Sept. 2, 1947. O. A. KOTTEMANN 2,426,971

LOOM AND HYDRAULIC CHECK THEREFOR

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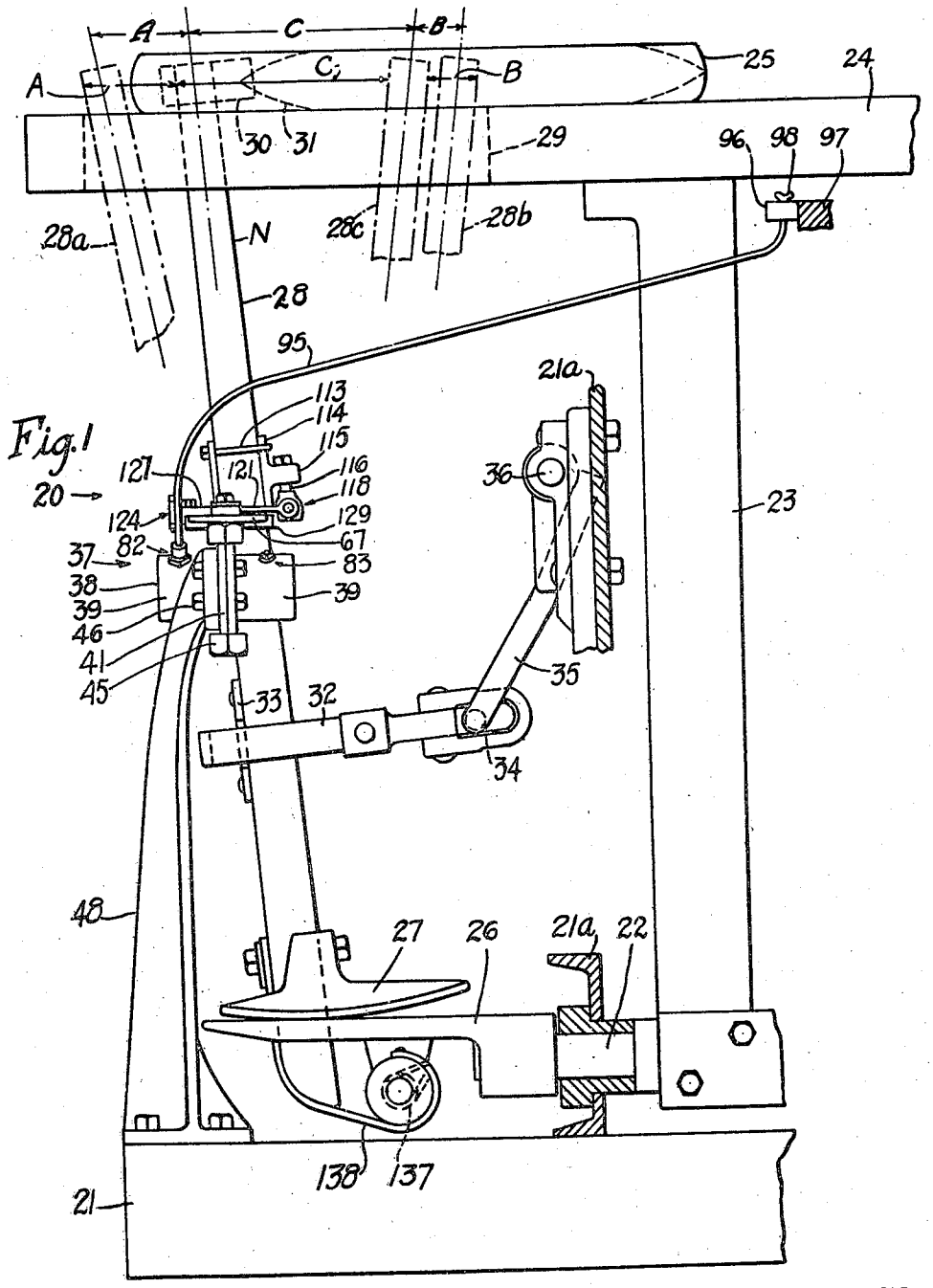


