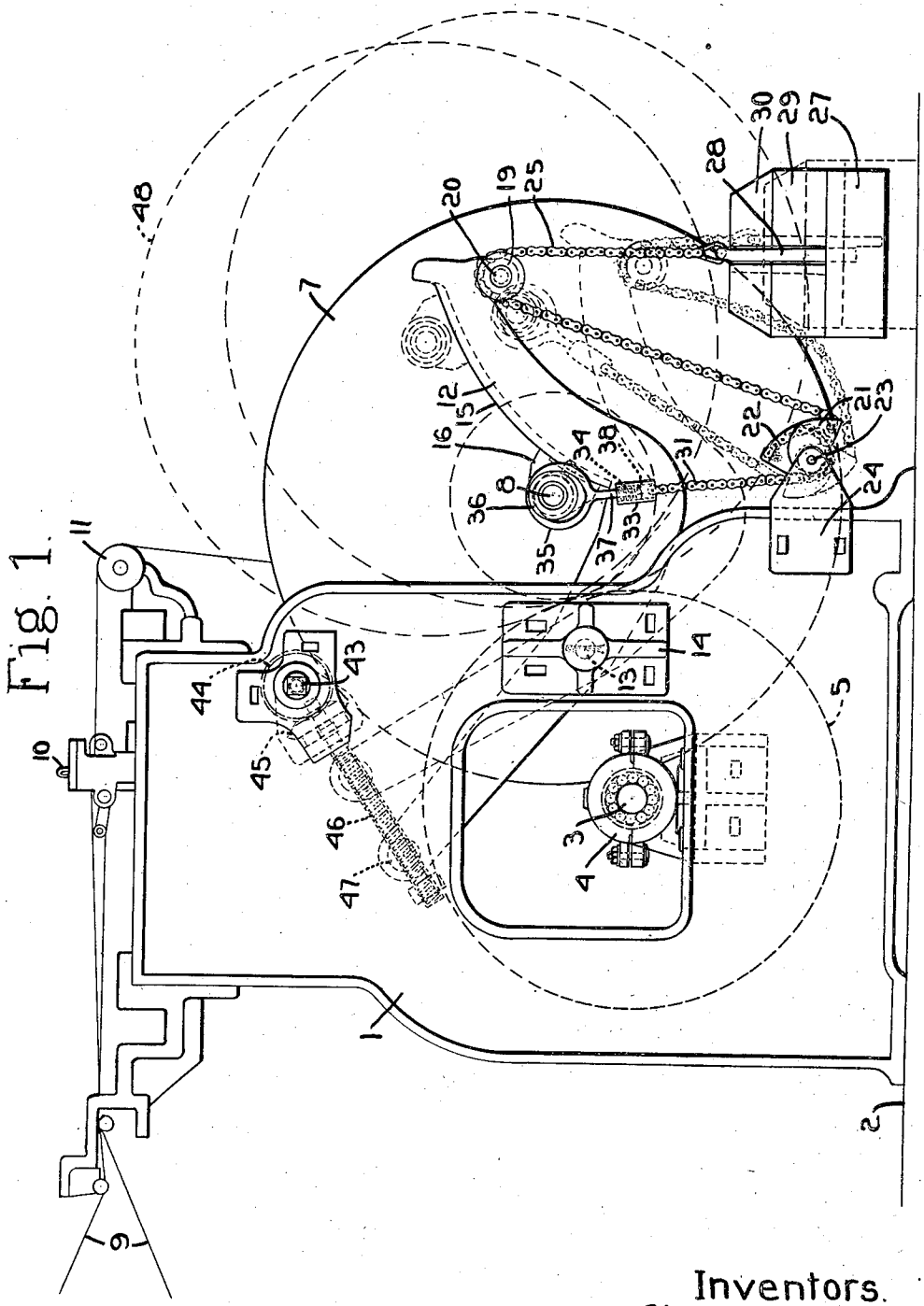
Nov. 4, 1930. C. H. DRAPER ET AL 1,780,892

WARPER

Filed Dec. 5, 1928 3 Sheets-Sheet 1

Fig. 1.



