whole.

It will be obvious to those skilled in the art to which the invention appertains, that the same

may be incorporated in several different constructions. The accompanying drawings, therefore, are submitted merely as showing the preferred exemplification of the invention.

Referring in detail to the drawings, a knitting machine is mentioned herein having two beds, a row of jacks in each bed, a jacquard for the rear row of jacks, and a row of double hooked needles reciprocatory from one bed to the other under actuation of the transversely reciprocating jacks that are operated by a head sliding to and fro along the beds and having cams engaging the jacks, all according to conventional practice. In the present invention, the head **15** comprises a pair of sections **16, 17** which are generally similar to each other except for minor details that are immaterial to the invention. A description of one head section will therefore apply to the other, except as otherwise stated. It is noted that the cams are built up of pieces, but this is unimportant to the invention, the significant part of the cam structure being the cam grooves and certain movable and settable cam pieces.

Near the center of the head sections **16, 17** are provided the respective cam grooves **18, 19** at which the needles are transferred from engagement with the jacks at one bed to engagement with the jacks of the other bed, in the usual manner. At one end of the head is provided an oscillatable shifting cam **20** movable into and out of the adjacent cam groove for causing shifting of the jacks, in a conventional manner.

It is unnecessary to describe the details of construction and operation of the parts of the machine above referred to because they represent standard practice, and because the invention can be understood without more detailed discussion.

Immediately at the opposite ends of the usual cam grooves **18, 19** are the grooves **21** at which the jacks cause the needles to receive the yarn in the hooks thereof. From the grooves **21** extend the cam grooves **22** which slope at equal angles toward each other toward the center of the machine and in which the jacks cause the needles to begin to cast off the loops provided that the relative travel between the cam and the jacks is such that the jacks are moved away from the center of the machine. By the center of the machine is meant the area between the beds thereof. The casting off operation is completed by jacks at the cam grooves **23** which lead into the cam grooves **24, 25**. In the conventional single cast-off knitting machines, the cam grooves **25** represented the point of entry and also of disengagement of the jacks relative to the head, except that certain additional entrance and outlet guide grooves were provided, including the oscillatory cam **20**, where required.

From the cam grooves **25**, according to my invention, extend the grooves **26** which lead to the grooves **27** at which the jacks cause the needles to again lay in yarn. The latter grooves in turn lead to the cam grooves **28** at which the jacks cause the needles to again cast-off the yarn loops, the casting off being completed at the grooves **29**. From the latter extend the inlet-outlet grooves **30, 31**.

It will be perceived that when the head **15** is set for the double cast-off as shown in Fig. 1, the operation at the series of cam grooves **21, 22, 23** is exactly like that at the series of cam grooves **27, 28** and **29**, and the shape and location of the one series may be exactly like that of the other series of cam grooves.

Adjustment is sometimes desirable for the size or tightness of the yarn loops which is in general controlled by the cam grooves **23, 24** and **29, 30**. As shown in Fig. 3, the inner edges of these cam grooves are moved inward toward the center of the machine, causing a reduced length of travel of the jacks so that shorter or tighter loops are formed, whereas with the setting according to Fig. 1, the loops are made relatively long. The means by which this is accomplished will be described hereinafter.

Each series of cam grooves at the opposite ends of the center grooves **18, 19** may, if desired, be provided with a movable cam portion **32**, each of which is independently spring actuated by its individual tension coil spring **33**, see Figs. 6 and 7, to occupy the positions shown in Fig. 1. These cam portions permit relative travel of the jacks in the direction indicated by arrow **34**; but when the relative direction of travel is as indicated by the arrow **35**, the cam portion **32** is pushed inward by the jack follower portion **35a** against the tension of the spring **33** as shown in Fig. 3. In other words, when the head is traveling toward the left, the left cam portion **32** is moved inward, and when the head is traveling toward the right, the right cam portion **32** is moved inward. This results in the formation of a cam groove **36** leading from the groove **27** directly to the groove **24**. It will be understood that no cast-off occurs at that series of cams at which the cam portion **32** is thus moved inward. In other words, the cams at the right end of the head cause the cast-off when the head is traveling toward the left, and vice versa. The reason for moving the cams **32** inward according to Figs. 2 and 3 is to avoid movement of the jacks toward the center of the machine with the consequent possibility that the yarn may be thrown from the needle hooks or latches.

For mounting the cam portion **32**, the same may have affixed thereto a strip member **37** movable along a guide slot **38** in a plate **39** of the head section, the tension coil spring **33** being connected at one end to said strip **37** and at its other end to the base plate **39**.

