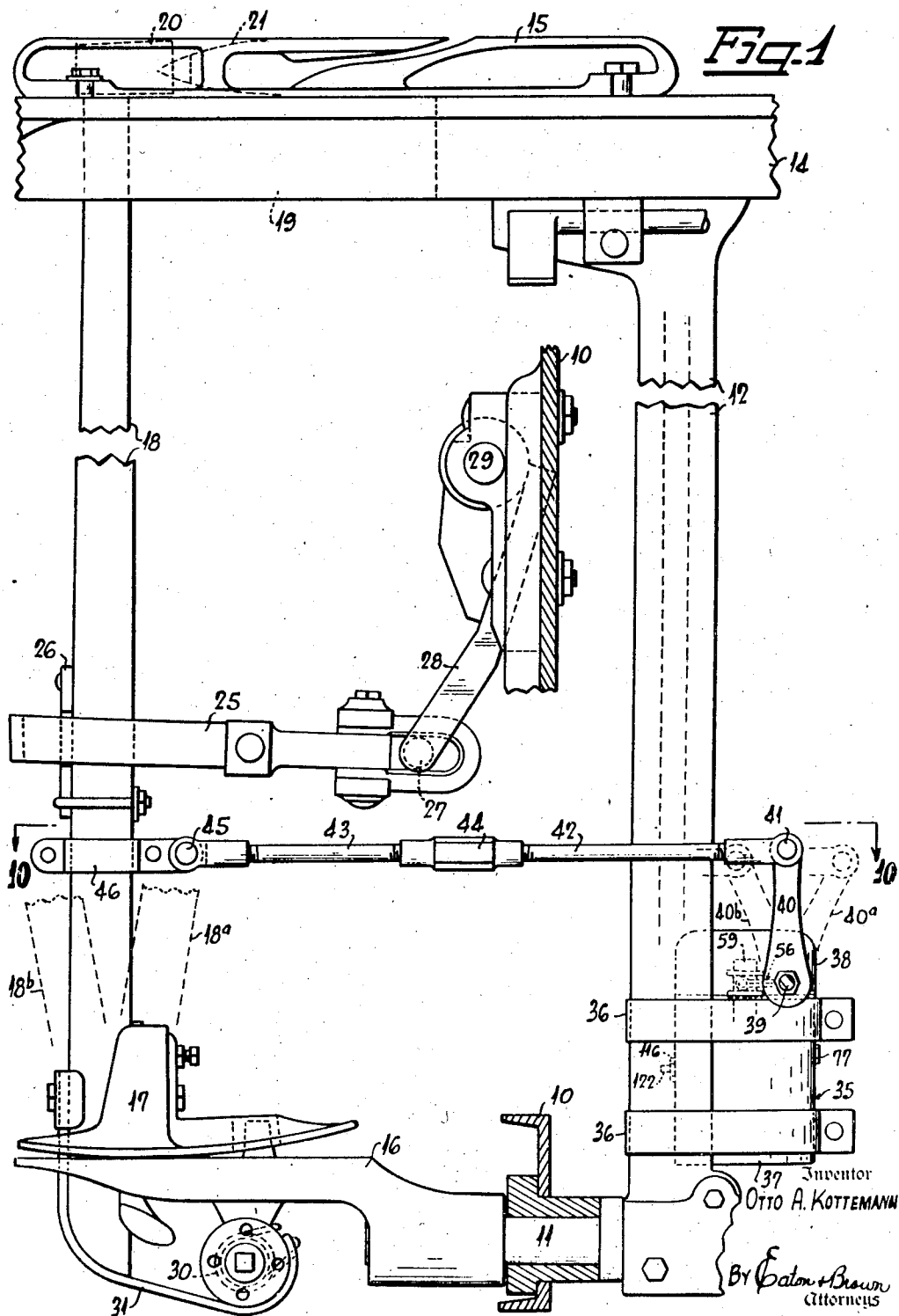


O. A. KOTTEMANN

HYDRAULIC CHECK FOR LOOMS

Filed Nov. 23, 1942.

4 Sheets-Sheet 1



Dec. 30, 1947.

O. A. KOTTEMANN

2,433,764

HYDRAULIC CHECK FOR LOOMS

Filed Nov. 23, 1942

4 Sheets-Sheet 2

Fig. 4

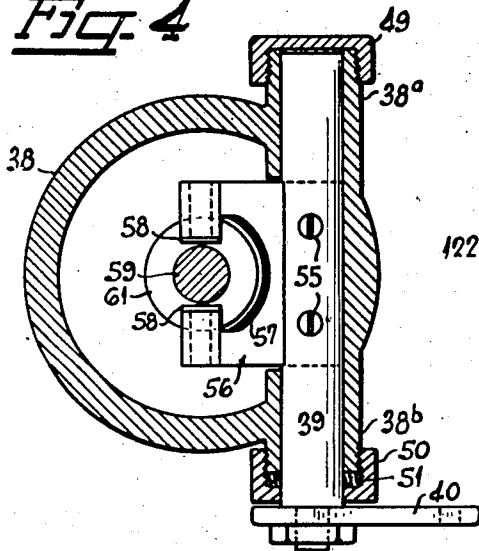


Fig. 5

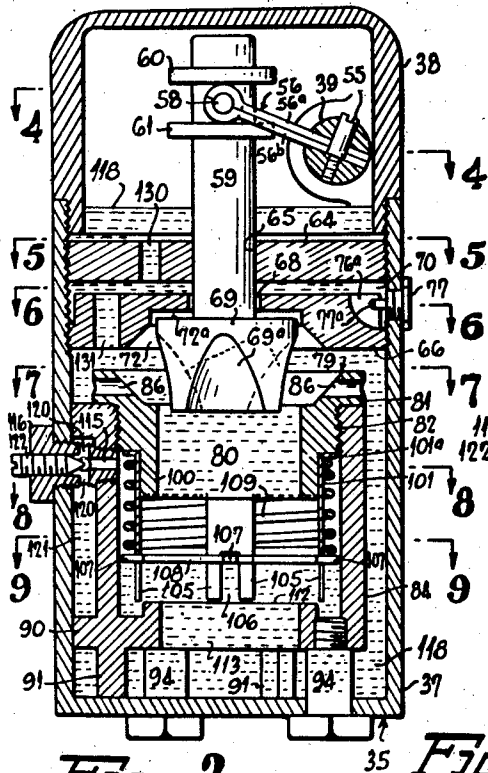
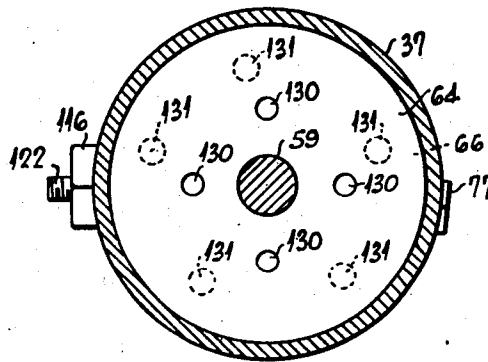
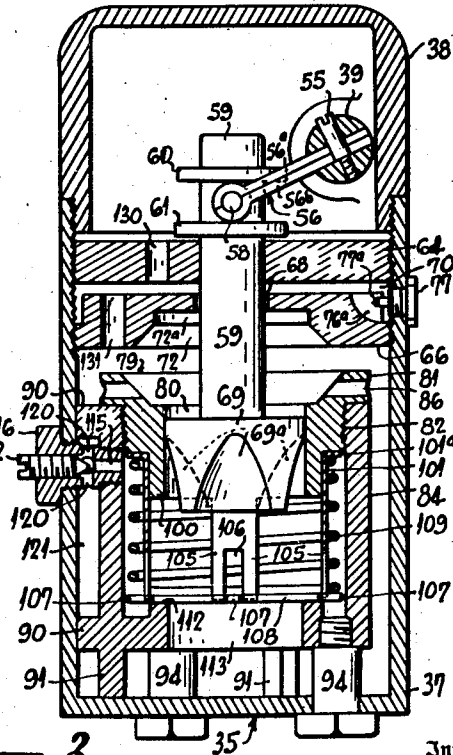


Fig. 2

Fig. 3



Inventor:
OTTO A. KOTTEMANN

Eaton & Brown
Attorneys

Dec. 30, 1947.

