

**Sept. 26, 1933.**

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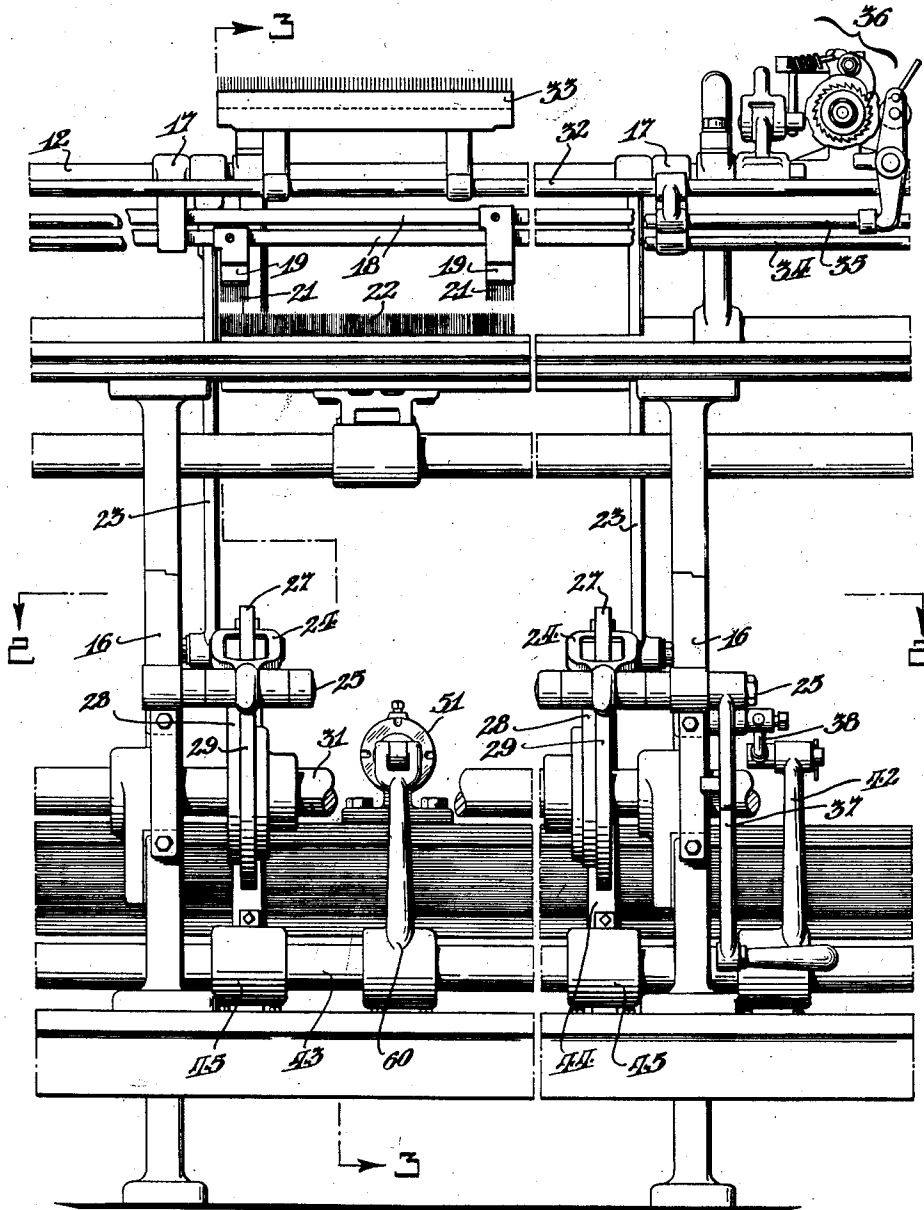
**1,928,283**