Fig. 1

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LOOM AND HYDRAULIC CHECK THEREFOR

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Fig. 2

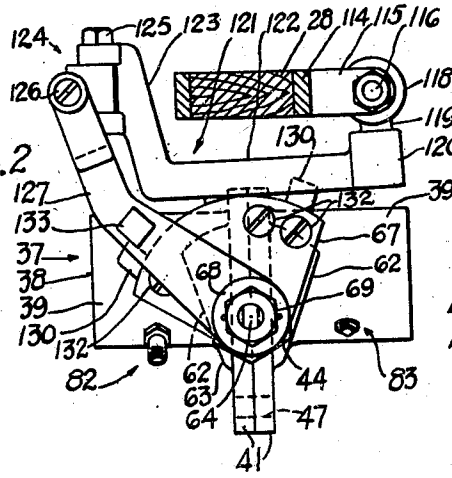


Fig. 4

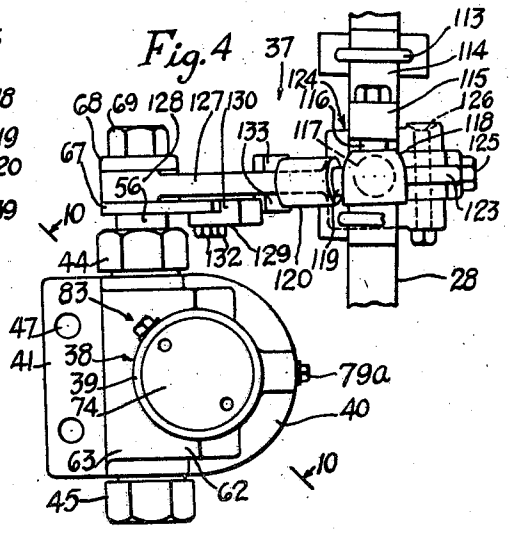


Fig. 3

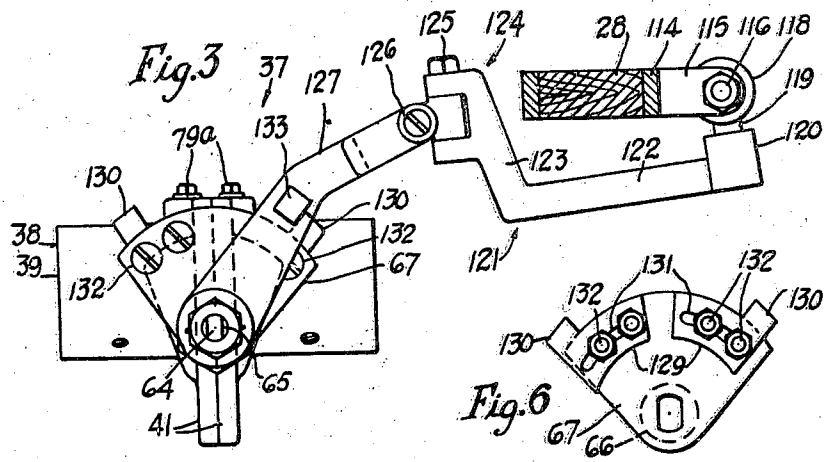
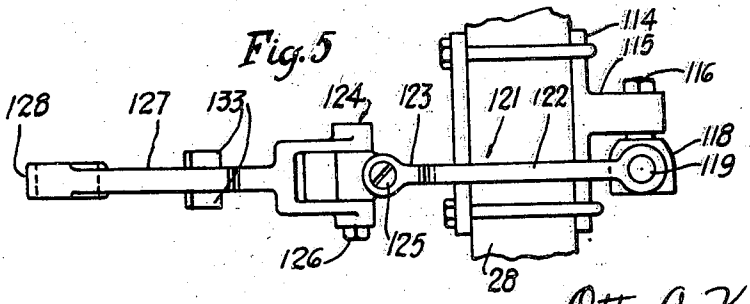


Fig. 6

Fig. 5



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LOOM AND HYDRAULIC CHECK THEREFOR