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WARPER

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Fig. 2

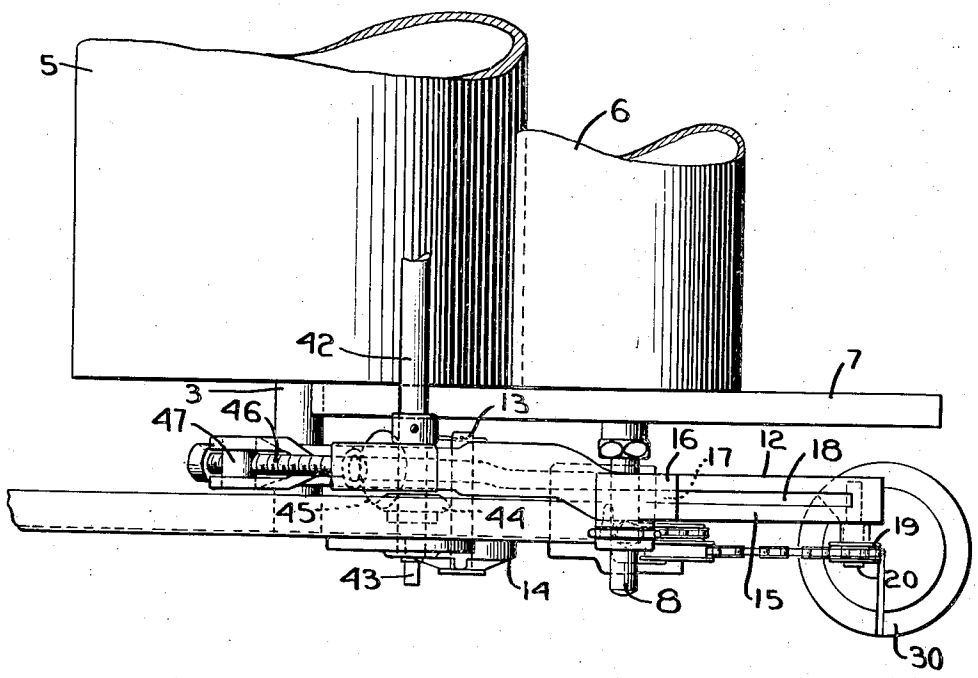
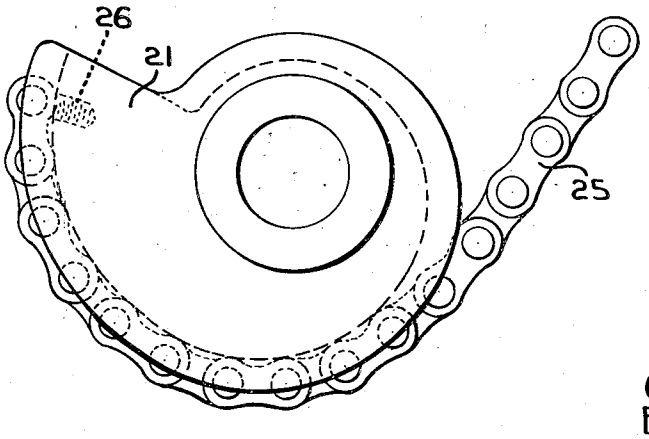


Fig. 3.



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Fig. 4.

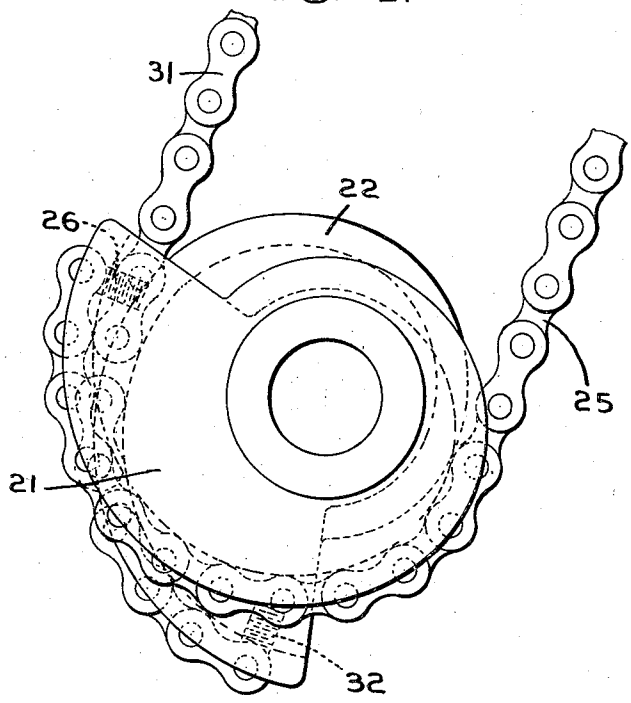
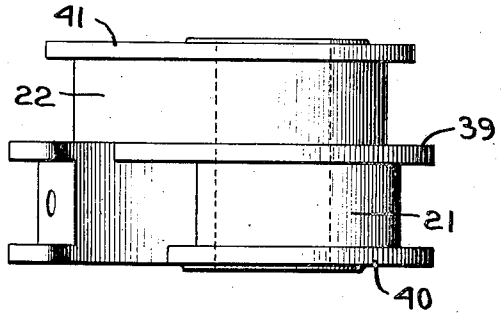


Fig. 5.