## STRAIGHT KNITTING MACHINE

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4 Sheets-Sheet 1

FIG-1-



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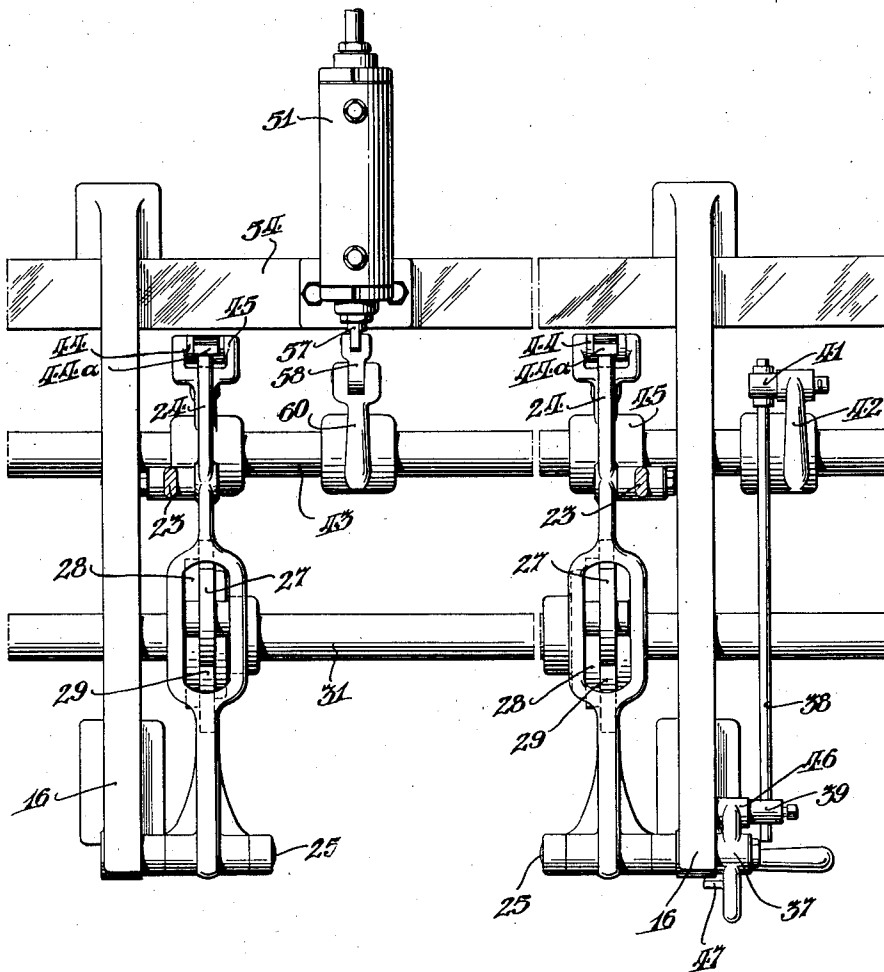
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STRAIGHT KNITTING MACHINE

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4 Sheets-Sheet 2

FIG. 2.



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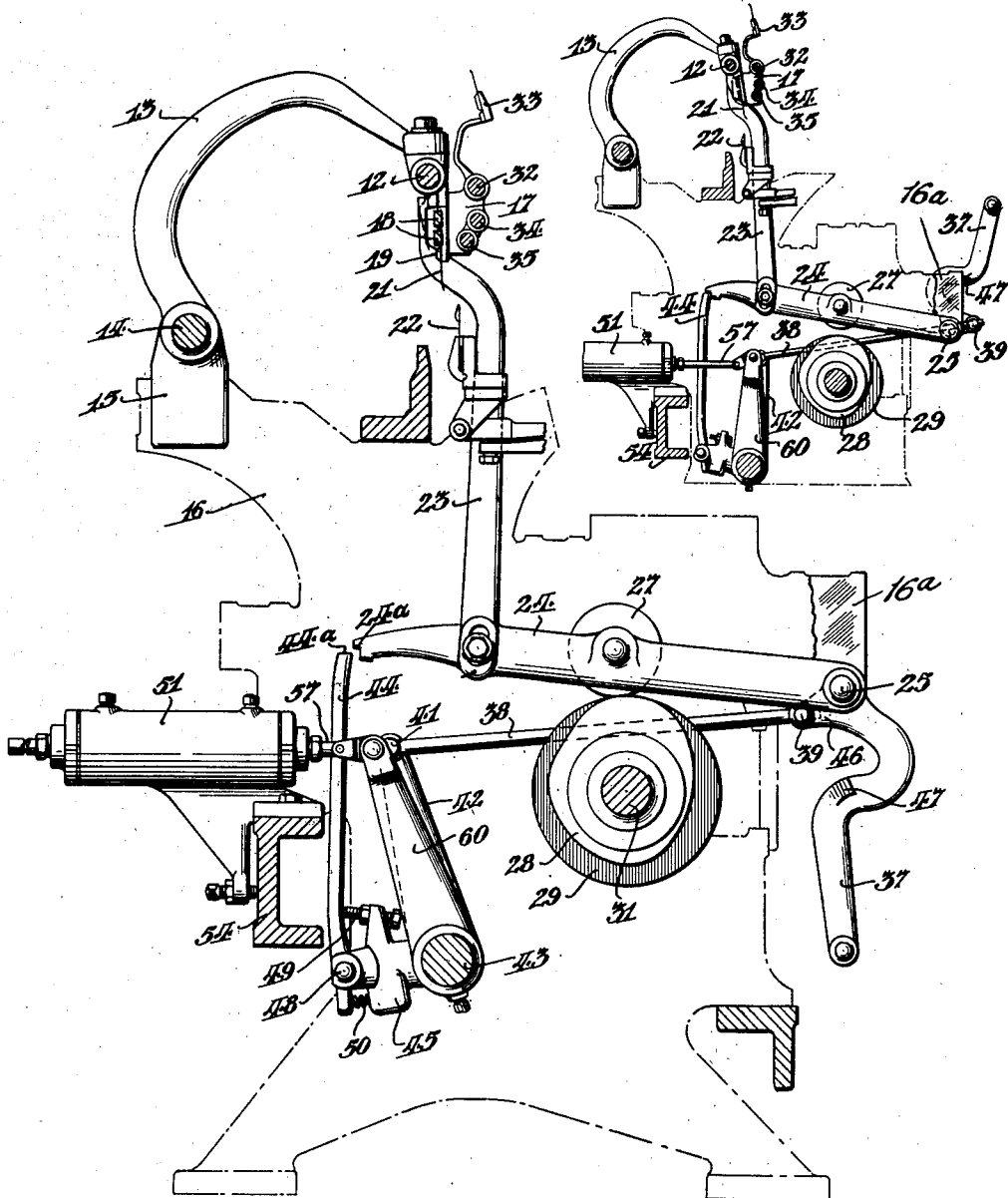
STRAIGHT KNITTING MACHINE