The setting and adjusting movement of the cam means will now be described. For convenience C1 will denote the first cast-off cam, and C2 the second cast-off cam, there being such cams at each end of the center cams **18, 19**, for each head section. These cams C1, C2 are movable in parallel relation to each other. The cam C1 is movable only for loop adjustment as shown in Fig. 3. The cam C2 is movable for such loop adjustment as in Fig. 3 and also to inoperative position as shown in Fig. 2, so that no cast-off will occur at this cam. In other words, the machine will then cause only a single cast off for each run or course of the head. When in inoperative position, the cam C2 must have moved sufficiently far inward to aline with the inner edge of the cam groove **36** so as to avoid strain on the yarn, the stitch having already been formed at the cam C1. In that case, the cams **32** are moved into and maintained in inoperative position as shown in Fig. 2.

Desirably the cams C1, C2 are movable in guide grooves **40** provided therefor on the base plate **39**. For mounting these cams, the strip or rail elements **42** may be suitably affixed thereto for movement in the slots **43** formed in the base plate **39**. Connected to each element **42** at **44** is a tension coil spring **45** secured at its other end to the base plate **39** at **46**. Hence the action is such that the springs **45** tend to individually

move the cams C1 and C2 away from the center of the machine, to keep them in the position shown in Fig. 1.

For the cam C1, a block 47 may be secured to its rail or guide element 42 so as to be adapted to engage the arm 48 of an actuator 49 to which the guide element 42 of the cam C2 is affixed as by the screws 50. In other words, the actuator 49 moves in the direction of movement of the cam C2, and additional guiding action for the actuator 49 may be provided by the guide element or angle strip 51 that is affixed to the plate 39. It will now be perceived that if the member 47 is moved by any suitable means hereinafter mentioned, it will move the abutting arm 48 of the actuator 49, according to Fig. 4, and cause the latter to correspondingly move the cam C2. Thus accuracy is assured in that both cams C1, C2 will be adjusted exactly alike as shown in Fig. 3, to adjust the size of the loops formed by the needles. As shown in Fig. 9, a bar 52 may have cam portions 53 for simultaneously equally moving both of the members 47, the bar 52 being guided as at 54 for accurate movement and being controlled as by a nut 55 on a threaded portion of the bar, said nut abutting any fixed part 56. In Fig. 9, the series of cams, including cams C1 and C2 is schematically shown at 57.

In order to move cam C2 to inoperative position, a slide member 58 is guidingly mounted in a casing 59 secured to the plate 39, the limits of motion of the slide member being determined as by a slot 60 in the casing receiving a pin 61 of the slide member. To permit the slide 58 to operate the actuator 49, the latter may have a pin 63 affixed thereto and lying in the path of the slide 58. Since the travel of the cam 32 is less than that of the cams C1 and C2, the slide 58 is undercut at 64 to abut a plate 65 that is affixed to the cam 32, and to which the spring 33 is connected. It will thus be apparent that on moving the slide 58 from the position of Fig. 4 to that of Fig. 5, the slide causes movement of the cams C2 and 32 against the tension of their respective springs 45 and 33, the actuator 49 being moved first and being thereafter accompanied by movement of the cam 32. Upon release of the slide 58, the same and the actuator 49 and the cams referred to are returned to initial position by the several springs.

For actuating both cam series 57 simultaneously and equally, a bar 66 guided at 67 may have cams 68 for pushing against the individual slides 58 of the cam means 57 upon longitudinal motion of said bar as in the case of the bar 52.

It will now be seen that the cams C1, C2 may be adjusted by the bar 52 for loop size and that the adjusting means is not interfered with by the means for setting cam C2 in inoperative position.

Likewise, it will be noted that cam C2 can be set in inoperative position, and vice versa without affecting the adjustment of the cams C1, C2 by the bar 52.

Further, it will be observed that cam 32 is moved into inoperative and operative positions together with the cam C2, and when cam 32 is in operative position, its momentary movement to inoperative position, as shown in Fig. 3, is not impeded by its control mechanism.

I claim:

1. A knitting machine comprising two series of needle controlling jacks and cam means for actuating each of said series of jacks, each cam means including means for controlling engagement and disengagement of the jacks in course of the travel thereof, each controlling means including a single transfer cam, and a pair of movable cast-off cams adjacent each end of said controlling means arranged so that one or the other of said pairs of cams actuates the jacks to cause the needles to cast off yarn loops according as the jacks are traveling in respectively one or an opposite direction, one pair of cams being inclined oppositely to the other pair of cams, an intermediate cam portion between the cams of each pair, movable to cause a different path of the jacks when the latter pass in noncast-off direction relative to a pair of cams, and means to move one cam of each of said pairs of cams to a position inoperative for causing the cast-off actuation of the jacks.

2. A knitting machine according to claim 1, including means independent of the last mentioned means for setting both pairs of cams to vary the path of the jacks to cause the latter to actuate the needles so as to adjust the size of the yarn loops formed, whereby one or both of a pair of cams can be set to loop adjusting position according as one or both of a pair of cams are in cast-off causing position.