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UNITED STATES PATENT OFFICE

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WARPER

Application filed December 5, 1928. Serial No. 323,842.

This invention relates to a warper for winding warp yarns drawn from a suitable supply such as a creel on to a warp beam of that type in which the warp beam rests against a driving drum and is rotated by the frictional engagement of the drum with the warp mass as the warps are wound on the beam. In this type of machine, the warp beam moves away from the driving drum as the warps are wound on the beam due to the increasing diameter of the warp mass.

The primary object of the invention is to provide a construction of this type which can be run at a high speed. The great increase in speed being demanded by the trade has rendered it difficult to control the winding operation so as to place the yarns under even tension in a homogeneous compact mass on the beam and has greatly increased the difficulty due to vibration of the warp beam when thus rotated at high speed. The present invention overcomes these difficulties and enables the desired results to be secured.

The object of the invention is further to provide means for controlling or predetermining throughout the winding operation the pressure of the beam on the driving drum, notwithstanding the gradually increasing weight of the beam and yarn as the yarn is wound on the beam, and notwithstanding the gradually increasing diameter of the yarn mass resting directly against the driving drum.

The object of the invention is further to provide means for applying an additional amount of weight to the warp beam and to control the application of this weight both so as to prevent jumping of the beam during the winding operation and so as not undesirably to affect the total pressure of the beam on the driving drum.

The invention has for its further object more specifically to provide a pair of supporting arms for the warp beam gudgeons with these arms extending forward and upward in a convex curve so shaped that, as the gudgeons move along the arms as the winding operation proceeds, the resultant pressure of the beam on the driving drum will be of the required character.

The invention further has as its object to provide means for preventing the resultant pressure of the warp beam on the driving drum from increasing during the winding operation and more particularly for securing a gradually decreasing resultant pressure from the beginning of the winding operation so that the yarn mass will be rendered compact and any bulging of the yarn mass prevented as the winding operation proceeds.

The invention has for its further object to provide means for doffing the warp beam at the end of the winding operation which shall automatically free the gudgeons of the warp beam from the additional amount of weight applied thereto during the winding operation.

The invention has for its further object to provide a simple and efficient form of construction readily manufactured and readily embodied in the warper rendering it capable of high speed and producing a wound warp beam of the desired character.

These and other objects and features of the invention will appear more fully from the accompanying description and drawings and will be particularly pointed out in the claims.

Since the invention is concerned solely with the control of the warp beam during the winding operation, the preventing of the jumping or vibration of the warp beam and the provisions for doffing the warp beam, and as the other features and mechanism of the warper may be of any suitable construction and form, and as the general principle of operation of a warper is well known and familiar to those skilled in the art, it is only necessary here to illustrate and describe those portions of a warper directly concerned with one preferred form of embodiment of the present invention.

In the drawings:

Fig. 1 is a side elevation of a warper with a simple and preferred form of the invention embodied therein and with elements of the warper not concerned with the present invention omitted. In this figure the full lines indicate the position of the parts at the beginning of the winding operation, while the

dotted lines indicate the position of the parts at the end of the winding operation and with the beam ready to be doffed.

Fig. 2 is a top plan view of a portion of one end of the construction shown in Fig. 1.

Fig. 3 is a side elevation of a cam and the end of the flexible connector or chain extending to a weight employed.

Fig. 4 is a side elevation of the complete cam device interposed between the two flexible connectors.

Fig. 5 is a top plan view of the cam construction in the position shown in Fig. 4.