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4 Sheets-Sheet 3

FIG. 3.

FIG. 4.



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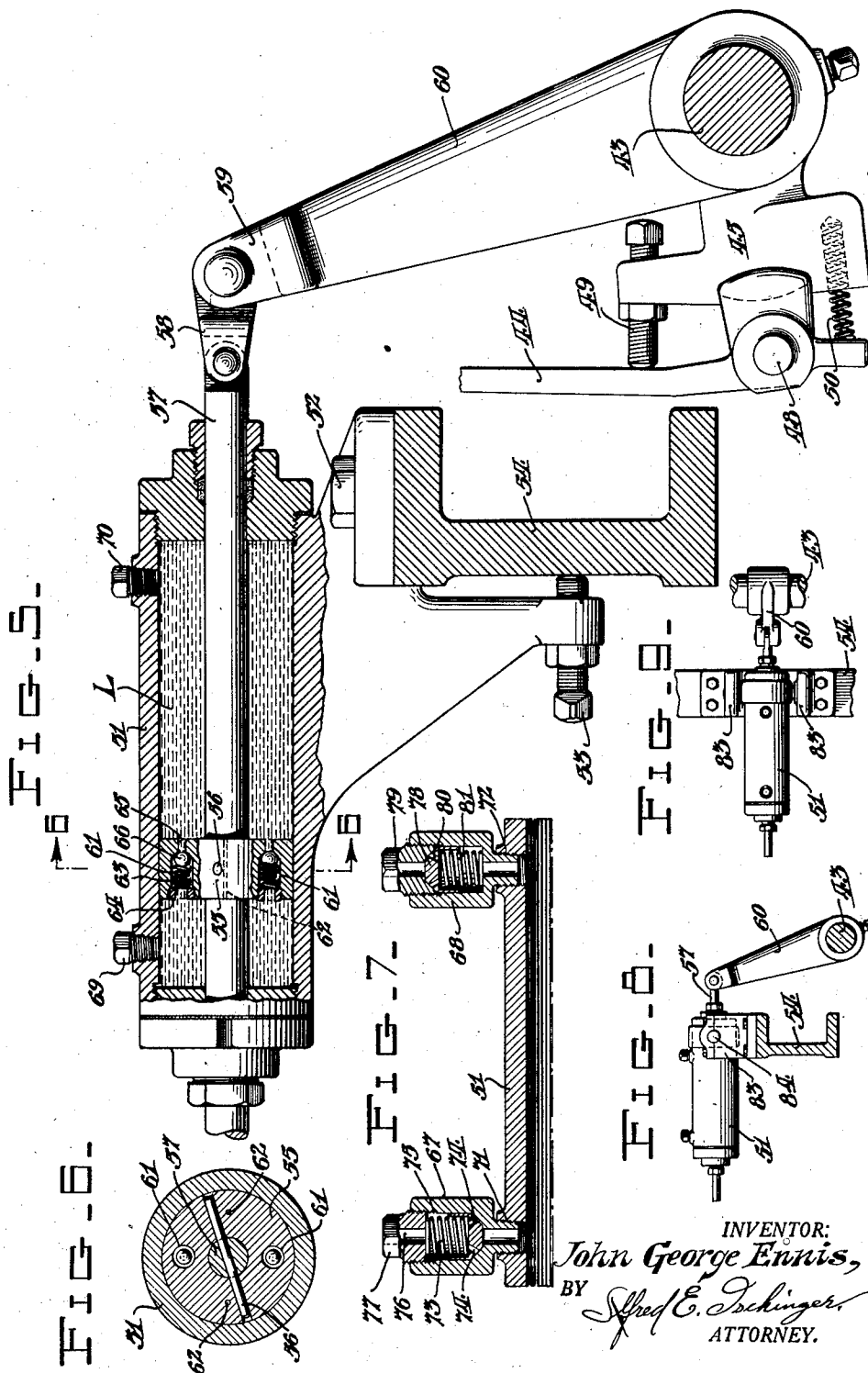
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STRAIGHT KNITTING MACHINE