3. A device including a double bed knitting machine of the type having a single series of double hooked needles reciprocable between the beds, a longitudinal series of jacks for each bed movable therealong, each bed having a transfer cam at which the jacks engage and release the needles, a pair of cams along the bed adjacent to each end of the transfer cam, the cams of each pair being alike and being generally at right angles relative to the cams of the other pair, one cam of each pair being movable to operative and inoperative position to actuate the jacks to cause the needles to cast off yarn loops according as the jacks travel in a predetermined direction relative to a pair of cams, both cams of each pair being settable to vary the path of the jacks to actuate the needles to control the size of the yarn loops, and means for moving one of each pair of cams to inoperative position, including means for equally setting one or both cams of each pair according as one or both of each pair of cams are in operative position.

4. In a knitting machine of the type having double hooked needles reciprocable between two beds having jacks for actuating the needles, the combination with a first cast-off cam, of a second cast-off cam, said cams being adjustable, the second cam being movable to inoperative position, an intermediate guide cam between said cams, the intermediate cam being movable to inoperative position, and means for adjusting the first and second cams equally and for moving the second cam and the intermediate cam to inoperative position without affecting the adjustment of the first cam.

5. In a knitting machine of the type having double hooked needles reciprocable between two beds having jacks for actuating the needles, the combination with a first cast-off cam, of a second cast-off cam, said cams being adjustable, the second cam being movable to inoperative position, an intermediate guide cam between said cams, the intermediate cam being movable to inoperative position, the intermediate cam being automatically yieldingly movable to operative position and being movable by a jack to inoperative position, and means for adjusting the first and second cams equally and for moving the second cam and the intermediate cam to inoperative po-

sition without affecting the adjustment of the first cam, said means cooperating with the intermediate cam to permit the same to be automatically-and-jack-operated as stated in the operative position of the intermediate cam, and said means coacting with the second cam to maintain it in the said position of adjustment upon return of the second cam to operative position.

6. In a knitting machine of the type having double hooked needles reciprocable between two beds having jacks for actuating the needles, the combination with a first cast-off cam, of a second cast-off cam, said cams being adjustable, the second cam being movable to inoperative position, an intermediate guide cam between said cams, the intermediate cam being movable to inoperative position, the intermediate cam being automatically yieldingly movable to operative position and being movable by a jack to inoperative position, a setting means for moving the second cam to operative and inoperative positions, said setting means releasably coacting with the intermediate cam to move the same to inoperative position, an adjusting means coacting with the first cam and releasably with the setting means and being movable in one direction to adjust the first cam together with the second cam, the setting means being movable in said direction beyond the adjusting position to move the second and intermediate cams to inoperative position without affecting the adjusting means, the setting means being movable in opposite direction to the position of adjustment of the adjusting means.

7. In a knitting machine of the type having double hooked needles reciprocable between two beds having jacks for actuating the needles, the combination with a first cast-off cam, of a second cast-off cam, said cams being adjustable, the second cam being movable to inoperative position, an intermediate guide cam between said cams, the intermediate cam being movable to inoperative position, the intermediate cam being automatically yieldingly movable to operative position and being movable by a jack to inoperative position, a setting means fixedly connected to the second cam for moving the same to inoperative position, a spring for moving the second cam to operative position, an actuator for moving the setting means and the intermediate cam different distances to their respective inoperative positions, the intermediate cam being releasably engageable with the actuator so as to be movable to inoperative position independently of the actuator, an adjusting means for adjusting the first cam and for releasably engaging the setting means to move the second cam to adjusted position against the tension of said spring, another spring tending to oppose the adjusting movement of the first cam, said setting means being movable beyond the adjusted position to move the second cam to inoperative position.

8. In a knitting machine of the type having a row of double hooked needles movable between two beds of jacks along which is movable a single cam head for the beds, having a needle transfer cam and a cast-off cam, the combination with the first cast-off cam of a second cast-off cam parallel to the first cast-off cam, the first and second cast-off cams being adjustable to adjust the yarn loops, the second cast-off cam being movable to inoperative position, a setting means for moving the second cam to operative and inoperative positions, an adjusting means movable in one direction to adjust the first cam, the adjusting means releasably coacting with the second cam to adjust the latter together with the first cam, the setting means being movable in said direction beyond the adjusting position of the adjusting means to move the second cam to inoperative position without affecting the adjustment of the first cam, the setting means being movable in opposite direction to the position of adjustment of the adjusting means whereby the latter adjusts the second cam upon return of the second cam to its operative position.

9. In a knitting machine of the type having a row of double hooked needles movable between two beds of jacks along which is reciprocable a single cam head for the beds, having a single needle transfer cam and a cast-off cam, the combination with the single transfer cam and the first cast-off cam of a second cast-off cam parallel to the first cast-off cam, both cast-off cams being at one side of the transfer cam, the second cast-off cam being movable to inoperative position, and means for moving the second cast-off cam between operative and inoperative positions.