The warper frame comprises end frames such as 1 standing on the floor 2. A shaft 3 is mounted in suitable bearings 4 in the end frames and extends transversely of the warper and is driven at a high speed in any suitable manner from a suitable source of power. This shaft 3 extends through, supports and rotates the driving drum 5 of the usual type. The warp beam may be of any suitable type comprising the cylindrical barrel 6, the heads 7 and gudgeons 8. The barrel of the beam rests against the driving drum and the warps 9 extend as usual from a creel or other supply through the drop wires 10 and other usual adjunctive devices over the roll 11 and are secured at their ends in any suitable manner to the barrel 6 of the warp beam. Consequently as the driving drum 5 is rotated, the frictional engagement of the drum with the beam barrel rotates the beam, winding the warp yarns thereon. The yarn mass on the warp beam therefore gradually increases in diameter until the beam is filled. Consequently also, the total weight of the beam and yarn mass likewise gradually increases.

In the preferred construction, the supporting and weighting means for the warp beam is the same at both sides of the warper so that it is sufficient to illustrate the construction at one side. A supporting arm 12 is pivotally mounted on a stub shaft 13 projecting inwardly of each end frame 1 and preferably braced by a bracket 14 secured to the end frame. During the winding operation these supporting arms are held in fixed position projecting forward of the warper and with the upper surface 15 extending forward and upward in a convex curve of a character hereinafter described. The warp beam gudgeons during the winding operation move along the supporting surfaces. Preferably, as illustrated, the gudgeon 8 rotates in a gudgeon block 16 mounted to slide on the surface 15 and provided with a depending fin 17 sliding in a groove 18 formed in the upper surface of the arm 12 so as to prevent lateral movement of the gudgeon block.

An additional amount of weight is applied to the warp beam and again the preferred construction illustrated for applying this weight is the same at each side so that it is sufficient to illustrate the construction adopted at one side. In the preferred construction illustrated for this purpose, an idler 19 is journalled at 20 on the forward end of each supporting arm 12. A leverage changing mechanism is supported on the end frame and is shown as a cam device having two oppositely disposed lobes 21 and 22 rigidly connected to and pivotally mounted on a shaft 23 carried by a bracket 24 secured to the end frame. A flexible connector in the form of a chain 25 is secured at one end, as by a set screw 26, to the high point of the lobe 21 of the cam device and extends up over the idler 19 and down to a weight device suspended thereon. This weight device is shown as a weight 27 having a central standard 28 to which the lower end of the chain 25 is connected and a plurality of removable weights 29 and 30 are adapted to be placed on top of the weight 27. A second flexible connector shown also as a chain 31 is attached at one end to the beam gudgeon 8 and at its other end to the high point of the other cam lobe 22 as by means of the set screw 32. This chain 31 is shown detachably connected to the gudgeon 8 and also as having interposed in it a yielding or spring device. As illustrated, the upper end of the chain proper 31 has secured thereto a cylindrical casing 33 enclosing a spring 34. An eye member 35 fits over a grooved collar 36 of the gudgeon 8 and has its stem 37 passing into the casing 33 and presenting a head 38 beneath the spring.

The cam device is shown separately in Fig. 5 as an integral member comprising the central fin 39 separating the lobes 21 and 22 and serving to keep the two chains separate. Fins 40 and 41 are also provided at each side of the cam member and form with the central fin 39 grooves for the respective chains. The cam lobes 21 and 22 which are oppositely disposed thus cause the leverages acting on the chains as the cam member rotates to vary inversely and the surface of each lobe against which the chain acts is preferably formed on a curve of gradually increasing radius.

The convex curved surface 15 of the supporting arms 12 upon which the gudgeon blocks slide are designed according to the following principle. The total weight of the warp beam and the mass of yarn thereon with the gudgeons resting on these curved surfaces and the beam resting against the driving drum is resolved into two resultant forces, one acting on a line extending through the gudgeons perpendicular to the curved surfaces and the other acting on a line extending from the gudgeon to the center of the shaft 3. The additional weight applied to the beam gudgeon from the weights such as 27, 29 and 30 acts to increase both of these resultant forces.

