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B. PLUNKETT ET AL

2,446,104

WEB LET-OFF MECHANISM

Filed Oct. 22, 1946

4 Sheets-Sheet 1

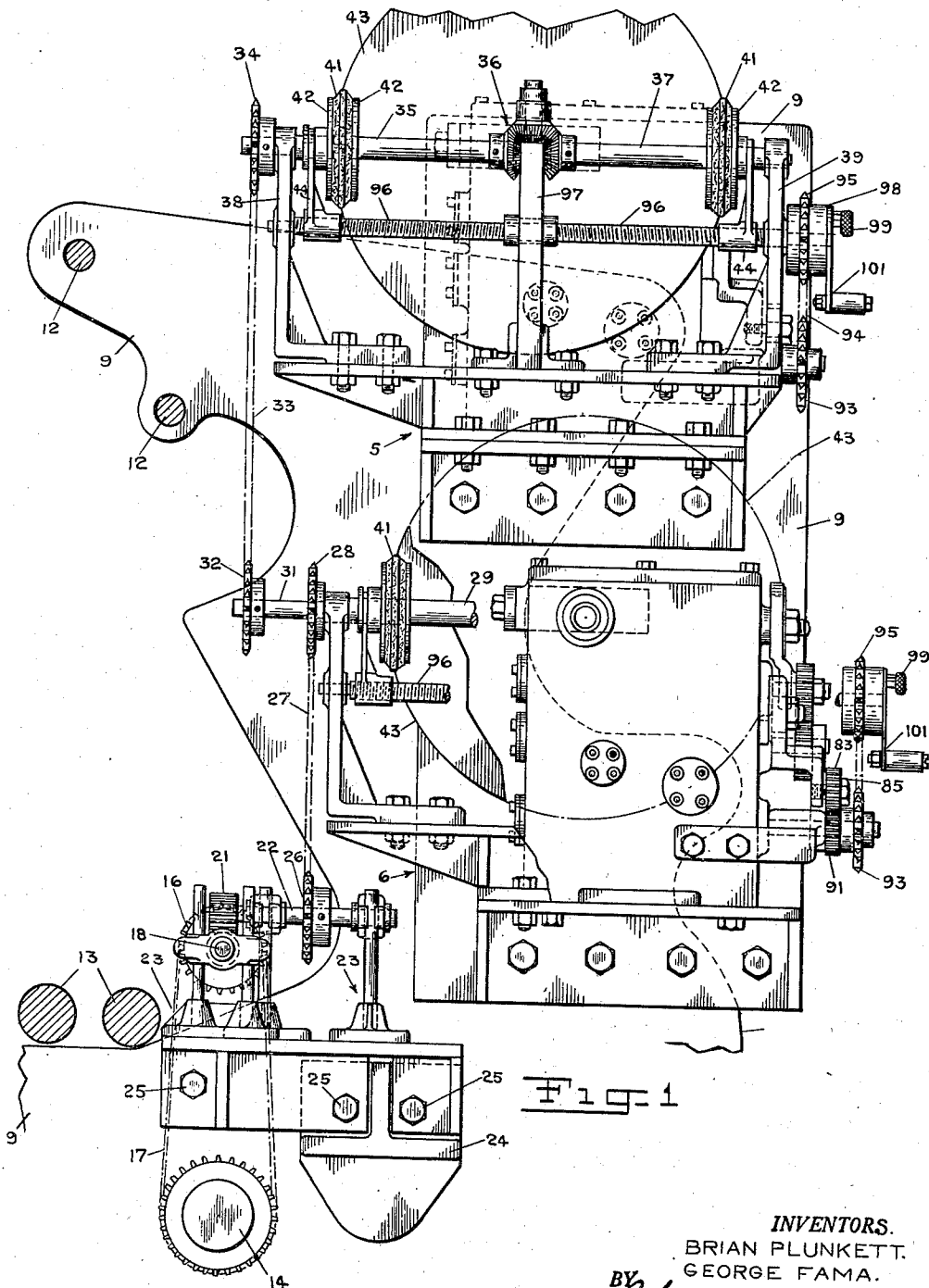


Fig. 1

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4 Sheets-Sheet 2

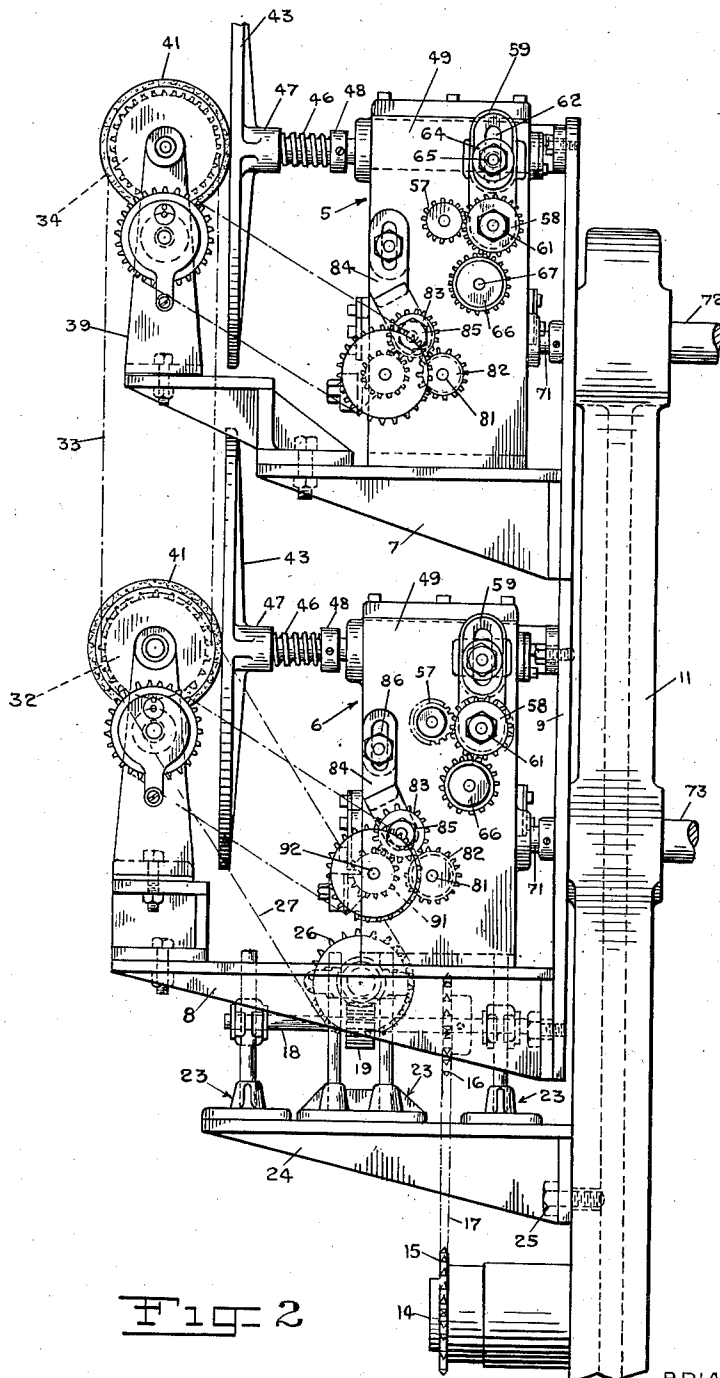


Fig. 2