10. In a knitting machine of the type having a row of double hooked needles movable between two beds of jacks along which is reciprocable a cam head for the jacks, the combination of a single reciprocable head having a single jack transfer cam, and a pair of cast-off cams at each end of the transfer cam, the cams of each pair being generally parallel for successive like cast-offs.

11. In a knitting machine of the type having a row of double hooked needles movable between two beds of jacks along which is movable a single cam head for the beds, having a needle transfer cam and a cast-off cam, the combination with the first cast-off cam of a second cast-off cam parallel to the first cast-off cam, the second cast-off cam being movable to inoperative position, means for moving the second cast-off cam between operative and inoperative positions, a movable cam intermediate of the first and second cams, said intermediate cam having operative and inoperative positions to cause the jacks to follow different cam paths, means for yieldingly urging the intermediate cams to operative position, and means releasably acting between the intermediate cam and the first mentioned means to cause the latter to move the intermediate cam to inoperative position together with the second cam, said intermediate cam in the operative position thereof being momentarily movable by a passing jack to inoperative position without affecting the first mentioned means.

12. In a knitting machine of the type having a row of double hooked needles movable between two beds of jacks along which is reciprocable a cam head for the jacks, the combination of a single reciprocable head having a single jack transfer cam, and a pair of cast-off cams at each end of the transfer cam, the cams of each pair being generally parallel for successive like cast-offs, intermediate cams between the cast-off cams of each pair movable to inoperative position, and means for equally setting said cast-off cams as a unit to vary the path of the jacks for controlling the size of the yarn loops.

13. In a knitting machine of the type having a row of double hooked needles movable between two beds of jacks along which is reciprocable a single cam head for the beds, having a single needle transfer cam and a cast-off cam, the combination with the single transfer cam and the

first cast-off cam of a second cast-off cam parallel to the first cast-off cam, both cast-off cams being at one side of the transfer cam, the second cast-off cam being movable to inoperative position, and means for adjusting the cast-off cams equally and for holding the second cast-off cam in inoperative position without affecting the said adjustment, so that the inoperatively positioned cam is in adjusted position upon being returned to operative position.

14. A knitting machine comprising two series of needle controlling jacks and cam means for actuating each of said series of jacks, each cam means including means for controlling engagement and disengagement of the jacks in course of the travel thereof, each controlling means including a single transfer cam, and a pair of castoff cams adjacent each end of said controlling means arranged so that one or the other of said pairs of cams actuates the jacks to cause the needles to cast off yarn loops according as the jacks are traveling in respectively one or an opposite direction, one pair of cams being inclined oppositely to the other pair of cams, and an intermediate cam portion between the cams of each pair, movable to cause a different path of the jacks when the latter pass in noncast-off direction relative to a pair of cams.

15. A knitting machine comprising two series of needle controlling jacks and cam means for actuating each of said series of jacks, each cam means including means for controlling engagement and disengagement of the jacks in course of the travel thereof, each controlling means including a single transfer cam, and a pair of cast-off cams adjacent each end of said controlling means arranged so that one or the other of said pairs of cams actuates the jacks to cause the needles to cast off yarn loops according as the jacks are traveling in respectively one or an opposite direction, one pair of cams being inclined oppositely to the other pair of cams, and an intermediate cam portion between the cams of each pair, movable to cause a different path of the jacks when the latter pass in noncast-off direction relative to a pair of cams, and like cams of each pair of cast-off cams being movable to inoperative position.

16. In a knitting machine of the type having a row of double hooked needles movable between two beds of jacks along which is movable a single cam head for the jacks, the combination of a single transfer cam and a pair of parallel cast-off cams at each side of the transfer cams, one pair of cast-off cams being at an angle to the other pair of cast-off cams, a first cast-off cam of each pair nearest to the transfer cam being relatively permanently fixed, and the second cast-off cam of each pair being movable to inoperative position.

17. In a knitting machine of the type having a row of double hooked needles movable between two beds of jacks along which is movable a single cam head for the jacks, the combination of a single transfer cam and a pair of parallel cast-off cams at each side of the transfer cams, one pair of cast-off cams being at an angle to the other pair of cast-off cams, a first cast-off cam of each pair nearest to the transfer cam being relatively permanently fixed, and the second cast-off cam of each pair being movable to inoperative position, and an intermediate cam between the cams of each pair of cast-off cams, said intermediate cams being movable to and retained in inoperative position together with the second cast-off cams, and said intermediate cams being movable to and fro between operative and inoperative positions when the second cast-off cams are in operative position, said to and fro movement of the intermediate cams being in accordance with the direction of movement of the cam head.

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