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4 Sheets-Sheet 4



## UNITED STATES PATENT OFFICE

1,928,283

## STRAIGHT KNITTING MACHINE

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Application March 2, 1933. Serial No. 659,325

10 Claims. (Cl. 66—89)

This invention relates to straight knitting machines, such as those employed in the manufacture of full fashioned hosiery, and more particularly to the narrowing mechanism thereof.

In the operation of full fashioned knitting machines, particularly stocking machines, it is necessary in knitting various courses of the fabric to shift or transfer loops from certain needles to adjacent needles in the row of needles, thereby to narrow or decrease the width of the stocking blank in order to fashion the same. The narrowing motion of a full fashioned knitting machine includes a narrowing machine which carries the narrowing combs or fingers, and which imparts the necessary vertical movement to the narrowing combs and the points carried thereby, causing them to dip down and lift certain loops from the stems of the needles and replace them on adjacent needles. This vertical movement is furnished by cams mounted on the main cam shaft acting through associated cam follower and lever assemblies operatively connected at each knitting section to the narrowing machine. At various times, as when the narrowing machine is not in use, or during certain knitting operations, for example, during the welt turning operation, the narrowing machine is lifted by means of a hand lever or equivalent lifting device from its normal operating position to an elevated position so that it clears the narrowing combs and points from the needles and prevents possibility of injury to the narrowing points which might otherwise be caused by the welt bar.

The full fashioned knitting machine of today is called upon to perform an increased number of intricate operations, and is ordinarily fitted with a narrowing machine having attachments for producing lace, non-run, and other special fabrics, in addition to the usual narrowing mechanism, so that the machine is both heavy and extremely delicate in its adjustments. When the narrowing machine is raised from its normal operating position by means of the hand lever or other lifting device above referred to, the increased number of point combs and bars on the narrowing machine necessitates the exercise of extreme care when lowering the machine to its normal operating position. If, due to slipping of the lifting lever from the hand of the operator, or for any other reason, the machine is permitted or caused to suddenly drop it may become misaligned and cause serious damage to the transfer points and the various attachments carried by the machine, thus requiring frequent shutdowns

for adjustment or repairs, and seriously curtailing the output of the machine.

An object of the invention is to provide safety release mechanism for causing the narrowing machine automatically to be lowered from an elevated position at a predetermined rate into its normal operating position.

Another object is the provision of safety release mechanism, effective upon release of the narrowing machine lifting device, either through accident or design, for preventing the narrowing machine from dropping at a rate which would cause injury to the machine or its associated mechanism.

Another object of the invention is to provide a safety release device of the character described which is simple in construction and fool-proof in operation, and which may readily be attached to existing installations.

With these and other objects in view, which will become apparent from the following detailed description of the illustrative embodiments of the invention shown in the accompanying drawings, my invention resides in the novel elements of construction, mechanism and combination of parts in cooperative relationship, as hereinafter more particularly pointed out in the claims.