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4 Sheets-Sheet 3

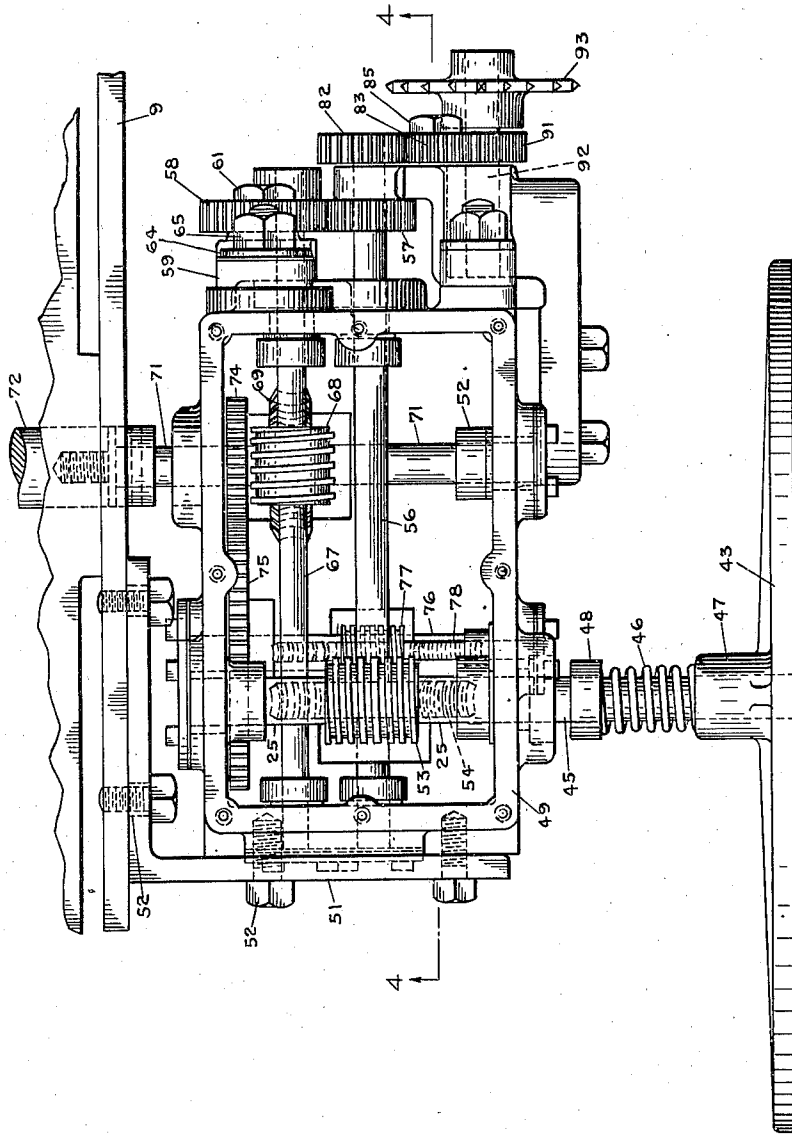


Fig. 3

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4 Sheets-Sheet 4

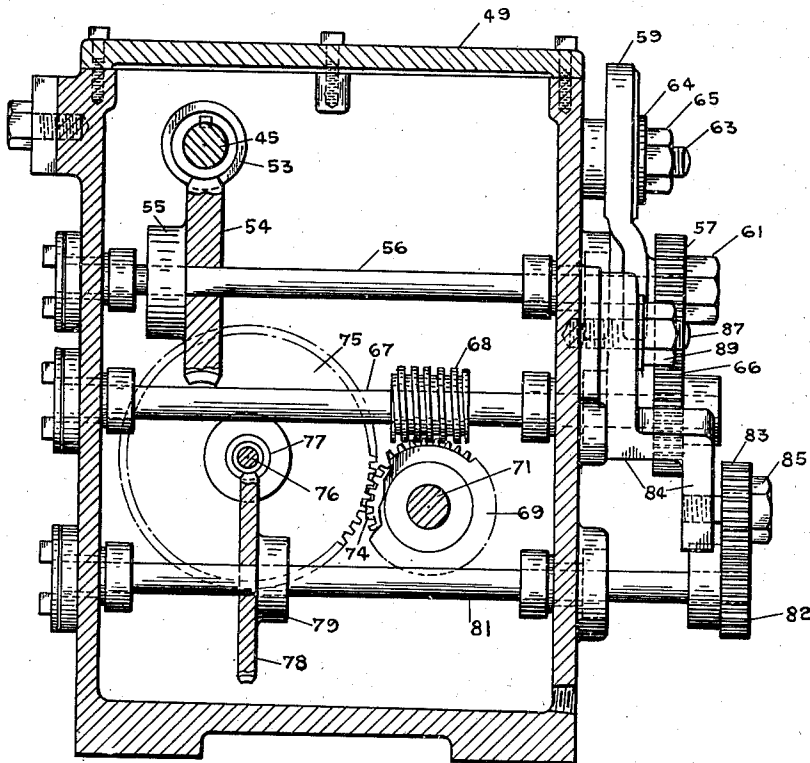


Fig. 4

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WEB LETOFF MECHANISM

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11 Claims. (Cl. 66—86)

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This invention relates to web let-off mechanisms, and relates more particularly to continuous drive positive warp let-off mechanisms for use in conjunction with warp knitting machines.