O. A. KOTTEMANN

2,433,764

HYDRAULIC CHECK FOR LOOMS

Filed Nov. 23, 1942

4 Sheets-Sheet 3

Fig. 10

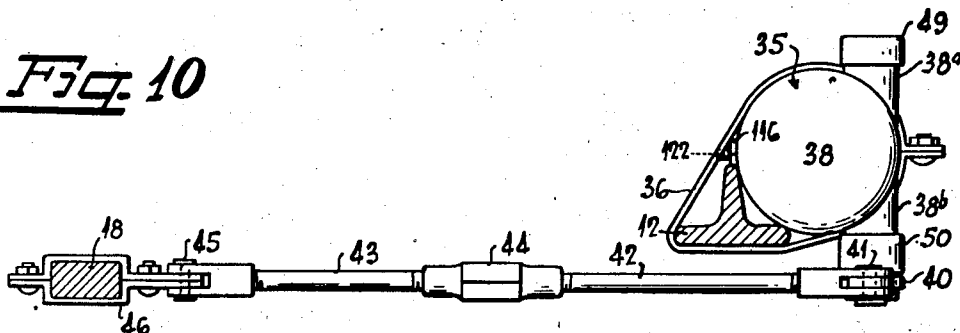


Fig. 6

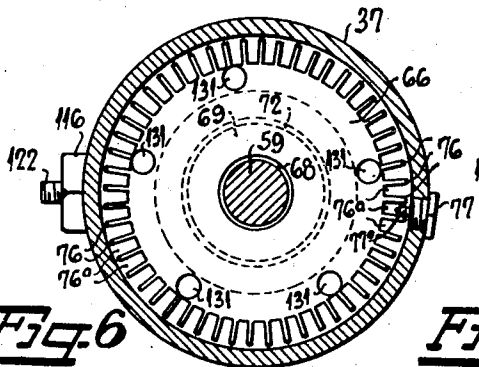


Fig. 7

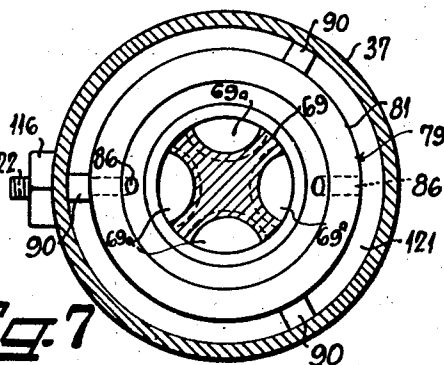


Fig. 8

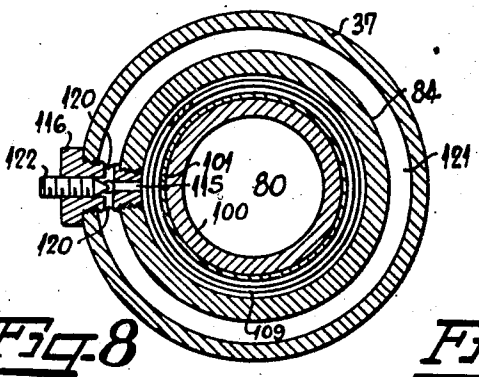
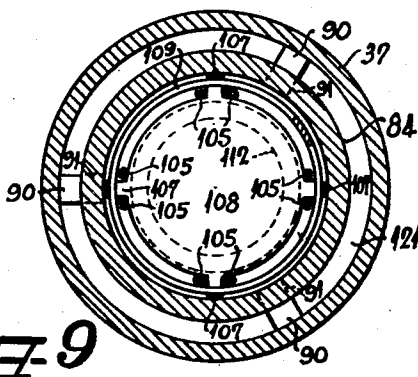


Fig. 9



Inventor:
OTTO A. KOTTEMANN

Eaton & Brown
Attorneys

Dec. 30, 1947.

O. A. KOTTEMANN

2,433,764

HYDRAULIC CHECK FOR LOOMS

Filed Nov. 23, 1942

4 Sheets-Sheet 4

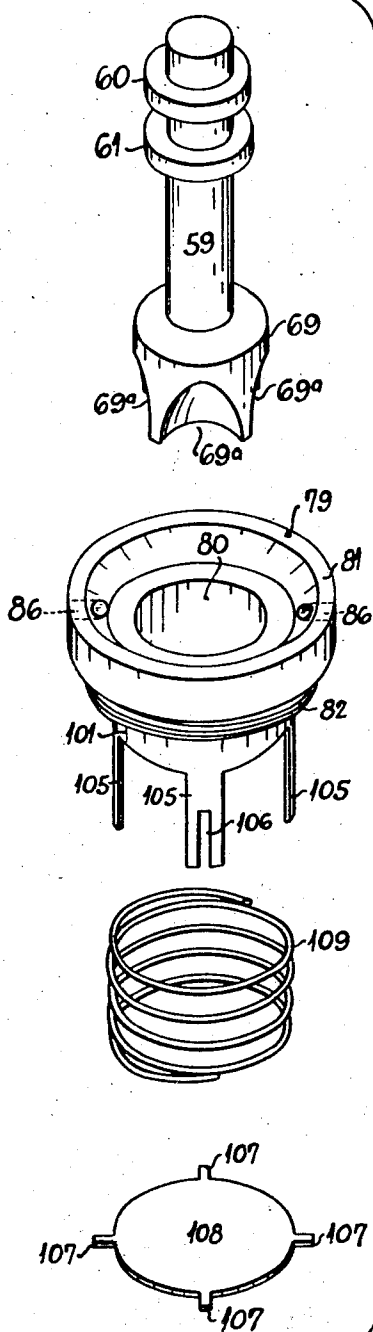


Fig. 11

Fig. 12

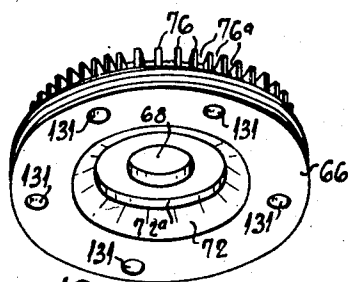
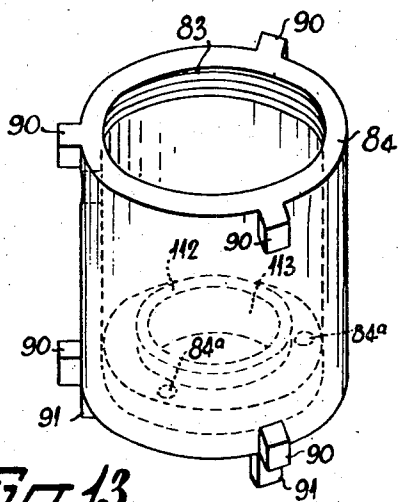


Fig. 13



Inventor:
OTTO A. KOTTEMANN

Eaton & Brown
Attorneys

UNITED STATES PATENT OFFICE

2,433,764

HYDRAULIC CHECK FOR LOOMS

Otto A. Kottemann, Greenville, S. C., assignor to
William D. Dodenhoff, Greenville, S. C.

Application November 23, 1942, Serial No. 466,565

25 Claims. (Cl. 139—161)

1

This invention relates to a snubbing device and more especially to a hydraulic check or snubber for checking the oscillatory movement of a loom picker stick at the ends of its inner and outer strokes.