In the drawings:

Fig. 1 is a partial front elevational view of a full fashioned knitting machine embodying safety release mechanism in accordance with the invention;

Fig. 2 is a plan view taken along the line 2—2 of Fig. 1;

Fig. 3 is a vertical cross-sectional view, taken along the line 3—3 of Fig. 1, showing the narrowing machine in its normal operating position;

Fig. 4 is a view of the mechanism of Fig. 3, showing the narrowing machine in raised position;

Fig. 5 is a longitudinal sectional view of certain elements employed in one form of the safety release mechanism;

Fig. 6 is an enlarged cross-sectional view taken along the line 6—6 of Fig. 5;

Fig. 7 is a detailed view of valve structure adapted for use in a modification;

Figs. 8 and 9 show a modified form of support means for certain elements of the mechanism.

Referring particularly to Figs. 1 to 4, there is shown, for the purpose of illustrating the invention, the usual narrowing machine employed in the "Reading" full fashioned knitting machine. For the sake of simplicity only those

parts of the knitting machine necessary for an understanding of the invention are shown in the drawings; the various other parts and mechanisms and their manner of operation are well known in the art, and are shown and described in detail in the Reading Full Fashioned Knitting Machine catalog (copyrighted 1929) published by the Textile Machine Works, Reading, Pennsylvania. The narrowing machine comprises the usual front narrowing shaft 12 connected by a plurality of guide arms 13 to the rear narrowing shaft 14 supported in bearings 15 secured to frame members 16 of the knitting machine. Bracket members 17 secured to the front narrowing shaft 12 support the usual narrowing rods 18 having combs or fingers 19 carrying transfer or narrowing points 21 adapted to coast with selected needles in the row of needles 22 during the narrowing operation.

The vertical movement of the narrowing machine is normally controlled by vertical levers 23 pivotally connected at their upper ends to the front narrowing shaft 12 and at their lower ends to levers 24 pivotally mounted on studs 25 secured to portions 16a of the frame members 16, and carrying cam followers or rollers 27 for selective engagement with narrowing lift cams 28 or round cams 29 carried by and rotating with the main cam shaft 31. In Figs. 1 and 2 the cam shaft is shown in the plain knitting position, at which time the rollers 27 normally engage the round cams 29; in the narrowing courses, the cam shaft is automatically shifted to the right, by means of the usual pattern mechanism, so that rollers 27 engage the narrowing lift cams 28 and thereby impart to the narrowing machine the vertical movement necessary to cause the points 21 to engage selected needles for narrowing the fabric. It will be understood that the narrowing combs are automatically racked to the proper position in the narrowing courses by means of narrowing head mechanism in the well known manner.

Usually, and as shown, the narrowing machine carries additional devices, such as a picot rod 32 with picot bars 33, and lace rods 34 and 35, mounted in the brackets 17, and the lateral or shifting movements of one or more of the lace rods are often obtained by pattern controlled mechanism, such as the simplified mesh attachment 36, mounted on the narrowing machine frame. These devices must be maintained in accurate adjustment, and are relatively fragile, so that any substantial jar or shock occurring to the narrowing machine is liable to affect the adjustment of and cause injury to the devices.

In order to lift the narrowing machine from the knitting field, as during the welt turning operation above referred to, there is provided a lifting device comprising a hand lever 37 fulcrumed on one of the studs 25, the hand lever having a connecting rod 38 pivotally connected at 39 to the hand lever and at 41 to a lever arm 42 on rock shaft 43, so that when the hand lever 37 is raised (rotated in a counter-clockwise direction as viewed in Figs. 3 and 4) the rock shaft 43 is caused to rotate in a clockwise direction, thus causing lifting levers 44, carried by bracket members 45 secured to rock shaft 43, to rotate about the shaft 43 in a clockwise direction. This movement causes the upper ends 44a of each lever 44 to move to the right, as viewed in Figs. 3 and 4, and engage with a shoulder 24a of one of the narrowing lift levers 24. Continued upward movement of hand lever 37 results in further rotation

of rock shaft 43 in a clockwise direction, and this causes ends 44a of the lifting levers 44 to be raised upwardly, which upward movement is transmitted by means of the levers 23 and 24 to the narrowing machine, thus causing the narrowing machine to be elevated, as shown in Fig. 4, to a position in which the desired clearance between the points 21 and needles 22 is obtained. By reason of the offset portion 46 of the hand lever to which the rod 38 is pivotally connected, this forms in effect an over-travelled toggle connection such that when the hand lever has been rotated to the position shown in Fig. 4, the narrowing machine is locked in raised position, further movement of the hand lever in a counter-clockwise direction being prevented by means of a lug 47 thereon which engages the frame member 16 when the narrowing machine has been raised to the desired elevation. The lifting levers 44 are pivotally mounted at 48 to their respective brackets 45, and the time of engagement and release of the levers with respect to levers 24 is adjustable by means of adjustable stop members 49 carried by brackets 45, the levers 44 being urged or biased towards their respective stop members by means of springs 50.