While the mechanism of our invention can be employed for positively unwinding any web, such as fabric, paper and the like, from a roll at constant speed, it is particularly effective for the positive unwinding at a constant speed of a warp of yarns being supplied to a warp knitting machine.

As is well known, the warp can be unwound from the beam mechanically with little or no torque. The yarn must be knitted under tension and this tension is sufficient, through most of the knitting cycle, to turn the beam to let off the warp at the desired speed. However, it is always a desideratum to avoid sudden pulls on the warp caused by the variation in the amount of yarn required at different stages in the knitting motion. These sudden pulls are apt to put a strain on the yarn making up the warp and also on the knitting elements of the warp knitting machine, particularly the guides and the needles. Warp knitting machines having beams provided with brakes so that the warp is alternately pulled and braked suffer from this disadvantage. Accordingly, means have heretofore been devised for positively letting off the warp of yarns from the beam. In such positive let-off devices any variation in the yarn requirements through formation of the stitch is taken care of by slight deflections on the tension rod, which merely requires sufficient load on the springs to maintain sensitive operation. Consequently, the yarn is knitted with a minimum of variation in the tension required for the proper knitting of the fabric being manufactured.

It is an object of this invention to provide an improved let-off mechanism for warp knitting machines which will continuously let off the warp from the beam or beams without causing any sudden pulls or strains on the yarn or knitting elements, and without the use of tension rods.

Other objects of this invention, together with certain details of construction and combinations of parts, will appear from the following detailed description.

The warp let-off mechanism according to the instant invention comprises a unit, consisting of two substantially similar motions, which is readily attachable to the framework of a warp knitting machine. The let-off mechanism is driven from the cam-shaft of the warp knitting machine and, through friction gearing and reducing gear-

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ing, is in driving connection with the beams of the warp knitting machine. Thus, the let-off and knitting rates are correlated.

The friction gearing comprises a driver element adapted to be constantly rotated by a friction member, or members, driven from the cam-shaft and movable to radial distances with respect to the driver member. Suitable gearing connects the warp beam shaft and friction gearing, which not only drives the warp beam shaft but also effects a change in the radial distance in which the driving member, or members, contacts with the driver member. In this way, the R. P. M. of the warp beam is controlled to maintain constant the lineal feed of yarn to the knitting elements as the diameter of the yarn wound on the warp beam decreases.

The positive let-off mechanism of this invention enables the warp knitting machine to weave fabric of high quality, giving the same accurate stitch and giving an exact yarn consumption per rack, with the elimination of waste on both warps, such as has not heretofore been attained. Visibility of stop marks is greatly reduced.

The let-off mechanism of this invention as applied to a warp knitting machine will now be described in greater detail with reference to the accompanying drawings in which,

Figure 1 is a front elevational view of the let-off mechanism showing the same on a support by which it is mounted on the framework of the warp knitting machine, certain portions of the lower motion being broken away or omitted in the interest of clarity,

Figure 2 is a side elevational view of the let-off mechanism showing the same mounted on the framework of a warp knitting machine and operatively attached to the warp beams thereof,

Figure 3 is a top plan view of one motion of the let-off mechanism, and

Figure 4 is a cross-sectional view taken on line 4—4 in Figure 3.

Like reference numerals indicate like parts throughout the several views of the drawings.

Referring to Figures 1 and 2, two let-off motions 5 and 6, one for each of the warp beams of the warp knitting machine are carried on brackets 7 and 8, respectively, which are fixed to a support 9 mounted on the framework 11 of the warp knitting machine by any suitable means including tie rods 12 and cross bars 13. The let-off motions are operated from cam shaft 14 through a sprocket 15 fixed thereto which drives a sprocket 16 by means of a chain 17. Sprocket 16 is fixed to and rotates on counter-shaft 18

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on which is mounted a spiral gear 19 cooperating with a spiral gear 21 mounted on and rotating on counter-shaft 22. Counter-shaft 22 is journaled in suitable bearings in adjustable shaft supports 23 mounted on a bracket 24 fixed by means of serew bolts 25 to the framework 11 of the warp knitting machine.