It is desirable that the total resultant force

exerted by the warp beam on the driving drum shall not increase during the winding operation and preferably that it shall decrease from the beginning of the winding operation. With this resultant force decreasing from the beginning of the winding operation, it follows that the pressure between the warp beam and the driving drum is greatest at the beginning of the winding operation. This latter result is desirable because it acts to compact the yarn in the desired manner on the beam and prevent the yarn bulging out as it is wound on the beam so that as the winding operation proceeds, the yarn is wound under a substantially even tension in a homogeneous, properly compacted mass. In the preferred form of the invention, the curved surface 15 is so shaped that the total weight of the warp beam and the yarn mass thereon at all stages of the winding operation and disregarding the additional weight applied to the gudgeons produces a substantially constant resultant pressure against the driving drum in the direction of a line extending from the gudgeon to the center of the shaft 3. As this total weight of the warp beam and yarn is ascertainable at each stage of the winding operation and as the diameter of the warp mass is also ascertainable at each stage of the winding operation, the curve of the surface 15 is readily plotted so as to give this substantially constant resultant pressure force on the driving drum. And as the lowermost position of the gudgeon is determined by the size of the warper, the size of the beam head, the desired clearance of the beam from the floor, etc., and as the uppermost position of the gudgeon is also limited by similar considerations, and as it is desirable that the curve of the surface 15, for convenience in manufacture, shall be a circular arc, it will be found that a curve plotted in accordance with the foregoing principles can be made readily substantially to coincide with a circular arc extending between the extreme positions of the warp beam gudgeon thus determined.

In the construction thus described and illustrated with the gradually increasing total weight of the warp beam and yarn wound thereon producing, by reason of the curvature of the surfaces 15, a substantially constant pressure of the warp beam on the driving drum, the desired greater pressure at the beginning of the winding operation with a gradual decrease therefrom is secured by the additional weight applied to the gudgeons. The cam device 21 and 22 is so positioned and the cam lobes are so shaped, as illustrated, that at the beginning of the winding operation shown in full lines in Fig. 1, the flexible connector 25 extends in a straight line to the high point of the cam lobe 21 so that the weight 27, etc., acts on the center of rotation 23 through a relatively long leverage, that is, through the longest radius of the lobe 21 while the flexible connector 31 extending from the gudgeon is wrapped around the cam lobe 22 and thus has the shortest leverage with respect to the center of rotation 23, that is, the leverage equal to the shortest radius of the cam lobe 22. Accordingly as the winding operation proceeds and the gudgeon 8 travels forwardly and upwardly on the supporting arm, raising the weights, it will be seen that the cam device rotates clockwise, viewing Fig. 1, thus gradually decreasing the leverage radius between the connector 25 and the center of rotation 23 and gradually increasing the leverage radius between the connector 25 and this center of rotation. Consequently the effective weight applied to the gudgeons from the weights 27, etc., gradually decreases as the winding operation proceeds and the gudgeons travel forwardly and upwardly along the supporting arms.

An important function of the weights 27, 29, 30, etc., is to provide sufficient additional weight to the gudgeons to prevent the warp beam from jumping or vibrating with respect to the supporting arms while rotating at high speed. Consequently these weights are applied in a sufficient amount so that the effective weight acting on the gudgeons shall be sufficient at the end of the winding operation to prevent the beam from jumping and if the weight is sufficient at this point, it will, of course, be sufficient throughout the winding operation. Consequently the surfaces of the cam lobes 21 and 22 and the relative proportions of their radii may readily be determined so as to give the desired additional amount of weight upon the gudgeons at the end of the winding operation and at the same time a greater amount of effective weight at the beginning of the winding operation with this amount gradually decreasing from the beginning to the end of the winding operation. Thus there will be secured the desired total gradual decrease of resultant pressure against the driving drum from the beginning to the end of the winding operation so that this total pressure will be the greatest at the beginning and gradually decrease to the end of the winding operation.

It is desirable also, in order to dampen minor vibrations of the warp beam, that there shall be a yield or give in the connection through which the weight is applied to the gudgeon of the warp beam and for this purpose the yielding connection including the spring 34 already described is provided.

While there has thus been set forth the desired character of resultant pressure between the driving drum and the warp beam, it will be obvious that the curvature of the supporting surfaces 15, the proportions and shape of the cam lobes 21 and 22 and the amount of weight applied to the connector 25 are readily determinable so as to produce any pre-

determined resultant pressure between the warp beam and the driving drum either constant or variable throughout the winding operation as may be desired.

While there has thus been disclosed the application and control of additional weight to the beam for controlling and preferably decreasing the pressure of the beam on the drum during the winding operation, it will be understood that such additional weight is but one form of additional resistance to the movement of the beam and that such an additional resistance so controlled or decreased during the winding operation, when combined with a support for the beam during its movement embodying the principles hereinbefore set forth, may be of any desired character within the broad scope of the invention. Furthermore, the principle of applying additional weight to the beam during its movement away from the drum and varying, preferably by decreasing, the resultant of this additional weight in pressure between the beam and drum during the winding operation is a broad feature of the invention irrespective of the means employed for supporting the beam during its movement.