As shown in Fig. 4, the rollers 27 are raised out of engagement with their associated cams at this time, and the weight of the narrowing machine is held by the levers 44. As above stated, if the hand lever 37 should accidentally be released before removal of the welt bar, or if the lever is not so held by the operator as to insure gradual descent of the narrowing machine when the same is to be returned to the knitting field, serious damage to the narrowing machine, transfer points, and various devices and attachments carried by the machine, and to the cam and roller elements, is liable to occur. There is also the possibility that the cam shaft may be in its shifted or narrowing position at the time the narrowing machine is dropped, so that the machine will fall through a considerable distance until the rollers 27 engage the narrowing lift cams 28, and thus cause greater damage to the mechanism, with liability of smashing both the needles and points.

The safety release mechanism, which insures that the narrowing machine will be lowered slowly and at a predetermined rate to its normal operative position upon release of the lifting means, and its manner of operation is as follows:

Referring particularly to Figs. 5 and 6, there is shown a retarding or cushioning unit comprising, in the specific embodiment illustrated, a housing 51 in the form of a cylinder fastened, as by means of cap screws 52 and adjusting screw 53, to the rear beam 54 of the knitting machine. Reciprocable within the cylinder is a piston 55 mounted on and secured by suitable means, such as a pin 56, to piston rod 57 which extends through each end of the cylinder and is pivotally connected at one end to a coupling member 58 which, in turn, is pivotally connected to the fork head 59 of a lever 60 secured to and rotatable with the rock shaft 43.

The cylinder 51 is filled with machine oil L, and is sealed by suitable gasket means against escape of the oil from the cylinder, the oil acting to cushion and control the downward movement of the narrowing machine, although various other fluids, either liquids or gases, for example, glycerine, water, or air, may be employed for this purpose. The piston member 55 has two one-way valves 61 which, during forward move-

ment of the piston, to the right as viewed in Fig. 5, permit ready displacement of the oil L from the right hand end of the cylinder into the left hand end, the oil passing through the valves without substantial resistance, but when the piston is moved in the opposite direction, or to the left as viewed in Fig. 5, the valves 61 will close and thus prevent flow of the oil therethrough, the passages 62 which extend through the piston affording the only means of displacement of the oil from the left hand end of the cylinder into the right hand end.

In the form shown, each of the valves 61 comprises a ball member 66, a compression spring 63 and an apertured retaining nut 64, and when the hand lever 37 is raised to elevate the narrowing machine, the piston is moved forwardly by the clockwise rotation of the lever 60, at which time the balls 66 are forced away from the ports 65, the fluid L readily flowing through the ports and thereby permitting quick and free lifting movement of the narrowing machine when it is desired to raise the same. When the narrowing machine is lowered, however, the lever arm 60 rotates in a counter-clockwise direction, and piston 55 is forced to the left; at this time the balls 66 act to close the ports 65, and the path of flow of the oil displaced by the piston from the left hand end of the cylinder into the right hand end is by way of the restricted passages 62, so that the downward movement of the narrowing machine is automatically retarded and the machine will return to its normal operating position at a relatively slow and uniform rate, thus preventing injury to the various parts of the narrowing machine and associated mechanism. In this manner, the rollers 27 are caused to again contact with cams 28 or 29, as the case may be, without abrasion or injury thereto, and without jar to the various elements and mechanisms of the machine. The safety release device described not only protects the narrowing machine and its various parts from misalignment or injury, but it also saves time for the operator; he can rack in the narrowing nuts on one end of the machine and release the narrowing machine lifting lever as he passes on his way to the other end of the machine, and is not required to wait until the narrowing machine is safely supported by its cams, and it makes no difference whether or not the operator's hand slips off the narrowing lifting lever since no damage can result.

The rate of return of the narrowing machine from its elevated position to the knitting field may be varied to suit any purpose or need by varying the cross-sectional area of the passages 62, or by varying the number of such passages; likewise, the action of the valves 61 may be changed or modified by varying the size or number of the valves, or by adjustment of the springs 63 by means of the threaded nuts 64.