Counter-shaft 22 has fixed thereon for rotation therewith a sprocket 26 which by means of chain 27 rotates sprocket 28 which is fixed to and is adapted to drive shaft 29 of the lower let-off motion 6. The sprocket 28 also drives stub shaft 31 to which is attached a sprocket 32 driving through chain 33, sprocket 34 which is attached to and adapted to drive shaft 35.

Since remaining elements of the top let-off motion 5 are substantially similar to the remaining elements of lower let-off motion 6 only the top let-off motion will be described.

Shaft 35 through a meter gear arrangement, generally indicated by reference numeral 36, rotates shaft 37 in the opposite direction as shaft 35. Shafts 35 and 37 are journaled in bearing brackets 38 and 39, respectively, and each shaft has keyed thereon a driving wheel 41 of leather or other suitable friction material held between plates 42, the guiding wheels being adapted to rotate disc 43 of steel or other suitable material. While two friction wheels are shown, it is to be understood that the disc 43 may be driven by a single driving wheel. The driving wheels 41 are rotatably carried in shift brackets 44 which are movable laterally by means hereinbefore set forth. In Figure 1, the driving wheels are shown in their extreme outer position on disc 43.

As shown in Figures 3 and 4, disc 43 is mounted on a shaft 45, a compression spring 46 being positioned between the hub 47 of disc 43 and collar 48 on shaft 45 for maintaining the disc 43 in contact with driving wheels 41. Shaft 45, which is the input shaft, extends through a gear housing 49 which is attached by means of bracket 51 and screw bolts 52 to support 9. A worm 53 is mounted on shaft 45 within housing 49 and meshes with a worm gear 54 fixed, as by means of a collar 55 to a shaft 56. A portion of shaft 56 extends through housing 49 and has affixed thereto a spur gear 57 and meshes with and operates a spur gear 58. Spur gear 58 is rotatably mounted on a bracket 59 being held thereon by a nut 61. The bracket 59 is provided with a slot 62 by which it is mounted on a threaded stud 63, the arrangement being such that the bracket is capable of vertical and angular adjustment. A washer 64 and a nut 65 are provided to hold the bracket in adjusted position. Spur gear 58 meshes with and is adapted to rotate a spur gear 66 fixed to a suitable journaled shaft 67.

The shaft 67 extends within housing 49 and has mounted thereon, within said housing a worm 68 which meshes with and is adapted to rotate a worm gear 69 fixed to a suitably journaled shaft 71. The shaft 71 passes through housing 49 and drives warp beam shaft 72 to which it is directly coupled as will be seen from Figures 2 and 3. The warp beam shaft 73 is driven in a similar manner by the lower let-off motion 6.

The shaft 71 also has fixed thereto a spur gear 74 which meshes with and is adapted to rotate a spur gear 75 carried by a suitably journaled shaft 76. A worm 77 is mounted on the shaft 76, which worm cooperates with and is adapted to rotate worm gear 78 integral with a hub 79 mounted on a suitably journaled shaft 81 which extends through housing 49 and carries through

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its free end a spur gear 82. The spur gear 82 meshes with and is adapted to rotate spur gear 83 which is rotatably mounted on a bracket 84 being held thereon by a nut 85. The bracket 84 is provided with a slot 86 by which it is mounted on threaded stud 87 to permit the bracket to be vertically and angularly adjustable. A washer and nut arrangement 89 is provided to maintain the bracket in adjusted position.

The spur gear 82 meshes with and is adapted to rotate spur gear 91 fixed to spur shaft 92 on which is also fixed a sprocket 93. A chain 94 connects sprocket 93 with a sprocket 95 fixed to a reversely threaded shaft 96 and is adapted to rotate said shaft. Shift brackets 44 which carries driving wheels 41 are mounted on the threaded shaft 96, which is journaled in brackets 38 and 39 and also in standard 97, and as the threaded shaft is rotated the shift brackets are caused to move radially with respect to the center of disc 43.

Means are provided for operatively disconnecting the threaded shaft 96 from sprocket 95 and for manually rotating the threaded shaft. This means comprises a clutch, generally indicated by reference numeral 98, provided with a manual release 99 and a handle 101.

