SHUTTLE DRIVING APPARATUS FOR WEAVING LOOMS

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ABSTRACT OF THE DISCLOSURE

A loom shuttle is actuated by the rod of a driving piston in a pneumatic cylinder also equipped with an axially movable carrier piston. Two catch levers movably mounted on the carrier pivot pin having an axis transverse to the cylinder axis have first arms which can enter the hollow interior of the piston through a restricted opening when the second arms are spread apart, but are locked in the piston by camming engagement of cooperating conical frontal cam faces with the opening in the piston, and are moved apart by camming engagement of the second lever arms with a stationary control ring on the cylinder during movement of the carrier.

The present invention relates to weaving looms.

In particular, the present invention relates to structure for driving the shuttle of a weaving loom.

It is a primary object of the present invention to provide an improved and simplified shuttle-driving apparatus in which the accumulated power of a source of energy is applied to the shuttle through the action of an intermediate member.

In order to achieve the required high shuttle speeds to be transmitted to the shuttle by way of the intermediate member, conventional mechanisms herefore used for this purpose are not satisfactory.

With known shuttle drives, the shuttle is driven from a source of energy in the form of compressed air, a compressed spring, or the like. In these cases, it is always necessary to release the power of the accumulated energy, at an accurately determined instant, by way of an intermediate mechanism such as a release device which transmits the energy to the shuttle. These intermediate mechanisms, beside transmitting the driving force to the shuttle, can perform some additional operating functions. In each case, however, these intermediate mechanisms are required to release the accumulated energy to the shuttle instantaneously when they are at an accurately predetermined position, without any losses.

For example, in the case of driving the shuttle by the expansion of compressed air, it is essential to situate between the compressed air and the shuttle an intermediate member such as a piston rod. In this case it is advantageous to use the piston rod itself for releasing and transmitting the energy to the shuttle. With the known constructions, the front end portion of the piston rod provides the release action. Therefore, the shaft portion of the piston rod must connect with a release mechanism up to the instant when actual releasing takes place. At some instant of release the area of contact between the piston rod and the release mechanism diminishes up to a point contact, and as a result the piston rod and the release mechanism frictionally rub against each other in an undesired manner. In the event that the release mechanism is not reliably displaced to the desired extent out of the path of movement of the piston rod, the piston rod itself is thrown out of its proper path. Therefore, this type of release is highly undesirable since the resistances encountered during the release action, which is to say the transverse forces and the friction, result in substantial losses of speed which might otherwise be applied to the shuttle, and furthermore there is an extremely high wear at the shuttle itself as well as at the moving components of the release mechanism.

While it is known to provide constructions where the piston rod is held at a rear portion thereof, this type of construction requires the rear portion of the piston rod to be enlarged, so that with a given pneumatic force the speed which would otherwise be applied to the shuttle is reduced because of the additional mass of the piston rod at its rear portion. The holding and release of the piston rod should be very precisely and reliably carried out by the release mechanism, and for this purpose it is not of particular advantage to use the uncontrollable movement and operation of springs, as is the case with known constructions, since during improper or inaccurate operation of the springs, the piston rod and the shuttle are not properly operated and improper loom operation results.

It is, therefore, an object of the present invention to provide a construction which will avoid the above drawbacks.

A further object of the present invention is to provide a construction where the moving components have a very small weight.

Furthermore, it is an object of the present invention to provide a construction which does not use any springs which during the operation can break or which through fatigue or over-loading can provide improper operation.

In addition, it is an object of the invention to provide a construction of the above type which is highly resistant to wear of the components.

According to the present invention, a piston assembly is provided for driving the shuttle in response to the power of a source of energy which acts on the piston. A pair of catch levers have a common turning axis normally to hold the piston in an initial position and may release the driving piston to the power of the source of energy. The levers are released by a stationary cam.

The invention is illustrated by way of example in the accompanying drawings which form part of this application and in which:

FIG. 1 is a partly sectional and partly schematic elevation of one possible embodiment of a structure according to the present invention, the sectional portion of FIG. 1 being taken in a plane which contains the axis of a driving piston assembly of the structure of the invention;

FIG. 2 is a fragmentary, longitudinal sectional elevation of the holding and release structure of the invention shown at an enlarged scale as compared to FIG. 1 and taken in a plane which contains the axis of the driving piston and a cylinder in which it slides;

FIG. 3 shows the position which the parts of FIG. 2 assume in order to release the driving piston, the parts being shown in FIG. 2 in their holding position holding the driving piston in opposition to the power of a source of energy; and

FIG. 4 is a transverse section taken along line A-A' of FIG. 2 and showing how a pair of catch levers of the invention coat with a piston of a driving piston assembly of the present invention.