Fig. 7 is a detail view of valve members 67 and 68 which may be employed when air, instead of a liquid, is used in the cylinder 51. In such an arrangement, valve 67 replaces the plug 69, and valve 68 replaces plug 70, of the cylinder, the valves being provided with nipples 71 and 72 respectively for this purpose. Valve 67 is adapted to permit exhaust of air from the cylinder at the proper time, and valve 68 is an intake for admission of air into the cylinder. In operation, when the piston 55 is moved to the right, as when the hand lever 37 is raised to elevate the narrowing machine, the valves 61 permit ready

displacement of air from the right hand end of the cylinder into the left hand end, but when the narrowing machine is lowered, at which time the piston is moved in the opposite direction, to the left as viewed in Fig. 5, the valves 61 will close, trapping air in the left hand end of the cylinder, the air providing a cushioning means for the narrowing machine and preventing any jar attendant to lowering the machine.

When the pressure of the trapped air exceeds the valve-closing pressure exerted by the contractile spring 73 of exhaust valve 67, the valve is unseated and permits the air to slowly escape through restricted passages or ports 74 into the valve chamber 75 from whence it escapes through the opening 76 of the apertured retaining nut 77 to the atmosphere. The action of the valve may be adjusted to suit varying needs and conditions by adjustment of the screw threaded nut 77 to vary the tension of the spring 73. During the time that the piston is moved to the left as stated, the valve member 78 of intake valve 68 is unseated by atmospheric pressure and admits air through apertured check nut 79 and ports 80 into the right hand end of the cylinder. The action of the intake valve may be varied by adjustment of the threaded retaining nut 79. It may be found desirable to eliminate the passages 62 so that the only relief afforded to the air trapped in the left hand end of the cylinder 51 is controlled by valve 67. Obviously, the intake valve 68 may be positioned at the same end of the cylinder as the exhaust valve 67, if desired.

Figs. 7 and 8 show a modified form of the invention in which the cylinder 51 is rotatably mounted in trunnions 83 or other suitable bearings, thus obviating the necessity of providing a flexible coupling between the piston rod 57 and lever 60. The cylinder 51 is thus caused to oscillate about an axis 84 in such manner as to compensate for the curved path of the lever arm 60 and cause the thrust exerted by the lever arm to be applied to the piston rod 57 in a direction along the longitudinal axis of the cylinder 51.

In the production of various fabrics, such as mesh or lace, the fabrics may be shaped by varying the thread carrier travel, instead of employing the narrowing machine for the fashioning process, the narrowing machine or equivalent structure being used to impart the necessary dipping movement to the lace points, and therefore in the specification and claims the term "narrowing machine" is used in a generic sense to define a device carrying loop engaging members, such as points, and vertically movable for bringing the points into cooperation with selected needles in the row of needles to effect the formation of loops other than plain loops.

In the specific embodiments illustrated, the cushioning means is in the form of a cylindrical housing, and the piston member operating therein is cylindrical in form, but it will be understood that various other forms and kinds of housings having various forms of pistons, plungers or other fluid control members coacting therewith may be employed, and that either the piston or the housing may be operatively connected to the narrowing machine and movable in correspondence therewith. Also, it is to be understood that various other types of cushioning devices adapted to operate generally in the manner disclosed may be employed to obtain substantially the advantages of the invention, and that the improvements specifically shown and described by which I obtain the above results can therefore be

changed and modified in various ways without departing from the scope of the invention herein disclosed and hereinafter claimed.

I claim:

1. In a full fashioned knitting machine, the combination of a series of needles and a narrowing machine carrying a series of points cooperatively associated with said needles, means operable at will for raising said narrowing machine and points from their normal position, and fluid cushioning means effective upon release of said lifting means for controlling the rate of return of said narrowing machine and points to their normal position.

2. In a full fashioned knitting machine, the combination of a series of needles and a narrowing machine carrying a series of points cooperatively associated with said needles, means for raising said narrowing machine and points a predetermined distance from their normal position during the welt turning operation, and safety release means comprising fluid controlled mechanism operative upon release of said lifting means for preventing accidental dropping of said narrowing machine and points to their normal position.

3. In a full fashioned knitting machine, the combination of a series of needles and a narrowing machine carrying a series of points adapted to coact with said needles, means including a lifting lever for raising said narrowing machine and points from their normal position, and safety release means comprising hydraulic cushioning means effective upon release of said lifting means for preventing jars attendant to the return of said narrowing machine and points to their normal position.