In operation, the warp beam is driven through driving wheels 41, operated from the cam-shaft 14, and disc 43, and, as there is no power required except that necessary to overcome what little friction there may be in the gear, there is no slippage between the driving wheels 41 and disc 43, notwithstanding the small area of the friction driving surface of driving wheels 41. Moreover, the gear ratio between disc 43 and the warp beam is very great.

After the warp beams are in position, the driving wheels are set on disc 43 at a distance from the center of the latter corresponding exactly to the radius of the yarn windings on the warp beam, this being effected manually by means of clutch 98 and handle 101. The gear is so arranged that a predetermined amount of yarn is let off the warp beam and fed through the machine. As the diameter of the yarn windings on the warp beam decreases, the speed of the disc is increased because to maintain constant lineal yarn feed the R. P. M. of the warp feed must be increased. By increasing the speed of the disc 43, the rotation of the threaded shaft 96 is increased, thus moving the driving wheel 41 at an increased rate towards the center of disc 43 which accelerates through the gear above described the speed at which the warp beam is driven. By way of example, where there are 5,000 turns of yarn on the warp beam, the outside diameter of the warp beam is $4\frac{1}{2}$ inches and the diameter of the barrel of the warp beam is 2 inches, then a radial distance of $2\frac{1}{2}$ inches must be traversed by each driving wheel on the disc in 5,000 turns of the shaft 71 connected to the warp beam 72.

The pitch of the thread on shaft 96 does not have to be changed should different deniers of yarn cause the thickness of the warp beam to vary for the same number of turns. Change in yarn deniers are compensated for by changing the size of gear 57. Where it is desired or it is necessary to change the run-in or lineal amount of yarn to be fed for a given number of cam-shaft revolutions, it is effected by changing the size of gear 82. Changing the size of gear 82 changes the instantaneous R. P. M. of the warp beam without changing the rate at which the R. P. M. increases as the warp diameter decreases.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. A let-off motion for positively rotating a beam, comprising means including friction gearing for rotating said beam, said friction gearing comprising a driver member adapted to be constantly rotated and a driving member for frictionally rotating said driver member, and means operated by said first-mentioned means for moving said driving member to variable radial distances with respect to said driver member so as to cause the speed of rotation of said beam to vary.

2. A let-off motion for positively rotating a beam, comprising means including friction gearing for rotating said beam, said friction gearing comprising a driver member adapted to be constantly rotated and a driving member for frictionally rotating said driver member, means operated by said first-mentioned means for automatically moving said driving member to variable radial distances with respect to said driver member so as to cause the speed of rotation of said beam to vary, and manually operated means for also moving said driving member to variable radial distances with respect to said driver member.

3. A let-off motion for positively rotating a beam, comprising means including friction gearing for rotating said beam, said friction gearing comprising a disc adapted to be constantly rotated and a driving wheel for frictionally rotating said disc, and means operated by said first-mentioned means for moving said driving wheel to variable radial distances with respect to said disc so as to cause the speed of rotation of said beam to vary.

4. A let-off motion for positively rotating a beam, comprising means for rotating said beam, said means comprising a driver member adapted to be constantly rotated, a driving member for frictionally rotating said driver member, reducing gearing operated by said driver member, and a shaft rotatable by said reducing gearing and connected to said beam, and means operatively connected to said shaft for moving said driving member to variable radial distances with respect to said driver member so as to cause the speed of rotation of said beam to vary.

5. A let-off motion for positively rotating a beam, comprising means for rotating said beam, said means comprising a disc adapted to be constantly rotated, a driving wheel frictionally rotating said disc, reducing gearing operated by said disc, and a shaft rotatable by said reducing gearing and connected to said beam, and means operatively connected to said shaft for moving said driving wheel to variable radial distances with respect to said disc so as to cause the speed of rotation of said beam to vary.

6. In a warp knitting machine wherein two beams are employed for supplying warps of yarn, a let-off motion operatively attached to each of said beams, each of said let-off motions comprising friction gearing including a driver member adapted to be constantly rotated, a driving member for fractionally rotating said driver member, reducing gearing operated by said driver member, a shaft rotatable by said reducing gearing and connected to a beam, and means operatively connected to said shaft for moving said driving mem-

ber to variable radial distances with respect to said driver member so as to cause the speed of rotation of the beam to vary, and means connected to the camshaft of the warp knitting machine for simultaneously operating said let-off motions.