Another advantage of the invention results from the use of the weight construction such as described in providing for a ready doffing of the warp beam. An ordinary type of device is provided for swinging the supporting arms about their pivotal axes 13 and for holding them in position. This device is shown as a shaft 42 extending through the warper frame and squared at the end 43 to receive a wrench. This shaft is provided with bevelled gears 44 engaging bevelled gears 45 secured to screw-threaded shafts 46. Each shaft 46 is threaded through a block 47 pivotally mounted in the end of the corresponding supporting arm. Consequently by rotating the shaft 42, the supporting arms are raised and lowered as desired. When the winding operation has been completed, the gudgeons 8 will stand in the positions shown in dotted lines in Fig. 1 with the warp beam in the position shown by the dotted circle 48 and the weight 27, etc., will still be out of engagement with the floor 2. The shaft 42 is then rotated to lower the supporting arms 12 into the position shown in dotted lines in Fig. 1. This brings the weight to the floor, allowing the connector 25 to slacken and the cam device to rotate and slacken the connector 31. Thus the warp beam is entirely freed of any additional weight and the eye member 35 is loose and may readily be lifted from the grooved collar 38 on the gudgeon. Then the warp beam with the gudgeon blocks may be lifted off from the arms and the gudgeon blocks removed and then a new warp beam put in place and the supporting arms restored to normal position.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. A warper comprising a driving drum, a warp beam having gudgeons, a pair of supporting arms extending forward of the drum, a pair of gudgeon blocks supporting the beam gudgeons and movable along the arms as the yarn is wound on the beam by the frictional engagement of the drum therewith, the surfaces of the arms upon which the gudgeon blocks move extending forward and upward in a convex curve shaped to prevent increase in the resultant pressure on the driving drum due to the increase in the total weight of the beam and yarn as the yarn is wound on the beam, means for applying additional weight to the gudgeons to prevent the beam from jumping when rotating at high speed and means for gradually decreasing the amount of said additional weight from the beginning of the winding operation thus to cause a gradual decrease in the resultant pressure of the beam on the drum from said additional weight to compact and prevent bulging of the yarn mass.

2. A warper comprising a driving drum, a warp beam having gudgeons, a pair of supporting arms extending forward of the drum, a pair of gudgeon blocks supporting the beam gudgeons and movable along the arms as the yarn is wound on the beam by the frictional engagement of the drum therewith, the surfaces of the arms upon which the gugdeon blocks move extending forward and upward in a convex curve shaped to cause the total weight of the beam and yarn as the yarn is wound on the beam to exert a substantially constant resultant pressure on the drum, means for applying additional weight to the gudgeons to prevent the beam from jumping when rotating at high speed and means for gradually decreasing the amount of said additional weight from the beginning of the winding operation thus to cause a gradual decrease in the resultant pressure of the beam on the drum from said additional weight to compact and prevent bulging of the yarn mass.

3. A warper comprising a driving drum, a warp beam having gudgeons, a pair of supporting arms extending forward of the drum, a pair of gudgeon blocks supporting the beam gudgeons and movable along the arms as the yarn is wound on the beam by the frictional engagement of the drum therewith, the surfaces of the arms upon which the gudgeon blocks move extending forward and upward in a convex curve, and means for applying a gradually decreasing amount of additional weight to the beam gudgeons from the beginning of the winding operation, the said means acting in correlation with the curvature of the surfaces of the supporting arms, the weight of the beam and the increasing weight and diameter of

the yarn mass to effect a gradually decreasing resultant pressure of the beam on the drum to compact and prevent bulging of the yarn mass as the yarn is wound on the beam and to prevent the beam from jumping when rotating at high speed.

4. A warper comprising a driving drum, a warp beam supported to rest against the drum and to move away from the drum as the yarn is wound on the beam by the frictional engagement of the drum therewith, means acting to prevent increase in the resultant pressure on the driving drum due to the increase in the total weight of the beam and yarn as the yarn is wound on the beam, means for applying a gradually decreasing amount of additional weight to the beam from the beginning of the winding operation, the said two means acting in conjunction to effect a gradually decreasing total resultant pressure of the beam on the drum to compact and prevent bulging of the yarn mass as the yarn is wound on the beam and to prevent the beam from jumping when rotating at high speed.