4. In a full fashioned knitting machine, the combination of a series of needles and a narrowing machine carrying a series of points adapted to coact with said needles, means including a lifting lever for raising said narrowing machine and points from their normal position, and hydraulic cushioning means effective upon release of said lifting means for preventing damage attendant to the dropping of said narrowing machine and points to their normal position, said means comprising a housing and a piston like member operable therein, one of which is maintained relatively fixed while the other is operatively connected to the narrowing machine for establishing a difference in pressure of a fluid medium on opposite sides of the piston like member for controlling the downward movement of said narrowing machine.

5. In a full fashioned knitting machine, the combination of a series of needles and a narrowing machine carrying a series of points adapted to coact with said needles, means including a lifting lever for raising said narrowing machine and points from their normal position, and hydraulic cushioning means effective upon release of said lifting means for preventing damage attendant to the lowering of said narrowing machine and points to their normal position, said means comprising a cylinder, a piston in said cylinder operatively connected to said narrowing machine and moving in correspondence with movement of said lifting means, and means for controlling displacement of a fluid from one end of said cylinder to control the movement of the piston in one direction therein, thereby controlling the corresponding downward movement of narrowing machine.

6. In a full fashioned knitting machine, the

combination of a series of needles and a narrowing machine carrying a series of points adapted to coact with said needles, means including a lifting lever for raising said narrowing machine and points from their normal position, and hydraulic cushioning means effective upon release of said lifting means for preventing damage attendant to the lowering of said narrowing machine and points to their normal position, said means comprising a relatively fixed housing and a plunger reciprocable within said housing, one of which is operatively connected to said narrowing machine and moving in correspondence with the vertical movement of the narrowing machine when actuated by said lifting means, and means for controlling the displacement of a liquid in said housing from one side of said plunger to control the downward movement of the narrowing machine.

7. In a full fashioned knitting machine, the combination of a series of needles and a narrowing machine carrying a series of points adapted to coact with said needles, means including a lifting lever for raising said narrowing machine and points from their normal position, and cushioning means effective upon release of said lifting means for preventing damage attendant to dropping said narrowing machine and points to their normal position, said means comprising a relatively fixed housing having a fluid medium therein, a piston like member movable within said housing operatively connected to the narrowing machine and moving in correspondence with the vertical movement of said narrowing machine when actuated by said lifting means, and means for controlling flow of the fluid from one side of said piston member to the opposite side thereof for controlling downward movement of said narrowing machine.

8. In a full fashioned knitting machine, the combination of a series of needles and a narrowing machine carrying a series of points adapted to coact with said needles, means including a lifting lever for raising said narrowing machine and points from their normal position, and safety release means comprising hydraulic cushioning means substantially unhampering the lifting movement of said narrowing machine but effective upon release of said lifting means for preventing damage attendant to dropping said narrowing machine and points to their normal position, said hydraulic means comprising a piston like member operatively connected to and movable in correspondence with said narrowing machine when actuated by said lifting means, a relatively fixed cylinder like member in which said piston operates, and a one-way valve in said cylinder positioned at one side of said piston like member, said valve controlling the flow of a liquid within said cylinder for controlling the movement of said piston like member in a direction towards said valve.

9. In a full fashioned knitting machine, the combination of a series of needles and a narrowing machine carrying a series of points adapted to coact with said needles, means including a lifting lever for raising said narrowing machine and points from their normal position, and hydraulic cushioning means effective upon release of said lifting means for preventing damage attendant to the dropping of said narrowing machine and points to their normal position, said means comprising a cylinder and a piston like member operable therein, one of said members operatively connected to the narrowing machine

and moving in correspondence with the vertical movement thereof when actuated by said lifting means, and the other member maintaining a relatively fixed position in respect thereto, and  
5 means for restricting the rate of displacement of the fluid in said cylinder at opposite sides of said piston like member for controlling the downward movement of the narrowing machine.  
10 10. In a full fashioned knitting machine having a series of needles and a narrowing machine carrying a series of points for coaction with said needles, mechanism for controlling the ver-

tical movement of said narrowing machine including a cam and a cam follower for engagement therewith, manually operated means for raising said narrowing machine from its normal operating position and causing separation of  
80 said cam and cam follower, and fluid controlled cushioning mechanism effective upon release of said manually operable means for preventing damage attendant to the contact of said cam follower with its cam when the narrowing machine  
85 is dropped to its normal operating position.

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