7. In a warp knitting machine wherein two beams are employed for supplying warps of yarn, a let-off motion operatively attached to each of said beams, each of said let-off motions comprising friction gearing including a driver member adapted to be constantly rotated, a driving member for frictionally rotating said driver member, reducing gearing operated by said driver member, a shaft rotatable by said reducing gearing and connected to a beam, and means operatively connected to said shaft for moving said driving member to variable radial distances with respect to said driver member so as to cause the speed of rotation of the beam to vary, and means connected to the cam-shaft of the warp knitting machine for simultaneously operating said let-off motions, the construction and arrangement being such that each of the driving members revolves once for each revolution of said cam-shaft.

8. In a warp knitting machine wherein two beams are employed for supplying warps of yarn, a let-off motion operatively attached to each of said beams, each of said let-off motions comprising friction gearing including a disc adapted to be constantly rotated, two driving wheels for frictionally rotating said disc, reducing gearing operated by said disc, a shaft rotatable by said reducing gearing and connected to a beam, and means operatively connected to said shaft for moving said driving wheels relative to each other and to variable radial distances with respect to the disc so as to cause the speed of rotation of the beam to vary, and means connected to the cam-shaft of the warp knitting machine for simultaneously operating said let-off motions, the construction and arrangement being such that each of the driving wheels revolves once for each revolution of said cam-shaft.

9. In a warp knitting machine wherein two beams are employed for supplying warps of yarn, a let-off motion operatively attached to each of said beams, each of said let-off motions comprising friction gearing including a disc adapted to be constantly rotated, two driving wheels for frictionally rotating said disc, brackets for rotatably holding said driving wheels, a threaded shaft on which said brackets are mounted for longitudinal movement relative thereto, reducing gearing operated by said disc, a shaft rotatable by said reducing gearing and connected to said beam and means operatively connected to said shaft for rotating said threaded shaft so as to cause said driving wheels to move relative to each other and to variable distances with respect to the disc whereby the speed of rotation of the beam is caused to vary, and means connected to the cam-shaft of the warp knitting machine for simultaneously operating said let-off motions, the construction and arrangement being such that each of the driving wheels revolves once for each revolution of said cam-shaft.

10. In a warp knitting machine wherein two beams are employed for supplying warps of yarn, a let-off motion operatively attached to each of said beams, each of said let-off motions comprising friction gearing including a disc adapted to be constantly rotated, two driving wheels for frictionally rotating said disc, brackets for rotatably holding said driving wheels, a threaded shaft on

which said brackets are mounted for longitudinal movement relative thereto, reducing gearing operated by said disc, a shaft rotatable by said reducing gearing and connected to said beam, means operatively connected to said shaft for rotating said threaded shaft so as to cause said driving wheels to move relative to each other and to variable distances with respect to the disc whereby the speed of rotation of the beam is caused to vary, and means for manually rotating said threaded shaft to move said driving wheels relative to each other, and means connected to the cam-shaft of the warp knitting machine for simultaneously operating said let-off motions, the construction and arrangement being such that each of the driving wheels revolves once for each revolution of said cam-shaft.

11. In a warp knitting machine wherein two beams are employed for supplying warps of yarn, a let-off motion operatively attached to each of said beams, each of said let-off motions comprising friction gearing including a disc adapted to be constantly rotated, two driving wheels for frictionally rotating said disc, brackets for rotatably holding said driving wheels, a threaded shaft on which said brackets are mounted for longitudinal movement relative thereto, reducing gearing operated by said disc, a shaft rotatable by said reduc-

ing gearing and connected to said beam, means operatively connected to said shaft for rotating said threaded shaft so as to cause said driving wheels to move relative to each other and to variable distances with respect to the disc whereby the speed of rotation of the beam is caused to vary, and means including a clutch mounted on said threaded shaft for moving said driving wheels relative to each other, and means connected to the cam-shaft of the warp knitting machine for simultaneously operating said let-off motions, the construction and arrangement being such that each of the driving wheels revolves once for each revolution of said cam-shaft.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
161,996	Turner	Apr. 13, 1875
2,100,680	Wirth	Nov. 30, 1937
2,383,562	Plunkett et al.	Aug. 28, 1945
2,400,525	Amidon	May 21, 1946