5. A warper comprising a driving drum, a warp beam supported to rest against the drum and to move away from the drum as the yarn is wound on the beam by the frictional engagement of the drum therewith, means acting to cause the total weight of the beam and yarn as the yarn is wound on the beam to exert a substantially constant resultant pressure on the drum, means for applying a gradually decreasing amount of additional weight to the beam from the beginning of the winding operation, the said two means acting in conjunction to effect a gradually decreasing total resultant pressure of the beam on the drum to compact and prevent bulging of the yarn mass as the yarn is wound on the beam and to prevent the beam from jumping when rotating at high speed.

6. A warper comprising a driving drum, a warp beam having gudgeons, a pair of supporting arms extending forward of the drum, a pair of gudgeon blocks supporting the beam gudgeons and movable along the arms as the yarn is wound on the beam by the frictional engagement of the drum therewith, an idler at the end of each supporting arm, a flexible connector extending over each idler, a weight suspended on each of said connectors, a second flexible connector connected to and extending downward from each gudgeon and means supported from the warper frame interposed between said connectors and acting, as the gudgeons move along the supporting arms during the winding operation, to reduce the downward pull transmitted from the weights to the gudgeons.

7. A warper comprising a driving drum, a warp beam having gudgeons, a pair of supporting arms extending forward of the drum, a pair of gudgeon blocks supporting the beam gudgeons and movable along the arms as the yarn is wound on the beam by the frictional engagement of the drum therewith, an idler at the end of each supporting arm, a flexible connector extending over each idler, a weight suspended on each of said connectors, a second flexible connector connected to and extending downward from each gudgeon and a cam device for each pair of connectors pivotally mounted on the warper frame having two oppositely disposed lobes with the ends of the said connectors respectively connected thereto and acting, as the gudgeons move along the supporting arms during the winding operation, to reduce the downward pull transmitted from the weights to the gudgeons.

8. A warper comprising the construction defined in claim 6, in which the supporting arms are pivotally mounted on a horizontal axis on the warper frame, and in which the second connectors are detachably connected to the beam gudgeons, together with means for swinging the arms downwardly about their pivots until the weights rest upon the floor slacking the connectors and enabling the beam readily to be doffed.

9. A warper comprising the construction defined in claim 6, together with yielding means interposed in each of the second flexible connectors acting to dampen minor vibrations of the beam.

10. A warper comprising a driving drum, a warp beam having gudgeons movably supported to cause the beam to rest against the drum and to move away from the drum as the yarn is wound on the beam by the frictional engagement of the drum therewith, a pair of idlers fixedly supported forward of the beam gudgeons, a flexible connector extending over each idler, a weight suspended by each of said connectors, a second flexible connector connected to each beam gudgeon and extending downwardly therefrom, and means supported from the warper frame interposed between said connectors and acting, as the gudgeons move away from the drum during the winding operation, to reduce the downward pull transmitted from the weights to the gudgeons.

11. A warper comprising a driving drum, a warp beam having gudgeons movably supported to cause the beam to rest against the drum and to move away from the drum as the yarn is wound on the beam by the frictional engagement of the drum therewith, a pair of idlers fixedly supported forward of the beam gudgeons, a flexible connector extending over each idler, a weight suspended by each of said connectors, a second flexible connector connected to each beam gudgeon and extending downwardly therefrom and a cam device for each pair of connectors pivotally mounted on the warper frame having two oppositely disposed lobes with the ends of the said connectors respectively connected

thereto and acting, as the gudgeons move away from the drum during the winding operation, to reduce the downward pull transmitted from the weights to the gudgeons.

12. A warper having the construction defined in claim 10, in which a spring is interposed in each of said second flexible connectors acting to dampen minor vibrations of the beam.

13. A warper comprising a driving drum, a warp beam having gudgeons, a pair of supporting arms extending forward of the drum having supporting surfaces extending forward and upward in a convex curve to support and guide the gudgeons as the yarn is wound on the beam by the frictional engagement of the drum therewith, and means for applying a variable amount of additional weight to the beam gudgeons, the said means acting in correlation with the curvature of the surfaces of the supporting arms, the weight of the beam and the increasing weight and diameter of the yarn mass to effect a predetermined resultant pressure of the beam on the drum as the yarn is wound on the beam.

14. A warper comprising the construction defined in claim 13, in which the means for applying a variable amount of additional weight to the beam gudgeons includes a yielding element acting to dampen minor vibrations of the beam.