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Fig. 7

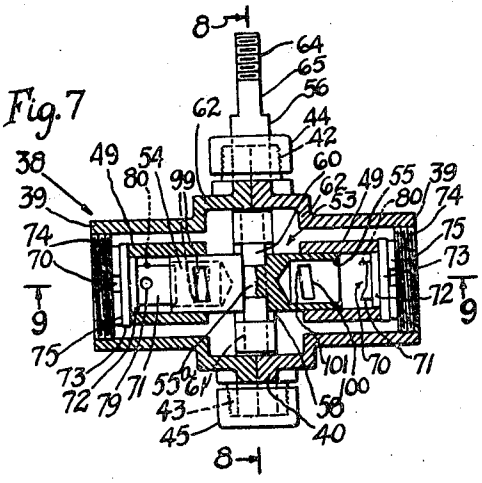


Fig. 8

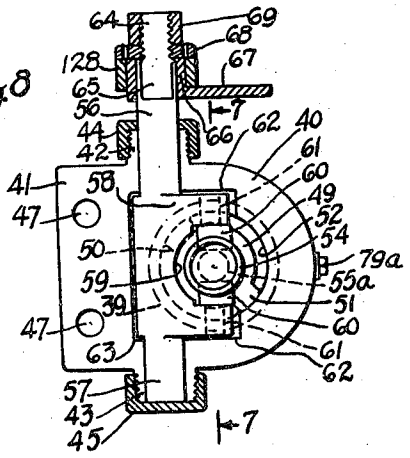


Fig. 9

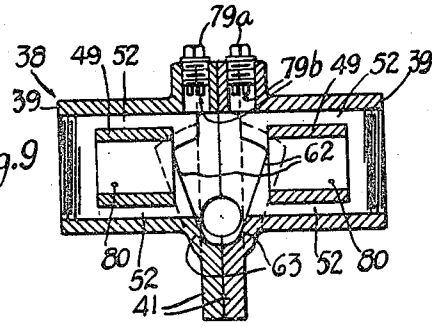


Fig. 14

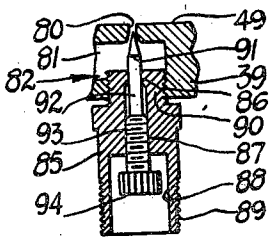


Fig. 15

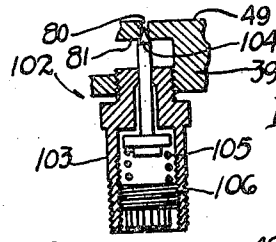


Fig. 10

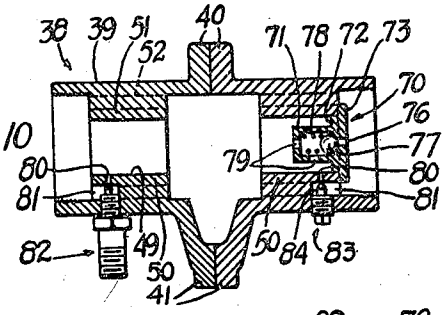


Fig. 16

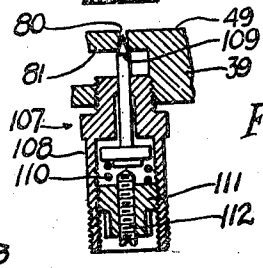




Fig. 13