In the operation of present day looms, the shuttle is propelled back and forth along the loom lay and through the warp shed at very high speeds. Some looms operate at 200 or more picks per minute, and therefore, the problem of properly expelling and receiving the shuttle at the ends of its path of travel becomes highly important. For example, if the forward or inward motion of the picker stick is not properly controlled, when the shuttle is expelled from the shuttle box, the shuttle is likely to be thrown "wild," or out of its prescribed path of travel, and thus produce defective cloth. Also it is very essential to yieldingly bring the picker stick to rest as soon as possible after its forward stroke has been delivered.

The checking of the picker stick on its outward or retraction stroke is equally important, because the impact of the incoming shuttle must be partially absorbed by the picker on the upper end of the stick. If the stick does not yield properly when the shuttle first engages the picker, the shuttle will rebound and be improperly positioned for the succeeding inward stroke; however, the movement of the stick must be arrested within a comparatively short space.

It is therefore an object of this invention to provide a hydraulic check or snubber which is adapted to arrest a loom picker stick at the limits of its inner and outer strokes. In the present embodiment of the invention, a liquid containing cylinder having a piston therein is operatively connected to the lower portion of the picker stick, so that the piston will be reciprocated back and forth by the picker stick oscillation. During this reciprocation, the flow of the liquid from one side of the piston to the other is controlled in accordance with the checking action desired, and as a result, the inward and outward movements of the picker stick are yieldingly arrested. The conventional picker stick operating mechanism, such as a lug strap, is adapted to be employed in association with the present checking device.

It is another object of this invention to provide a two-way picker stick check of the class described in combination with means for respectively varying the arresting action of the stick on the inner and outer strokes.

It is another object of this invention to pro-

2

vide a snubbing device comprising a liquid pressure cylinder into which a generally tapered piston is adapted to enter, the cross sectional area of said piston being substantially the same size and shape as the cylinder at its larger end and gradually diminishing in cross sectional area to its smaller end, so that as the smaller end moves into the cylinder, the escape of liquid will gradually diminish and thus offer increased resistance to the inward movement.

It is another object of this invention to provide a two-way hydraulic check or snubbing device comprising the above-named combination of a cylinder and tapered piston for arresting the movement in one direction, and a dashpot associated with the larger end of the piston for arresting the movement in the opposite direction.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings in which:

Figure 1 is an elevation of a portion of a loom, showing certain portions thereof in section, and illustrating an improved hydraulic snubbing apparatus for checking the movements of the loom picker stick at the inner and outer stroke limits, the apparatus being shown in its approximate position for receiving the impact of the shuttle against the picker;

Figure 2 is an enlarged vertical sectional view through the snubber unit, showing the portions therein in a position corresponding with the inner stroke limit of the picker stick;

Figure 3 is a sectional view similar to Figure 2 but showing the interior portions thereof in a position corresponding with the outer stroke limit of the picker stick;

Figure 4 is a sectional plan view taken along the line 4—4 in Figure 2;

Figure 5 is a sectional plan view taken along the line 5—5 in Figure 2;

Figure 6 is a sectional plan view taken along the line 6—6 in Figure 2;

Figure 7 is a sectional plan view taken along the line 7—7 in Figure 2;

Figure 8 is a sectional plan view taken along the line 8—8 in Figure 2;

Figure 9 is a sectional plan view taken along the line 9—9 in Figure 2;

Figure 10 is a sectional plan view taken along the line 10—10 in Figure 1, illustrating the connecting means between the snubber unit and the loom picker stick;

Figure 11 is an exploded isometric view of certain interior portions of the snubber unit;

3

Figure 12 is an isometric view of the dash-pot plate which is adapted to work in conjunction with the piston disposed within the pressure unit;

Figure 13 is an isometric view of a pressure cylinder which receives the parts shown in Figure 11 when the pressure unit is in an assembled position.

Referring more particularly to the drawings, the numeral 10 denotes portions of a loom frame, in which is mounted for oscillation a conventional rocker shaft 11, said rocker shaft having the lower end of a loom sword 12 fixedly secured thereto. This loom sword extends upwardly and is adapted to support a lay 14 which, in turn, supports a shuttle box 15.

Rocker shaft 11 also has fixedly secured thereto a base member 16, upon which a picker stick shoe 17 is adapted to rock back and forth. Shoe 17 supports an upwardly extending picker stick 18, which stick penetrates a slot 19 in the lay 14. The upper projecting end of the picker stick 18 is disposed within the shuttle box 15, and has a picker 20 secured thereon, said picker being adapted to receive and expel a conventional loom shuttle 21 during the normal operation of the loom.

In order for the picker stick 18 to be rotated in a clockwise manner about shoe 17, when the shuttle 21 is to be expelled from the shuttle box, it is necessary to provide some suitable means such as a conventional lug strap 25. One end of this lug strap encircles the intermediate portion of the picker stick and is held in position by means of notched hold-up strap 26. The other end of this lug strap is connected as at 27 to a lever 28, said lever being pivoted as at 29 to the loom frame 10. A conventional means, not shown, is employed for oscillating the lever 28 back and forth about pivot point 29 to thereby impart the necessary sudden thrust upon the picker stick and cause the shuttle 21 to be expelled from the shuttle box 15.

After the shuttle has been expelled, the picker stick 18 will move toward outermost position 18b by virtue of a conventional torsion spring 30; however, it will stop short of that position, according to usual practice, for instance, approximately as indicated in Fig. 1. Here the spring tension may be quite low or near zero, and the conventional check stop (not shown) may impede and thus momentarily stop the picker stick, in position to receive the shuttle impact, whereupon the check strap absorbs part of the momentum involved. This spring is disposed beneath the base member 16 and normally rotates the picker stick 18 and shoe 17 in a counter-clockwise manner through the medium of a strap 31.

When the loom is in operation, the members 12 to 20 inclusive are adapted to rock back and forth toward and away from the observer in Figure 1 about the rocker shaft 11 as an axis. At the same time, the picker stick 18 and its associated picker 20 oscillates back and forth in a plane disposed substantially at right angles to the plane of oscillation of members 12 to 20 to thereby receive and expel the shuttle 21 into and from the shuttle box 15. It is, of course, understood that in each loom structure there is an opposite-hand structure to the structure shown in Figure 1 disposed on the opposite side of the loom. In other words, the picker stick 18 propels the shuttle 21 from the shuttle box 15 to a similar shuttle box on the opposite side of the loom, and when the shuttle reaches this oppositely disposed

4

shuttle box, a picker such as indicated by reference character 20 is adapted to receive the nose of the shuttle. This picker stick on the opposite side then propels the shuttle reversely through the shed to the shuttle box 15 shown in the drawings, where the picker 20 will receive the nose of the shuttle.

The above-described mechanism and mode of operation is conventional in loom structures, but it is thought necessary to describe and illustrate this mechanism in order to more clearly set forth the function of the present invention.

Since higher speed looms make it necessary to propel the shuttle 21 across the warp sheds at a correspondingly increased rate of travel, there is a resultant increase of force to be checked when the shuttle reaches the shuttle box. There is also an increased momentum of the picker stick itself to be checked after the picker stick has delivered and received its stroke to and from the shuttle. Therefore, it is seen that two checking actions are necessary in order to arrest the picker stick at the outer and inner limits of its stroke.

There is another important factor to be considered when checking the picker stick at the inner and outer limits of its stroke during the operation of a loom; namely, that of having unequal forces to be checked at the respective limits of travel. It is well known that the inward stroke of a picker stick, when expelling the shuttle from the shuttle box, is of considerably greater force than the outward stroke of the picker stick, which results from an incoming shuttle striking the picker on the upper end of the picker stick as it enters the box because the binder ordinarily assists in stopping the shuttle when it enters the shuttle box. However, proper checking of the outward stroke of the picker stick is a critical matter if rebound of the shuttle is to be prevented, and hence this checking action is much more important than that of checking the inward stroke of the picker stick. For these reasons, the snubbing or checking apparatus herein described must have a different type of checking mechanism cooperating with the inward stroke of the picker stick from the mechanism which is associated with the outward stroke.