Referring now to FIG. 1, the supporting frame 1 of the loom is fragmentarily illustrated and fixedly carries a supporting body 31 which in turn fixedly carries a pressure cylinder 2 which extends partly into the body 31, in the manner shown in FIG. 1. A driving piston assembly is formed by a piston 3 and a piston rod 4 fixed to and extending therefrom, this piston rod 4 being integral with
the piston 3, for example. The driving piston 3 axially slides in the pressure cylinder 2, and a carrier piston 5 also slides in the cylinder 2. The piston 3 has a sealing ring 7 while the piston 5 has sealing rings 7.

The piston rod 4 is guided through a sleeve 8 for movement outwardly beyond the pressure cylinder 2 and at its left free end 9 forms an impact member to engage the shuttle 10 which is situated in a known manner in the body 11. The piston is formed with a hollow interior space or cavity 12 which is directed away from the piston rod 4, and at its end which is distant from the piston rod 4 the piston 3 has an inwardly directed annular flange 13 provided at its interior with a conical cams surface about the restricted access for the piston cavity 12 formed by the inner periphery of the flange 13.

The structure of the invention includes a pair of catch levers 15 respectively having first arms 14 and 14' which extend into the hollow interior 12 of the piston 3 when the catch levers 15 of the invention are in their holding position. The catch levers 15 are supported for turning movement by a common pivot pin 16 which extends transversely of the cylinder axis and is carried by an integral fork portion 17 of the piston 5. The catch levers 15 extend into the space between the pair of parallel walls of the fork portion 17 of the piston 5.

In accordance with the invention, the arms 14, 14' of the catch levers 15 have locking surfaces 18, 18' which form parts of cones tapering toward the pin 16 and which engage the inner camming surface of the flange 13, in the manner shown most clearly in FIG. 2, when the levers 15 are in their holding positions, shown in FIG. 2, holding the driving piston assembly 3 against movement by the force or power of a source of energy. The arms 14 and 14' also have conically curved control surfaces 19, 19', respectively, which are inclined oppositely to the locking surfaces 18, 18', the surfaces 18, 18' and 19, 19' of each lever 15 intersecting at the common base of the respective cones along a crest 29 which forms part of a circle. The second arms 21 and 21' of the levers 15 are respectively provided with conically curved control surfaces 22.

The circularly arcuate intersecting edge 29 between the conical control surfaces of each arm 14, 14' has a smaller radius of curvature than the opening formed by the inner periphery of the flange 13 of the piston 3.

The structure of the invention further includes a control ring 23 fixed to the interior of the pressure cylinder 2, by means of screws 30, and at its end which is directed toward the piston 3 this ring 23 is provided at its inner periphery with a frusto-conical camming surface 24.

The piston 5 is axially bored so as to have an axial passage 25 through which compressed air is introduced into the cylinder 2 in a well known manner, and the space 28 behind the piston 3 is capable of communicating with the outer atmosphere through a passage 26 shown in FIG. 1, which is also used in a well known manner for directing air under pressure into the space 28 so as to return the piston 3 to its initial position, shown in FIGS. 1 and 2.

As is apparent from FIG. 4, the arms 14 and 14' of the lever 15 have an L-shaped cross sectional configuration so as to provide for a highly superior and precise guiding of the pair of catch lever means which move at all times in opposition to each other.

The holding position of the apparatus, in which the levers 15 hold the piston 3 in its initial, retracted, starting position, is also indicated in FIGS. 1 and 2. In this position the arms 21, 21' extend into the ring 23 which is stationary, so that the arms 21, 21' overlap each other and are substantially coextensive, as viewed in FIG. 2. The arms 14 and 14' are offset from each other to the greatest extent and their locking surfaces 18 and 18' engage the inner periphery of the flange 13 while the ring 23 secures the levers 15 in their holding position shown in FIGS. 1 and 2. The contact of the arms 14 and 14' with the inner surface of the hollow piston 3 extends over a relatively large area.

When air under pressure is introduced into the compression chamber 27 between the pistons 5 and 3 through passage 25 while an unillustrated known mechanism driven from the main shaft of the machine advances the piston 5 toward the left so that arms 21, 21' move outwardsly of the ring 23, the arms 14 and 14' act on the piston 3 to advance the latter together with the piston 5 toward the left.

As soon as the arms 21, 21' move beyond the cylindrical interior of the ring 23, the movement of the piston 5 toward the left is terminated, and the movement of the piston 3 continues so that the arm 14 extends beyond the ring 23 of the flange 13 of the piston 3 acts on the locking surfaces 18 and 18' of the lever arms 14 and 14' to displace these lever arms toward each other while at the same time the arms 21 and 21' turn apart from each other toward the position shown in FIG. 3. Thus, the driving piston assembly 3, 4 is released and carries out its working stroke during which the impact end 9 of the piston rod 4 drives the shuttle 10 in which a known way is situated in the body 11. The air escapes from the chamber 28 through the passage 26 in the body 31.