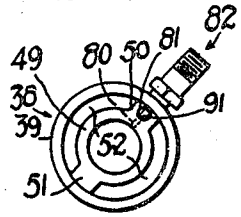


Fig. 11

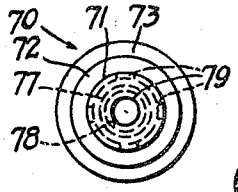


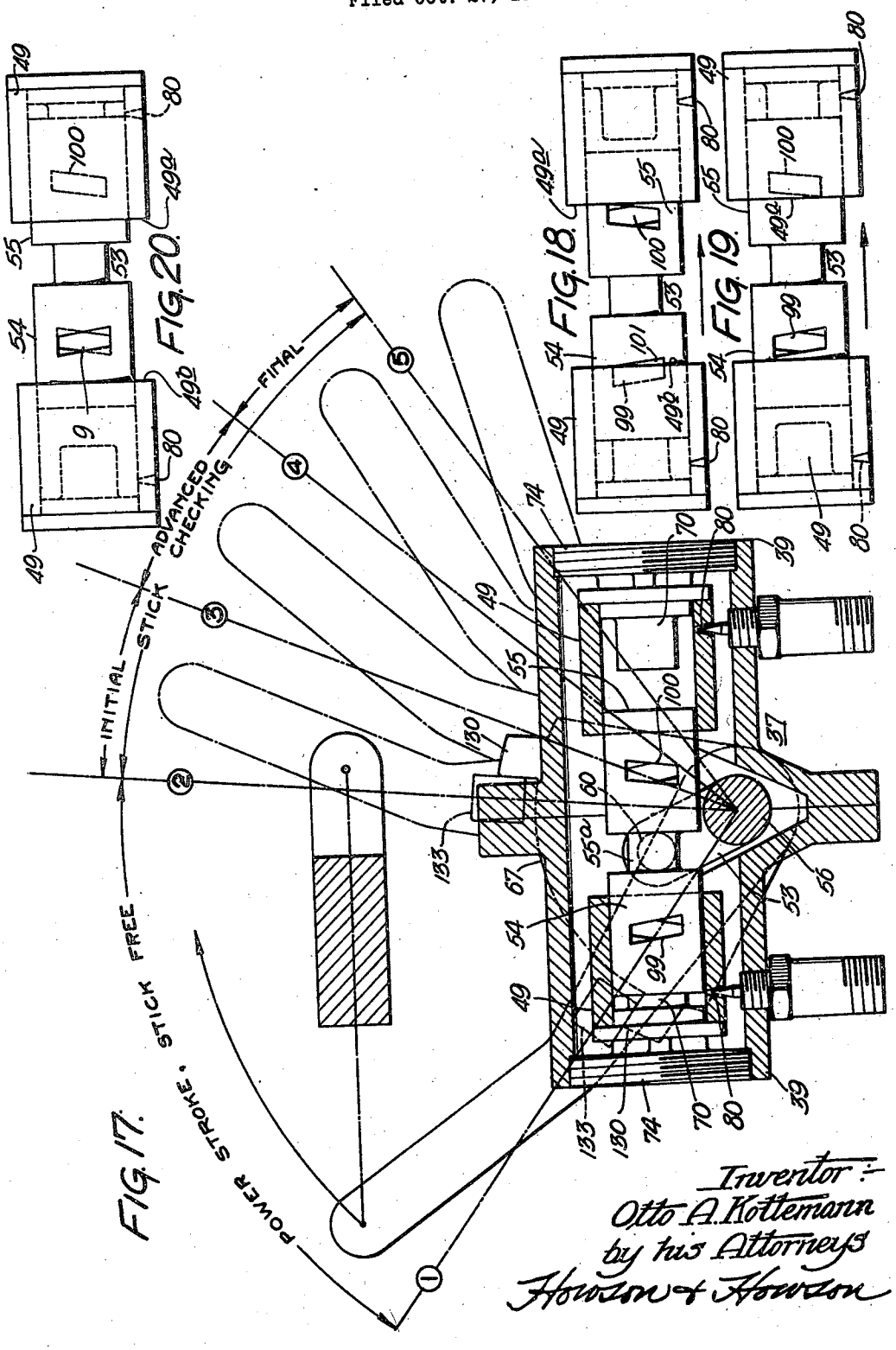
Fig. 12

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LOOM AND HYDRAULIC CHECK THEREFOR

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LOOM AND HYDRAULIC CHECK THEREFOR

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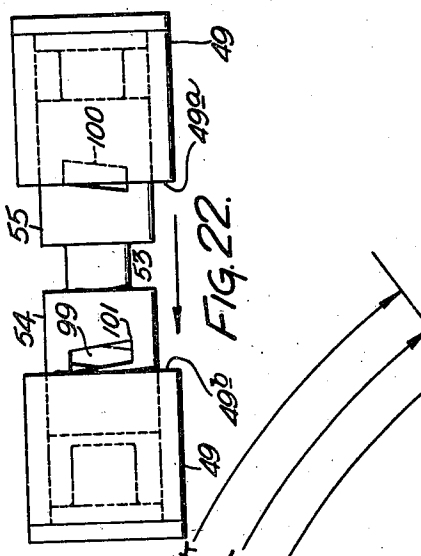


FIG. 22.