In order to provide a hydraulic snubber or checking apparatus for the picker stick 18, a snubber unit 35 has been secured to the intermediate portion of sword 12 by any suitable means such as band straps 36. This unit comprises a housing 37, said housing having threadably secured upon the upper end thereof a cap member 38. Rotatably mounted in this cap member is a shaft 39 which projects to the exterior of the unit and has fixedly secured on the projecting end thereof the lower end of a lever 40, said lever 40 having pivotally secured to its upper end as at 41 a link 42.

Link 42 is connected to a second link 43 by a turn sleeve 44, therefore, when it is desired to vary the over-all length of links 42 and 43, it is only necessary to manipulate the turn sleeve 44 because the threads on one end of the turn sleeve are right-handed and the threads in the other end are left-handed. The left-hand end of link 43 (Figure 1) is pivotally secured as at 45 to a fitting 46, said fitting being secured around the lower intermediate portion of picker stick 18. During the operation of the loom, the picker stick 18 assumes the dotted line position 18a at the limit of its inward stroke and at the same time, the lever 40 of the snubber unit 35 assumes position 40a. The outer limit of the picker stick 18

5

is also shown in dotted lines and designated by reference character 18b, the corresponding position of the lever 40 being designated by reference character 40b.

By observing Figure 4, it can be seen that the cap member 38 has projecting hubs 38a and 38b extending from opposed sides thereof. These hubs serve as bearings for the shaft 39. The hub 38a has threadably secured over its end a cap member 49, which completely closes this end and prevents leakage of liquid from cap 38, whereas the hub 38b has a similar cap 50 threadably secured thereover, which cap is penetrated by the previously described shaft 39. A packing gland 51 is disposed immediately beneath cap member 50 and around the shaft 39 to prevent leakage. When it is desired to reverse the shaft 39, end for end, and thereby position the lever 40 adjacent the hub 38a, it is necessary to remove the shaft from cap 38, then remove the caps 49 and 50, then reverse the shaft, end for end, and position it again in hub members 38a and 38b, after which the cap member 50 will be placed on hub 38a and the cap member 49 on hub 38b.

The intermediate portion of shaft 39 has secured thereto as at 55 a laminated bifurcated lever 56, said lever 56 being preferably formed from spring plate members 56a and 56b, which, in turn, have their free ends notched as at 57 to form a fork. The prongs of lever 56 have secured in the outer end thereof aligned pins 58, said pins having their proximate ends disposed adjacent the opposed sides of a vertically disposed shaft 59 and between spaced collars 60 and 61 around this shaft. The above-described connection between the shaft 59 and shaft 39 permits the shaft 59 to axially rotate within its bearing while it is being vertically reciprocated. A disk 64, having a centrally disposed bore 65 therein is provided, said bore being adapted to slidably receive shaft 59 and serve as a bearing. Disk 64 is threadably mounted in the upper portion of housing 37.

Disposed immediately below the disk 64, but in spaced relation thereto, is a second disk 66, said disk 66 also being threadably secured on the interior of housing 37. Figure 12 is an isometric view showing the lower face of this disk, whereas Figure 6 illustrates the top face thereof. Disk 66 is provided with a centrally disposed bore 68, which bore is slightly larger than the diameter of shaft 59 to permit free vertical reciprocatory motion of this shaft when the snubbing apparatus is in operation. The space between disks 64 and 66 is designated by reference character 70.

Shaft 59 penetrates bore 68 and has fixedly secured on the lower end thereof a cylindrical piston 69 fluted at 69a. The upper portion of the fluted piston has a larger cross-sectional area, but the lower portion gradually tapers inwardly until, at the lower or front end thereof the cross-sectional area is much less.

When the shaft 59 and piston 69 are in raised position, as shown in Figure 2, the picker stick 18 and lever 40 are disposed in dotted line positions 18a and 40a respectively. (See Figure 1.) Also when in this uppermost position of the piston 69, the enlarged upper portion of the piston 69 is disposed within a cavity 72, which cavity is slightly larger than the upper portion of the piston. Cavity 72 is disposed in the bottom face of disk 66. The function of this cavity 72 is that of a dash-pot, so that when the shuttle has

6

been expelled by the picker 20, the displacement of the liquid by the upper portion of piston 69 will arrest the inward motion of picker stick 18. There is normally a slight clearance 72a between the upper portion of the piston 69 and the base of cavity 72 when the piston 69 is in its uppermost position corresponding to the position 18a of the picker stick. The amount of this clearance may be varied, if desired, to thereby control the time and effect of the retarding action.

By observing Figure 6, it will be noted that the upper face of the disk 66 has a plurality of radially spaced vanes 76 integral therewith, said vanes having the outer edges thereof disposed adjacent the interior periphery of casing 37. The spaces between vanes 76 are designated by reference characters 76a. Penetrating the casing 37 at a point substantially at the same elevation as the vanes 76 is a threaded stud 77, said stud having an inner pointed end 77a which is adapted to fit in one of the spaces 76a between two adjacent vanes 76, and thereby lock the disk 66 in position. When it is desired to raise or to lower the disk 66 within the casing 37 to thereby vary the amount of clearance 72a between the piston 69 and the base of cavity 72, the stud 77 is removed and a pointed object such as a screw driver is inserted so that the inner end of the pointed object will penetrate a space 76a. Since the diameter of the stud screw hole is somewhat larger than the distance between adjacent spaces 76a, the disk 76 can be turned by repeated insertions of the pointed object in the stud hole and spaces, and by applying a rotative force upon the disk at each insertion. Thus the time when the piston enters the dash-pot 72 can be varied.

Concentrically disposed below the disk 66 and in spaced relation thereto is a cylinder 79, said cylinder having a cylindrical bore 80 therein which has substantially the same shape and diameter in cross-section as the upper portion of piston 69. Cylinder 79 has an enlarged rim or flange 81 integral with its upper portion, and immediately below this rim is a restricted threaded portion 82, which portion 82 is adapted to fit into threads 83 on the upper interior periphery of a pressure cylinder 84. (See Figures 2, 3, 11, and 13.) In order to facilitate the insertion and removal of the cylinder 79 within the upper portion of pressure cylinder 84, suitable radially disposed holes 86 are provided in the enlarged portion 81. A suitable wrench or rod may be inserted into these holes to enable rotative motion to be imparted for the insertion or removal of member 79.

Pressure cylinder 84 has radially disposed lugs 90 integral with its outer periphery. The outer edges of these lugs lie in a circle, whose diameter is substantially the same as the interior diameter of housing 37, consequently the lugs 90 will serve to hold the cylinder in proper position. The bottom of the pressure cylinder 84 has lugs 91 integral therewith, which lugs rest upon the bottom of housing 37.

In order to fix the pressure cylinder in position within the housing 37, suitable bolts 94 are provided, said bolts penetrating the bottom of the housing and having the upper ends thereof threadably secured in holes 84a in the bottom of pressure cylinder 84. (Figures 2, 3, and 13.)

The lower portion of pressure cylinder 79 has a restricted skirt portion 100 integral therewith. Around this restricted portion, a valve guide and

spring supporting member 101 is adapted to fit. Member 101 has four pairs of spaced prongs 105 extending downwardly from the lower side thereof, thereby providing four vertical slots 106 between which projections 107 of valve plate 108 are adapted to slidably fit. It is therefore seen that the four projections 107 of the valve plate 108 each slide in a vertical slot 106 between prongs 105 during the operation of the checking mechanism.

A compression spring 109 is disposed around the prongs 105 and has its lower end resting upon the upper surfaces of projections 107. The upper portion of the spring 109 abuts the outstanding flange 101a on the upper portion of valve guide 101, therefore, there is a normal tendency for the spring 109 to urge the valve plate 108 downwardly. When the valve plate is in its lowermost position, it rests upon a valve seat 112, which seat surrounds an opening 113.