15. A warper comprising a driving drum, a warp beam having gudgeons mounted to move toward and from the drum and permit the warp beam to rest against the drum and to move away from the drum as the yarn is wound on the beam by the frictional engagement of the drum therewith, a weight acting on each gudgeon to keep the beam from jumping when rotated at high speed, and a spring interposed between each weight and its gudgeon to neutralize minor vibrations of the beam.

16. A warper comprising a driving drum, a warp beam supported to rest against the drum and to move away from the drum as the yarn is wound on the beam by the frictional engagement of the drum therewith, means acting to cause the resultant pressure on the drum from the beam due to the weight of the beam and its supports and the gradually increasing weight of the yarn mass on the beam to remain substantially constant as the yarn is wound on the beam, and means for presenting a gradually decreasing additional resistance to the movement of the beam as the yarn is wound on the beam, said two means acting in conjunction to effect a gradually decreasing total resultant pressure of the beam on the drum to compact and prevent bulging of the yarn mass as the yarn is wound on the beam and to prevent the beam from jumping when rotated at high speed.

17. A warper comprising a driving drum, a warp beam supported to rest against the drum and to move away from the drum as the yarn is wound on the beam by the frictional engagement of the drum therewith, means acting to cause the resultant pressure on the drum from the beam due to the weight of the beam and its supports and the gradually increasing weight of the yarn mass on the beam to remain substantially constant as the yarn is wound on the beam, and means for presenting an additional resistance to the movement of the beam varying in a predetermined degree as the yarn is wound on the beam to effect a predetermined variation in the total resultant pressure of the beam on the drum.

18. A warper comprising a driving drum, a warp beam having gudgeons, a pair of supporting arms extending forward of the drum, a pair of gudgeon blocks supporting the beam gudgeons and movable along the arms as the yarn is wound on the beam by the frictional engagement of the drum therewith, the surfaces of the arms upon which the gudgeon blocks move extending forward and upward in a convex curve shaped to cause the total weight of the beam and yarn as the yarn is wound on the beam to exert a substantially constant resultant pressure on the drum, means for applying an additional resistance to the movement of the gudgeons away from the drum to prevent the beam from jumping when rotating at high speed and means for gradually decreasing the amount of said additional resistance from the beginning of the winding operation thus to cause a gradual decrease in the resultant pressure of the beam on the drum due to said additional resistance thus to compact and prevent bulging of the yarn mass.

19. A warper comprising a driving drum, a warp beam having gudgeons, a pair of supporting arms extending forward of the drum, a pair of gudgeon blocks supporting the beam gudgeons and movable along the arms as the yarn is wound on the beam by the frictional engagement of the drum therewith, the surfaces of the arms upon which the gudgeon blocks move extending forward and upward in a convex curve, and means for applying a gradually decreasing amount of additional resistance to the movement of the beam gudgeons from the beginning of the winding operation, the said means acting in correlation with the curvature of the surfaces of the supporting arms, the weight of the beam and the increasing weight and diameter of the yarn mass to effect a gradually decreasing resultant pressure of the beam on the drum to compact and prevent bulging of the yarn mass as the yarn is wound on the beam and to prevent the beam from jumping when rotating at high speed.

20. A warper comprising a driving drum, a warp beam supported to rest against the drum and to move away from the drum as the yarn is wound on the beam by the fric-

tional engagement of the drum therewith, means acting to cause the resultant pressure on the drum from the beam due to the weight of the beam and its supports and the gradually increasing weight of the yarn mass on the beam to remain substantially constant as the yarn is wound on the beam, means for presenting an additional resistance to the movement of the beam as the yarn is wound on the beam further to control the pressure on the drum from the beam and to prevent the beam from jumping when rotated at high speed, means interposed between the beam and said additional resistance presenting means acting to absorb abnormal changes in the force exerted by the beam in opposition to said resistance.

21. A warper comprising the construction defined in claim 16, together with means interposed between the beam and said additional resistance presenting means acting to absorb abnormal changes in the force exerted by the beam in opposition to said resistance.

22. A warper comprising the construction defined in claim 17, together with means interposed between the beam and said additional resistance presenting means acting to absorb abnormal changes in the force exerted by the beam in opposition to said resistance.

In testimony whereof, we have signed our names to this specification.

CLARE H. DRAPER.
EARL H. TREVETT.