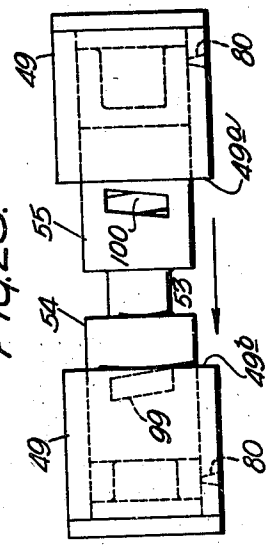


FIG. 23.

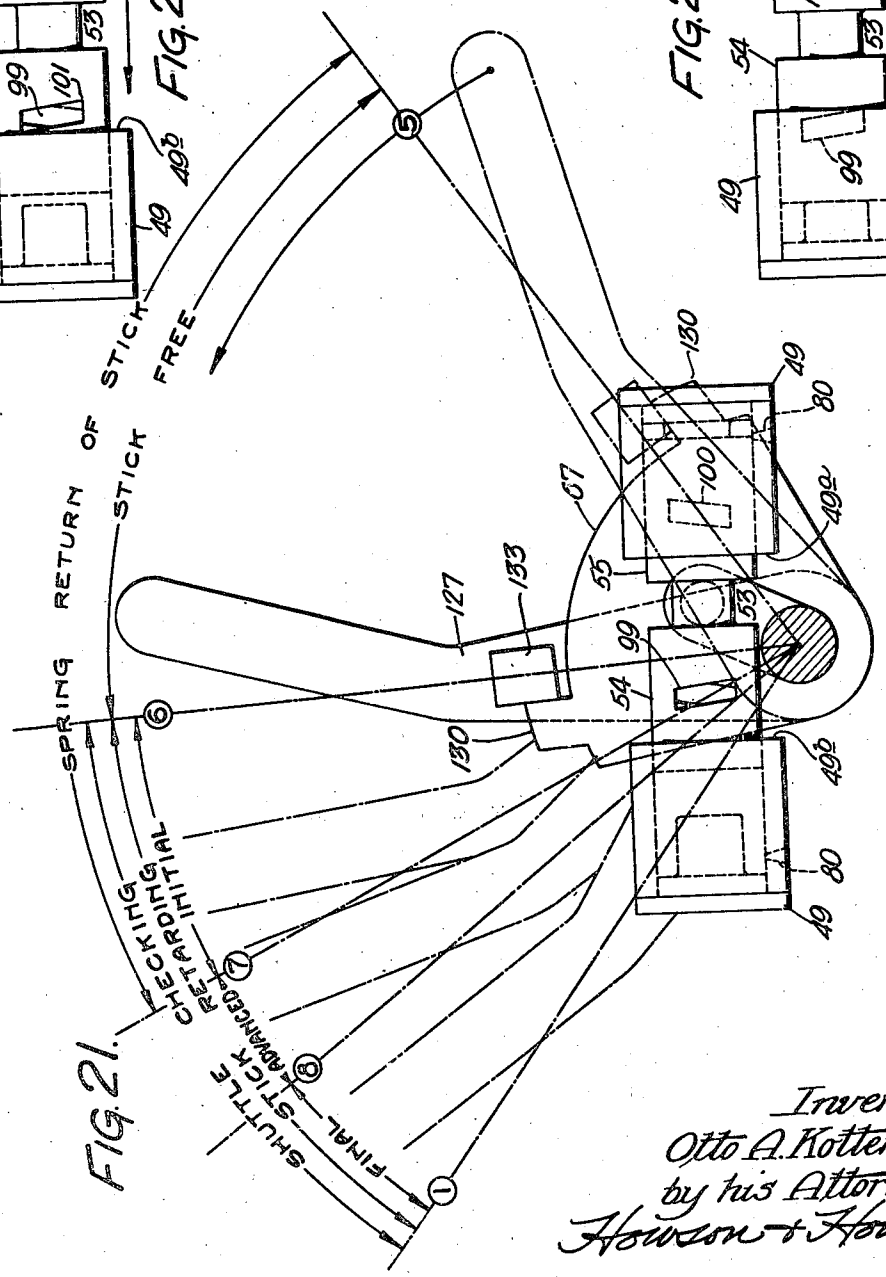


FIG. 21.