Figure 3 shows the valve plate 108 when disposed upon the seat 112. When in this position, the piston 69 is disposed within the bore 80 thereby closing all outlets from the pressure chamber 84 except for a small port 115 in a bleeder valve 116.

The substantially lowermost position of the piston 69, such as shown in Figure 3, corresponds to the dotted line positions 40b and 18b of members 40 and 18. In other words, after the picker stick 18 has received the impact of the shuttle and brought the same substantially to rest in the shuttle box, the piston 69 is at its lowermost position within the pressure cylinder 79. It should be borne in mind that when the piston 69 is near its lowermost position, the entire opening 80 is closed, and therefore, no liquid can escape upwardly therethrough; however, when the lower end of the piston 69 first enters the bore 80 in the manner such as shown in Figures 2 and 7, the tapered flutes 69a, in the lower periphery of the piston 69, permit a substantial amount of the liquid to escape between the outer surface of the piston and the inner side-walls of the bore 80. The flutes 69a taper outwardly and upwardly in curved lines from the bottom of the piston. At a point near the upper edge of the piston, each flute merges with the piston periphery and disappears entirely, thereby providing a piston having its upper portion of substantially the same cross-sectional area as the bore 80 in the cylinder, but having the lower portion cut away so that the cross-sectional area is substantially less than that of said bore. Preferably the shape of the flutes is so curved that the hydraulic resistance to inward movement of the piston increases more rapidly than its depth of penetration into the cylinder. It is to be understood that the piston 69 is so constructed as to form with the cylinder 79 an escape port, or escape passageway, whose flow area decreases progressively as said piston advances into said cylinder.

The remaining lower portions of the piston between the flutes 69a, are of the same diameter as the diameter of the upper portion of the piston where there are no flutes.

As the piston 69 moves downwardly to the position shown in Figure 3, the amount of liquid permitted to escape upwardly around the piston gradually decreases in proportion to the increasing cross-sectional area. It is, of course, evident that the shape, size and location of the flutes 69a will largely determine the amount of resistance

offered to the movement of the picker stick 18, and also the time at which this resistance is offered during the movement of the picker stick. At the time the picker stick 18 begins its outward stroke, the piston 69 moves downwardly into bore 80. Also at this time, the valve plate 108 is seated to close opening 113 under the pressure of spring 109 which prevents escape of the liquid 118 through this opening.

When the picker stick 18 begins its inner stroke, the liquid 118 within the pressure chamber will be suddenly lifted and consequently, the valve 108 will be raised substantially to the position shown in Figure 2 to permit the liquid outside of the pressure cylinder 84 to surge upwardly through the opening 113 into the pressure cylinder 84. This upward movement will be partially resisted, of course, by the compression spring 109 thereabove. It should be borne in mind that as the piston 69 approaches its lowermost position, a certain amount of liquid 118 will be permitted to escape by way of port 115 in bleeder valve 116, and thereafter, the liquid will pass from this port through ports 120 into the annular space 121 between the outer periphery of the pressure chamber 84, and the inner periphery of housing 37. If this bleeder valve were not provided, the resiliently or cushioning effect of the piston 69, as it reaches its lowermost position, would be greatly affected, since it is practically impossible to compress liquid.

The amount of this bleeding action through ports 115 and 120 can be controlled by a screw 122, said screw being threadably secured in valve body 116 and having its inner end pointed and so shaped that it will fit into, and close port 115 when desired. Usually this screw is adjusted to suit operating conditions to thereby permit the proper amount of liquid to flow from the interior of pressure cylinder 84 while the picker stick 18 approaches its outermost stroke limit.

The previously described laminated forked members comprising plates 56a and 56b serve an important function when the piston 69 approaches its lowermost limit. (Figures 2, 3, and 4.) For example, if the port 115 is closed so that an insufficient amount of liquid will be permitted to flow outwardly from the compression chamber, the laminated lever structure 56a and 56b (preferably made of spring steel) will yield or flex; thereby providing a flexible retarder connection between the piston 69 and the picker stick 18. In other words, the plates 56a and 56b will flex long enough to permit the proper amount of liquid 118 to flow out of the compression chamber to the exterior annular space 121 thereby doubly insuring a yielding retarder action for the picker stick 18 at its outer stroke limit. It will be understood that plates 56a and 56b are not relied upon for any checking of the picker stick and shuttle, because resilient action whether furnished by a spring or by a compressible fluid is unsatisfactory; hence it will be clear that these plates are so stiff as to be normally inoperative, but are capable of yielding to avoid breakage of parts in the event that the bleeder valve is closed. The bleeder valve structure designated by reference characters 116, 115, 120, and 122, also permits air to exhaust which might be disposed in the liquid at the upper portion of the annular space 121. If there is any air within the unit, it is desirable to have it disposed as much as

possible in the upper portion thereof, that is, within the hollow cap member.

During the operation of the loom, the unit 35 is bodily oscillated along with the lay; consequently there is a tendency for the liquid 118 to surge upwardly within the unit. It is desirable to maintain the liquid as much as possible in the bottom of the housing so that the piston 69 will always be submerged. It will be noted by referring to Figures 2, 3, 5, 6, and 12 that the disks 64 and 66 have holes 130 and 131 respectively therein. The holes 130, in the upper disk 64, are on a different radius from the holes 131 of the lower disk 66. Also there are a different number of holes in each disk which permits the holes to be staggered. This arrangement of the holes acts as a baffle to minimize the upward flow of liquid 118, as the liquid tends to surge, from the bottom of the unit to the top of the unit. In the present disclosure it is necessary for the liquid to first enter holes 131 and then proceed laterally through the space 70 between disks 64 and 66, after which it travels again upwardly through holes 130.

The checking of the picker stick and shuttle will now be briefly described. As already pointed out, with the beginning of the outward stroke of the picker stick under the influence of the spring 30, the piston 69 begins to enter its cylinder and assists in cushioningly bringing the picker stick substantially to a condition of rest approximately in the position shown in Fig. 1, at which time the shuttle enters the shuttle box and moves past the binder and strikes the picker stick with a powerful impact. The hydraulic resistance tends to rapidly increase substantially in proportion to the velocity of the shuttle. This tendency permits the shuttle to be brought to rest very rapidly and in a very short travel. But since the energy of the shuttle is being absorbed, the force or impulse is being correspondingly diminished, wherefore the hydraulic resistance tends to diminish. Hence too rapid and abrupt stoppage and possible rebound of the shuttle are avoided. But this diminution is affected by the curve of the flutes 69a, which is such that the openings thereat diminish at an increasing rate; in other words, the shape of the flutes tends to cause an increase in hydraulic resistance proportionately greater than the travel of the piston and shuttle. The net result is that the hydraulic resistance may vary approximately in proportion to the travel of the shuttle, which is gradually slowing down, or may diminish more slowly than the rate of reduction in the shuttle speed, the latter condition being preferable. Hence the shuttle is brought to rest quickly but not so rapidly as to cause rebound. Differently stated the rate of retardation preferably slightly increases as the shuttle loses speed. With a check strap the reduction in speed is abrupt and sometimes haphazard. With resilient devices there is a storing up of energy which causes resistance to increase very rapidly so that the shuttle is stopped rather abruptly with consequent rebound. In the present invention, when the shuttle comes to rest, there is zero energy in the system except for a slight amount that may be caused in the spring 30. With resilient systems, the great energy stored would supplement the lug strap actuator 25 and cause such a powerful projecting impulse on the picker stick as to cause the shuttle to be thrown wild; also, a premature impulse might be

caused. It will be noted that when the piston 69 fully enters its cylinder as in Fig. 3, the shuttle is substantially at rest, as already described, the remainder of its energy being expended by resistance at the minute port 115 whereby the precise point at which the shuttle finally stops is determined.