When the driving piston assembly 3, 4 has completed its working stroke, it returns to its starting position under the pressure of fluid entering the space 28 through a known valving arrangement. During this return movement of the driving piston towards its starting position, the levers 15 remain in the release position shown in FIG. 5, and the arms 14 and 14' are received again in the hollow space 12 of the piston 3 after clearing the opening defined by the inner periphery of the flange 13. Even if the larger weight of the arms 21 and 21' should have displaced the arms 14 and 14' from the releasing position, the inner periphery of the flange 13 engages the conical camming surfaces 19 and 19' of the arms 14 and 14' to move the latter near each other and permit them to be received again into the hollow interior of the piston 3 as the latter returns to its starting position.

As soon as the piston 3, during its continued return movement, moves beyond the position shown in FIG. 5, so that the inner periphery of the flange 13 moves beyond the crests 29 of the arms 14 and 14', the piston 3 is moved by the control mechanism operated from the main shaft of the loom toward the right, so that the arms 21 and 21' enter into the stationary ring 23. The camming surface 24 of the ring 23 engages the control surfaces 22 and 22' of the arms 21 and 21', respectively, to swing the lever arms 14 and 14' apart from each other about the pivot pin 16.

When the piston 5 has again reached, with respect to the ring 23, the position shown in FIG. 2, the entire release mechanism again assumes the holding position.

The described operating cycle is carried out repeatedly during the successive cycles of operation of the shuttle.

The release mechanism does not have any springs which during the operation can break or which can provide improper functioning or actuation of the structure as a result of fatigue and overloading of the springs.

The levers 15 are controlled only by camming engagement of conically curved control surfaces 18, 18', 19, 19', 22 and 22', which is of considerable advantage for the proper functioning of the entire assembly and for the long life thereof.

The L-shaped cross sectional configuration of the arms 14 and 14', as shown in FIG. 4, enables these arms to have the largest possible area of contact with the inner surface of the piston 3, so that wear of the components is reduced to a minimum.

We claim:

1. An apparatus for driving the shuttle of a loom having a pressure cylinder member, a driving piston assembly including a piston member of axially movably in
the cylinder member, means for admitting a pressure fluid to the cylinder member and for releasing the fluid from the cylinder member so as to move the piston member, means for drivingly connecting the piston assembly to the shuttle, and catch means for holding the piston member in a predetermined axial position against the pressure of said fluid, the improvement in the catch means which comprises:

(a) a carrier member axially movable in said cylinder;
(b) lever means mounted on said carrier member for pivotal movement about a turning axis transverse of the axis of said cylinder member between a holding position and a releasing position;
(c) cooperating first cam means on said lever means and on said cylinder member engageable for moving the lever means from one of said position to the other position in response to axial movement of the carrier member in said cylinder member;
(d) cooperating second cam means on said piston member and on said lever means engageable for moving the lever means from said other position toward said one position thereof in response to relative axial movement of said carrier member and of said piston member in said cylinder member; and
(e) cooperating locking means on said piston member and on said lever means engageable by movement of the lever means about said turning axis from the releasing toward the holding position when said piston member and said carrier member are in a predetermined relative axial position for holding said piston member in said predetermined position.

2. In an apparatus as set forth in claim 1, said one position of the lever means being said releasing position.

3. In an apparatus as set forth in claim 1, said piston member being formed with a cavity therein and having a flange portion defining a restricted opening for axial access to said cavity, said lever means clearing said flange portion for axial movement into and out of said cavity when in said releasing position, said flange portion and said lever means having respective locking faces transverse of the axis of said cylinder member and constituting said locking means.

4. In an apparatus as set forth in claim 3, said flange portion having an inner periphery about said restricted opening and said lever means having a cam face obliquely inclined relative to the axis of said cylinder member, said periphery and said cam face constituting said second cam means.

5. In an apparatus as set forth in claim 1, said lever means including two lever members mounted on said carrier member for movement about said turning axis, each lever member having a first arm and a second arm, said first arms being remote from each other transversely of the axis of said cylinder member and said second arms being near each other in said other position of the lever means, and the first arms being near each other and the second arms being remote from each other transversely of the axis of said cylinder member in said one position of said lever means, said one position being said releasing position.

6. In an apparatus as set forth in claim 5, said cylinder member and second arms of said lever members having respective cam faces constituting said first cam means.

7. In an apparatus as set forth in claim 1, a first and a second conically curved face on said lever means, said first conically curved face cooperating with a conically curved face on said cylinder member and constituting together with said face on said cylinder member said first cam means, said second conically curved face cooperating with a conically curved face on said piston member and constituting together with said face on said piston member said locking means, said first and second faces on said lever means and said faces on said cylinder and piston members being conically curved about the axis of said cylinder member, cooperating faces, when in engagement, making area contact.

8. In an apparatus as set forth in claim 7, said second cam means including a third conically curved cam face on said lever means, said second and third cam faces sloping toward said axis of the cylinder member in a direction away from each other axially of said cylinder member.

9. In an apparatus as set forth in claim 8, said second and third cam faces intersecting each other in a circular arc about the axis of said cylinder member in the releasing position of said lever means, said piston member being formed with a cavity therein and with a restricted opening for axial access to said cavity, said opening being substantially circular and having a radius greater than the radius of said circular arc.

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