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Patented Sept. 2, 1947

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UNITED STATES PATENT OFFICE

2,426,971

LOOM AND HYDRAULIC CHECK THEREFOR

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

Application October 27, 1943, Serial No. 508,086

18 Claims. (Cl. 139—161)

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This invention relates to a device for reducing the velocity of a body moving horizontally at a high rate of speed, along a prescribed path, and for bringing such body to a dead stop precisely at a predetermined point along said path, without rebound.

More specifically, the present invention relates to a device for checking the oscillatory motion of the picker stick at each side of the lay of a loom, to cause the picker sticks at the opposite sides respectively of the loom to alternately effect rapid deceleration and dead stopping of the loom shuttle at each end of the path of the shuttle, at a predetermined point in the shuttle path, accurately and without rebounding from the stopping point, whereby the filling yarn laid in the open warp shed in the loom by the shuttle will be maintained uniformly under predetermined tension at all times, thus avoiding the formation of marks in the fabric being woven and which are primarily formed normally by the shuttle rebounding from its stopping position in its path at the end of its travel which causes slack to develop in the filling yarn.

In the case of looms employing automatic bobbin replenishing apparatus, for replacing empty bobbins in the shuttle with full bobbins of the filling yarn, the device of the present invention, in stopping the shuttle dead at a predetermined point in the shuttle path at one end of the loom, avoids the possibility of failure of the bobbin replenishing mechanism. A typical loom operates at 180 picks per minute, in other words, there are 180 throws of the shuttle per minute. The travel for each throw may be about 70 inches. If it be considered that the shuttle is at rest in a shuttle box approximately three-fourths of the time, it will be perceived that the actual mean velocity of the shuttle is about 4200 feet per minute. Traveling at high speed, the shuttle must be brought to complete rest within a distance of 3 or 4 inches. This distance cannot be increased without loss in the speed of the loom. The extremely high deceleration involved has posed a problem which has not been solved heretofore.

It has been proposed to use pneumatic check devices, but these are unsatisfactory. Today the ordinary check strap is universally in use, although the complaints in regard thereto are widespread. Loom deterioration due to shock and vibration is rapid, and the slightest damage in the cloth is a basis for rejection especially under United States government specifications. Looms are operated at speeds below those for which they were built, and the blame is placed on the check

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straps. In attempting to assist the check straps, looms are provided with rather powerful binder springs in the shuttle box to laterally frictionally retard the shuttle; the tension on these springs is much greater than what is needed merely for a snug holding of the shuttle. But these springs absorb power on the throw or projection of the shuttle, and prematurely retard the shuttle as it enters the shuttle box, causing a loss in speed of the loom. They have not caused the check straps to operate satisfactorily.

It is therefore an object of the invention to provide improved means to obviate the difficulties mentioned. It is another object to provide an improved check capable of satisfactorily functioning without the use of the binder spring and utilizing only a light spring for snugly positioning the shuttle.

Because check straps are mounted on one side, a twisting tendency is imparted to the picker stick which results in excessive strains and eventual misalinement of parts.

It is therefore another object of the invention to provide improved means such that the impact of the picker stick is squarely received and absorbed.

After the picker stick has projected or thrown the shuttle, it is desirable to properly cushion it and to quickly bring it to rest for return by spring action to shuttle receiving position. This will affect the speed of the loom and the shock and vibration therein. The check straps and other leather cushioning devices have not been satisfactory.

It is therefore another object of the invention to provide an improved check that is double acting in that it will precisely and with split second timing arrest a picker stick both on its inward or power stroke and on its outward travel under the power of the shuttle, whereby the efficiency and life of the loom are substantially increased, and frequency recurring shutdowns for realinement and adjustment of parts of the loom avoided.