Although the present snubber unit has been described in connection with a loom structure and for the purpose of checking the inner and outer stroke limits of the picker stick, it is to be understood that there are other uses to which the same principle may be employed, consequently, it is thought that considerable novelty resides in the snubber unit per se.

Also the unit is shown mounted upon the loom lay, but in practice it could be mounted upon some stationary object without departing from the spirit of the invention.

The fluted portion of the piston and/or the cylindrical part thereof in conjunction with the cylinder, and including the bleeder valve 122, if need be, may be termed a liquid throttling means. However, the bleeder valve is preferably termed a second throttling means.

In the drawings and specification, there has been set forth a preferred embodiment of the invention and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. Apparatus for rapidly bringing to rest a projectile-like element without rebound and for instantly projecting the same, along a given path, including means for yieldingly receiving the projectile-like element and for powerfully projecting the same, comprising hydraulic means having a casing having a cylinder and a piston therein, a member for receiving the impact of the projectile-like element and for projecting the same, means engaging the member with the piston for moving the latter, the hydraulic means having a restrictive outlet and a low pressure section communicating with the outlet and having an inlet and an automatically operative check valve therefor, the outlet and inlet being spaced along the cylinder and being so related to the piston that when the member receives said impact liquid is forced by the piston through the restrictive opening to absorb the momentum of the projectile-like element, and upon reverse movement of the member and hence of the piston the check valve freely opens to admit liquid to the cylinder.

2. In combination with the picker of a loom and a shuttle which in its flight across the loom strikes said picker, a receptacle, a partition dividing the interior of the receptacle into a main compartment and an auxiliary compartment connected by an opening through the partition, a body of liquid in the receptacle, a piston mounted for reciprocation within the main compartment, and connections from the picker to the piston to drive the piston in a direction such as to force liquid from the main compartment through the opening into the auxiliary compartment when the shuttle strikes the picker, whereby the motion of the picker and shuttle will be checked.

3. A checking device for a shuttle in flight across a loom, comprising impact means engageable by the shuttle approaching the terminus of

said flight, a cylinder, a piston in said cylinder, an outer casing fully enclosing said cylinder and said piston, a liquid contained in said casing and completely filling said cylinder around said piston at all times, means operatively connecting said piston to said impact means for advancing said piston against a substantially isolated component body of said liquid disposed in the path of said piston advancing under impetus of said shuttle striking said impact means, said piston being constructed so as to form with said cylinder an escape port whose flow area decreases progressively as said piston advances, thus permitting diminishing escape of said isolated liquid to decelerate the forward motion of the shuttle in the course of said flight.

4. A checking device for a shuttle in flight across a loom, comprising impact means engageable by the shuttle approaching the terminus of said flight, a cylinder, a piston in said cylinder, an outer casing completely enclosing said cylinder and said piston, a liquid contained in said casing and completely filling said cylinder around said piston at all times, means operatively connecting said piston to said impact means for advancing said piston against a substantially isolated component body of said liquid disposed in the path of said piston advancing under impetus of said shuttle striking said impact means, and means for controlling the rate of displacement of said isolated body of liquid from in front of said piston including a pin having a tapered end projecting into an orifice through which said body of liquid must pass in the final stage of said flight of said shuttle to bring said shuttle to a dead stop at a predetermined point in the course of said flight.

5. A checking device for a shuttle in flight across a loom, comprising impact means engageable by the shuttle approaching the terminus of said flight, a cylinder, a piston in said cylinder, a liquid completely filling said cylinder around said piston at all times, means operatively connecting said piston to said impact means for advancing said piston against a substantially isolated component body of said liquid disposed in the path of said piston advancing under impetus of said shuttle striking said impact means, said piston being constructed so as to form with said cylinder an escape port whose flow area decreases progressively as said piston advances, thus permitting diminishing escape of said isolated liquid to decelerate the forward movement of the shuttle in the course of said flight, and a pin having a tapered end projecting into an orifice through which a predetermined portion of said isolated body of liquid must pass in the final stage of said flight of said shuttle, to bring said shuttle to a dead stop at a predetermined point in the course of said flight.

6. A checking device for a shuttle in flight across a loom, comprising impact means engageable by the shuttle approaching the terminus of said flight, a cylinder, a piston in said cylinder, a liquid completely filling said cylinder around said piston at all times, means operatively connecting said piston to said impact means for advancing said piston against a substantially isolated component body of said liquid disposed in the path of said piston advancing under impetus of said shuttle striking said impact means, said piston being constructed so as to form with said cylinder an escape port whose flow area decreases progressively as said piston advances, thus permitting diminishing escape of said isolated liquid

to decelerate the forward movement of the shuttle in the course of said flight, a pin having a tapered end projecting into an orifice through which a predetermined portion of said isolated body of liquid must pass in the final stage of said flight of said shuttle, to bring said shuttle to a dead stop at a predetermined point in the course of said flight, and means for adjusting said tapered pin axially in said orifice to establish said point.

7. A checking device for a shuttle in flight across a loom, comprising impact means engageable by the shuttle approaching the terminus of said flight, a cylinder, a piston in said cylinder, a receptacle containing a liquid completely filling said cylinder around said piston at all times, means operatively connecting said piston to said impact means for advancing said piston with a front end thereof pressing against a component body of said liquid disposed in the path of said piston advancing under impetus of said shuttle striking said impact means, said piston having at least one longitudinally tapering recess formed in the exterior thereof, said recess being of gradually diminishing cross sectional area from the front end of said piston to a point intermediate the opposite ends of said piston, and relatively fixed means comprising a circumferential edge on said cylinder cooperating with said longitudinally tapering recess to form an escape port whose flow area decreases progressively as said piston advances in said cylinder, thus permitting diminishing escape of said isolated liquid to decelerate the forward motion of the shuttle in the course of said flight.

8. A checking device for a shuttle in flight across a loom, comprising impact means engageable by the shuttle approaching the terminus of said flight, a cylinder, a piston in said cylinder, a receptacle containing a liquid completely filling said cylinder around said piston at all times, means operatively connecting said piston to said impact means for advancing said piston with a front end thereof pressing against a component body of said liquid disposed in the path of said piston advancing under impetus of said shuttle striking said impact means, said piston having at least one longitudinally tapering recess formed in the exterior thereof, said recess being of gradually diminishing cross sectional area from said front end of said piston to a point intermediate the opposite ends of said piston, relatively fixed means comprising a circumferential edge on said cylinder cooperating with said longitudinally tapering recess to form an escape port whose flow area decreases progressively as said piston advances in said cylinder, thus permitting diminishing escape of said isolated liquid to decelerate the forward motion of the shuttle in the course of said flight, and a tapered element operable axially in an exhaust orifice communicating with the interior of said cylinder and affording the sole means of escape for said liquid from said cylinder after the inner terminal end of said recess passes said circumferential edge of said cylinder, for stopping said shuttle dead at a predetermined point in said course of flight.

9. A checking device for a shuttle in flight in one direction across a loom, comprising impact means engageable by the shuttle approaching the terminus of said flight, a cylinder having an open end, a piston in said cylinder at the open end thereof, a receptacle containing a liquid completely filling said cylinder around said piston at all times, means operatively connecting said

13

piston to said impact means for driving a front end of said piston against a component body of said liquid disposed in the path of said piston advancing under impetus of said impact means being struck and driven in said direction by said shuttle, means for operating said impact means to drive and launch said shuttle in flight in the opposite direction across said loom, said piston having at least one longitudinally tapering recess formed in the exterior thereof at and adjacent said front end thereof, said recess being of gradually diminishing cross sectional area from said front end to a point intermediate the opposite ends of said piston, relatively fixed means comprising a circumferential edge at the open end of said cylinder cooperating with said longitudinally tapering recess to form an escape port whose flow area decreases progressively as said piston advances into said cylinder, thus permitting diminishing escape of said isolated liquid to decelerate the forward motion of the shuttle in the course of said flight, a head in said receptacle spaced axially beyond said open end of said cylinder, said head having a circular recess concentric with the axis of said cylinder to receive the second end of said piston and cushion it against liquid therein for arresting the movement of said impact means after said shuttle launching thereby.

10. A checking device for a shuttle in flight in one direction across a loom, comprising impact means engageable by the shuttle approaching the terminus of said flight, a cylinder having an open end, a piston in said cylinder at the open end thereof, a receptacle containing a liquid completely filling said cylinder around said piston at all times, means operatively connecting said piston to said impact means for driving a front end of said piston against a component body of said liquid disposed in the path of said piston advancing under impetus of said impact means being struck and driven in said direction by said shuttle, means for operating said impact means to drive and launch said shuttle in flight in the opposite direction across said loom, said piston having at least one longitudinally tapering recess formed in the exterior thereof at and adjacent said front end thereof, said recess being of gradually diminishing cross sectional area from said front end to a point intermediate the opposite ends of said piston, relatively fixed means comprising a circumferential edge at the open end of said cylinder cooperating with said longitudinally tapering recess to form an escape port whose flow area decreases progressively as said piston advances into said cylinder, this permitting diminishing escape of said isolated liquid to decelerate the forward motion of the shuttle in the course of said flight, a head in said receptacle spaced axially beyond said open end of said cylinder, said head having a circular recess concentric with the axis of said cylinder to receive the second end of said piston and cushion it against liquid therein for arresting the movement of said impact means after said shuttle launching thereby, and means for adjusting said head axially to vary the effective liquid capacity of said recess relative to said second end of said piston.

11. A checking device for a shuttle in flight across a loom, comprising impact means engageable by the shuttle approaching the terminus of said flight, a cylinder, a piston in said cylinder, a liquid completely filling said cylinder around said piston at all times, means operatively connecting said piston to said impact means for ad-

14

vancing said piston against a component body of said liquid disposed in the path of said piston advancing under impetus of said shuttle striking said impact means, said piston being constructed so as to form with said cylinder an escape port whose flow area decreases progressively as said piston advances, thus permitting diminishing escape of said body of liquid to decelerate the forward motion of the shuttle in the course of said flight, and a spring pressed valve element normally closing one end of said cylinder during forward movement of said piston therein and adapted to open during a return movement of said piston in said cylinder to permit said liquid to follow said piston in said cylinder without restriction.

12. In combination with the picker of a loom, a receptacle, a partition dividing the interior of the receptacle into a main compartment and an auxiliary compartment surrounding the main compartment, said compartments being interconnected by an opening through the partition, a body of liquid in the receptacle, a piston mounted for reciprocation within the main compartment, and connections from the picker to the piston to drive the piston in a direction such as to force liquid from the main compartment through the opening into the auxiliary compartment, whereby the motion of the picker will be checked.

13. In a loom, a picker, means to throw said picker inwardly to cast a shuttle, return means to move said picker outwardly to an intermediate shuttle-receiving position, a check device to absorb the energy of the shuttle after it strikes the picker to bring said picker and shuttle to a dead stop, said check device comprising a receptacle, partition means dividing the interior of the receptacle into a main compartment and an auxiliary compartment connected by an opening through the partition, a body of liquid in the receptacle, a piston mounted for reciprocation within the main compartment, and connections from the picker to the piston to drive the piston in a direction such as to force liquid from the main compartment through the opening into the auxiliary compartment when the shuttle strikes the picker in its flight, said liquid transfer causing the motion of the picker to be checked and the energy of the shuttle to be dissipated so that both stop without rebound.

14. A checking device for a shuttle in flight across a loom, comprising impact means engageable by the shuttle approaching the terminus of said flight, a cylinder member, a piston member in said cylinder member, a reservoir, a liquid contained in said reservoir and completely filling said cylinder around said piston member at all times, means operatively connecting said piston member to said impact means, the impetus of said shuttle striking said impact means advancing said piston against a substantially isolated component body of said liquid disposed in the path of said piston, means formed on said piston and cylinder members cooperating to form an escape port for said isolated body of liquid, relative motion of said cylinder and piston members progressively reducing the flow area of said escape port as said members telescope together, to decelerate the forward motion of the shuttle after it strikes said impact means in the course of said flight.

15. A checking device for a shuttle in flight across a loom, comprising impact means engageable by the shuttle approaching the

15

terminus of said flight, a cylinder, a piston in said cylinder, a reservoir, a liquid contained in said reservoir and completely filling said cylinder around said piston at all times, means operatively connecting said piston to said impact means, the impetus of said shuttle striking said impact means advancing said piston against a substantially isolated component body of said liquid disposed in the path of said piston, and passageway means formed by cooperation of said piston and cylinder for controlling the rate of displacement of said isolated body of liquid from in front of said piston to the reservoir, said passageway means being progressively reduced as said piston advances into the cylinder after the shuttle strikes the said impact means to bring said shuttle to a dead stop at a predetermined point in the course of its flight.

16. A checking device for a shuttle in flight across a loom, comprising impact means engageable by the shuttle approaching the terminus of said flight, a cylinder member, a piston member in said cylinder member, a receptacle containing a liquid completely filling said cylinder around said piston at all times, means operatively connecting said piston to said impact means, the impetus of said shuttle striking said impact means advancing said piston with a front end thereof pressing against a component body of said liquid disposed in the path of said piston, an escape passageway for said component body of liquid comprising a least one longitudinally tapering recess formed in the exterior of one of said cylinder and piston members and of gradually diminishing cross sectional area from one end to the other, the other of said members having a circumferential edge cooperating with said longitudinally tapering recess to provide an escape port and for automatically reducing the flow area of said port progressively as said piston advances in said cylinder, to decelerate the forward motion of the shuttle in the course of said flight.

17. In a loom, a shuttle for flight to and fro across the loom, shuttle impact means being alternately engageable by the shuttle approaching the terminus of its flight and operated to drive and launch said shuttle in flight in the opposite direction across the loom, a check device for the shuttle and impact means comprising a cylinder having an open end, a piston in said cylinder at the open end thereof, a reservoir containing a liquid with said liquid completely filling said cylinder ahead of said piston, means for operatively connecting said piston to the impact means of the loom, the impetus of the impact means when being struck and driven in one direction by the shuttle driving a front end of said piston against a component body of said liquid disposed in the path of said piston, a passageway in said piston for said component body of liquid comprising at least one longitudinally tapering recess formed in the exterior of said piston, said passageway being of gradually diminishing cross sectional area from a point near the front end of the piston to a point intermediate the opposite ends of said piston, relatively fixed means comprising a circumferential edge at the open end of said cylinder cooperating with said longitudinally tapering recess to form an escape port and for automatically reducing the flow area of said port progressively as said piston advances into said cylinder to decelerate the forward motion of the shuttle in the course of said flight, a second

16

cylinder means in said check device spaced axially beyond said open end of said first cylinder and concentric with the axis of said first cylinder to receive the second end of said piston and cushion it against liquid therein for arresting the movement of said impact means after said shuttle launching thereby.

18. In a loom, a shuttle for flight to and fro across the loom, impact means engageable by the shuttle approaching the terminus of its flight in one direction across the loom, means for operating said impact means to drive and launch said shuttle in flight in the opposite direction across said loom, a check device for said shuttle and impact means comprising a first cylinder having an open end, a piston in said cylinder at the open end thereof, a receptacle containing liquid completely filling said cylinder around said piston at all times, means operatively connecting said piston to said impact means, the impetus of said impact means when struck and driven in said direction by said shuttle driving a front end of said piston against a component body of said liquid disposed in the path of said piston, an escape port in said piston for said component body of liquid comprising at least one longitudinally tapering recess formed in the exterior of said piston at and adjacent said front end thereof and of gradually diminishing cross sectional area from said front end to a point intermediate the opposite ends of said piston, relatively fixed means comprising a circumferential edge at the open end of said cylinder cooperating with said longitudinally tapering recess for automatically reducing the flow area of said port progressively as said piston advances into said cylinder to decelerate the forward motion of the shuttle in the course of said flight, a second cylinder means in said receptacle spaced axially beyond said open end of said first cylinder, said second cylinder having a circular recess concentric with the axis of said first cylinder to receive the second end of said piston and cushion it against liquid therein for arresting the movement of said impact means after said shuttle launching thereby, and means for adjusting said second cylinder axially to vary the effective liquid capacity of said recess relative to said second end of said piston.

19. A check device for a loom shuttle that is cast in flight across the loom and received by impact means engageable by the shuttle approaching the terminus of its flight, said check device comprising a cylinder member, a piston member in said cylinder member, a reservoir, a liquid contained in said reservoir and completely filling said cylinder around said piston member at all times, means for operatively connecting said piston member to the impact means so that the impetus of the shuttle striking the impact means will advance said piston against a substantially isolated component body of said liquid disposed in the path of said piston, means formed on said piston and cylinder members cooperating to form an escape port for said isolated body of liquid, relative motion of said cylinder and piston members progressively reducing the flow area of said escape port as said members telescope together to decelerate the forward motion of the shuttle after it strikes the impact means in the course of its flight.

20. A checking device for a loom shuttle that is cast in flight across the loom and received by impact means engageable by the shuttle ap-

proaching the terminus of its flight, said check device comprising a cylinder, a piston in said cylinder, a reservoir, a liquid contained in said reservoir and completely filling said cylinder around said piston at all times, means for operatively connecting said piston to the impact means so that the impetus of the shuttle striking the impact means will advance said piston against a substantially isolated component body of said liquid disposed in the path of said piston, and passageway means formed by cooperation of said piston and cylinder for controlling the rate of displacement of said isolated body of liquid from in front of said piston to the reservoir, said passageway means being progressively reduced as said piston advances into the cylinder after the shuttle strikes the impact means, to bring said shuttle to a dead stop at a predetermined point in the course of its flight.

21. A checking device for a loom shuttle that is cast in flight across the loom and received by impact means engageable by the shuttle approaching the terminus of its flight, said check device comprising a cylinder member, a piston member in said cylinder member, a receptacle containing a liquid completely filling said cylinder around said piston at all times, means for operatively connecting said piston to the impact means so that the impetus of the shuttle striking the impact means will advance said piston with a front end thereof pressing against a component body of said liquid disposed in the path of said piston, an escape passageway for said component body of liquid comprising at least one longitudinally tapering recess formed in the exterior of one of said cylinder and piston members and of gradually diminishing cross sectional area from one end to the other, the other of said members having a circumferential edge cooperating with said longitudinally tapering recess to provide an escape port and for automatically reducing the flow area of said port progressively as said piston advances in said cylinder to decelerate the forward motion of the shuttle in the course of its flight.

22. A checking device for a loom shuttle that is cast in flight across the loom and received by impact means when the shuttle approaches the terminus of its flight with the impact means being operated to drive and launch said shuttle in flight in the opposite direction across the loom, said check device comprising a cylinder having an open end, a piston in said cylinder at the open end thereof, a reservoir containing a liquid with said liquid completely filling said cylinder ahead of said piston, means for operatively connecting said piston to the impact means of the loom for driving a front end of said piston against a component body of said liquid disposed in the path of said piston under impetus of the impact means when being struck and driven in one direction by the shuttle, a passageway in said piston for said component body of liquid comprising at least one longitudinally tapering recess formed in the exterior of said piston, said passageway being of gradually diminishing cross sectional area from a point near the front end of the piston to a point intermediate the opposite ends of said piston, relatively fixed means comprising a circumferential edge at the open end of said cylinder cooperating with said longitudinally tapering recess to form an escape port and for automatically reducing the flow area of said port progressively as said piston advances into said cylinder to decelerate the forward motion of the shuttle in the

course of said flight, a second cylinder means in said check device spaced axially beyond said open end of said first cylinder and concentric with the axis of said first cylinder to receive the second end of said piston and cushion it against liquid therein for arresting the movement of said impact means after said shuttle launching thereby, said second cylinder means being axially adjustable to vary the effect of said cushioning action.

23. A check device for a loom shuttle that is in flight in one direction across the loom and received by impact means engageable by the shuttle approaching the terminus of its flight, the impact means being operable to drive and launch said shuttle in flight in the opposite direction across said loom, said check device comprising a first cylinder having an open end, a piston in said cylinder at the open end thereof, a receptacle containing liquid completely filling said cylinder around said piston at all times, means for operatively connecting said piston to said impact means for driving a front end of said piston against a component body of said liquid disposed in the path of said piston under impetus of said impact means being struck and driven in said direction by the shuttle, an escape port in said piston for said component body of liquid comprising at least one longitudinally tapering recess formed in the exterior of said piston at and adjacent said front end thereof and of gradually diminishing cross sectional area from said front end to a point intermediate the opposite ends of said piston, relatively fixed means comprising a circumferential edge at the open end of said cylinder cooperating with said longitudinally tapering recess for automatically reducing the flow area of said port progressively as said piston advances into said cylinder to decelerate the forward motion of the shuttle in the course of said flight, a second cylinder means in said receptacle spaced axially beyond said open end of said first cylinder, said second cylinder having a circular recess concentric with the axis of said first cylinder to receive the second end of said piston and cushion it against liquid therein for arresting the movement of said impact means after said shuttle launching thereby, and means for adjusting said second cylinder axially to vary the effective liquid capacity of said recess relative to said second end of said piston.

24. In combination in a loom, lay mechanism, a shuttle, a picker mounted to move a predetermined distance inwardly and outwardly along said lay mechanism, power means to move said picker inwardly to cast the shuttle, spring means to thereafter move said picker outwardly to an intermediate position for receiving the shuttle in its flight, a hydraulic check device for said shuttle associated with the picker, said check device including a liquid reservoir, relatively movable cylinder and piston members, and restriction orifice means providing restricted liquid transfer from the cylinder to the reservoir upon relative motion of the cylinder and piston members, means associated with said picker and said check device to cause relative motion of said cylinder and piston members upon motion of the picker, impact of the shuttle urging said picker further outwardly after the spring means has returned the picker to said intermediate shuttle receiving position, whereupon liquid transfer within the check devices absorbs the energy of the shuttle to bring the shuttle and picker to a dead stop without rebound.

25. In combination in a loom, lay mechanism, a shuttle box, a shuttle, a picker mounted to move a predetermined distance inwardly and outwardly along said lay mechanism, power means to move said picker inwardly to cast the shuttle, spring means to thereafter move said picker outwardly to an intermediate position for receiving the shuttle in its flight, after the shuttle has substantially entered the shuttle box, a hydraulic check device for said shuttle associated with the picker, said check device including a liquid reservoir, relatively movable cylinder and piston members, and restriction orifice means providing restricted liquid transfer from the cylinder to the reservoir upon relative motion of the cylinder and piston members, means associated with said picker and said check device to cause relative motion of said cylinder and piston members upon motion of the picker, impact of the shuttle urging said picker further outwardly after the spring means has returned the picker to said intermediate shuttle receiving position, whereupon

liquid transfer within the check device absorbs the energy of the shuttle to bring the shuttle and picker to a dead stop without rebound.

OTTO A. KOTTEMANN.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
404,012	Nickerson	May 28, 1889
677,562	Comins	July 2, 1901
727,051	Adams	May 5, 1903
1,141,896	Fernando	June 1, 1915
1,366,514	Brais	Jan. 25, 1921
1,765,314	Stuart	June 17, 1930
1,873,481	Richter	Aug. 23, 1932
1,908,390	Whitted	May 9, 1933
1,928,283	Ennis	Sept. 26, 1933
2,160,339	Moessinger	May 30, 1939
2,426,971	Kottemann	Sept. 2, 1947