Another object of the invention is the provision of improved means whereby the checking action may be adjusted while the loom is in operation.

Another object of the invention is to furnish improved structure for a different precise checking of the inward and outward movements of the picker stick.

Another object of the invention is to provide a device having improved means such that a greater range of checking action for the outward as compared with the inward throw can be adjustably obtained.

Another object of the invention is to furnish improved means adjustable for different ranges of movement of the picker sticks of different looms, for checking the picker sticks at the opposite ends of their travel.

Another object of the invention is the provision of improved means for adjusting the checking action according to the varying sizes and weights of the shuttles of different looms.

Another object of the invention is to provide improved checking means which shall not retard the picker stick on its power stroke while it is actively engaged in projecting the shuttle.

Another object of the invention is to construct a device for checking a picker stick at both ends of its travel, with improved means for a lost motion engagement to reduce travel and wear of operating parts, increase compactness, and avoid imposing an added load or weight on the picker stick while it is projecting the shuttle.

Another object of the invention is to provide an improved highly compact unit, capable of responding to a substantial angular movement of the picker stick and hence adapted to be positioned relatively high up on the stick to avoid deflection of the latter.

Another object of the invention is to furnish a device as set forth capable of being positioned in an improved manner within the area defined by the loom so that adjoining looms can be placed virtually in contact with each other.

Another object of the invention is to construct an improved check which can be placed reversibly at the right or left of a loom.

Another object is to provide an improved circulatory system for an hydraulic check.

Another object is to utilize hydraulic action for cushioning engagement at the ends of a lost motion throw.

Another object is to obtain liquid rotation of a piston for even wear.

Another object is to cushion a picker stick by conjoint action of a bleeder valve and a piston closure.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in view, the invention consists in the novel combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated in the annexed drawing, wherein like parts are designated by the same reference characters throughout the several views.

In the drawing:

Figure 1 is a fragmentary view in front elevation with parts in section, drawn approximately to one quarter scale, showing a loom embodying the invention, with different positions of the picker stick indicated in dot dash lines.

Figure 2 is a top plan view with parts removed and in section, drawn to one half scale and showing a device according to the invention with the picker stick brought to rest at the end of its outward throw.

Figure 3 is a similar view but showing the device with the picker stick brought to rest at the end of its inward throw.

Figure 4 is a view in elevation with parts removed showing a position of the device intermediate of those of Figures 2 and 3 and with the picker stick angularly moved with the lay of the loom.

Figure 5 is a view in elevation with parts removed showing the linkage arbitrarily extended to disclose certain details thereof.

Figure 6 is a bottom plan view of an adjusting means of the device in detached position, showing a different adjustment for a lesser checking range on the inward than on the outward movement of the picker stick.

Figure 7 is a sectional view taken on the line 7—7 of Figure 8 with certain parts removed and with the device in an arbitrary central position for clarity in the drawings.

Figure 8 is a sectional view taken, generally, on line 8—8 of Figure 7.

Figure 9 is a sectional view taken on line 9—9 of Figure 7.

Figure 10 is a sectional view taken on line 10—10 of Figure 4, with parts omitted.

Figure 11 is a view of the left end of Figure 10.

Figure 12 is a full size view of a check valve device shown in Figures 7 and 10, looking at the inner end thereof.

Figure 13 is a view of the inside face of an end closure plug for the cylinder of the hydraulic unit.

Figure 14 is a full size fragmentary sectional view particularly of the bleeder valve of the hydraulic unit.

Figures 15 and 16 are similar views showing different modifications of the bleeder valve.

Figs. 17 to 23, inclusive, constitute a series of diagrams illustrating the actions of the pistons and other associated parts of the device throughout one complete cycle of operations thereof.

The advantages of the invention as here outlined are best realized when all of its features and instrumentalities are combined in one and the same structure, but, useful devices may be produced embodying less than the whole.

It will be obvious to those skilled in the art to which the invention appertains, that the same may be incorporated in several different constructions. The accompanying drawing, therefore, is submitted merely as showing the preferred exemplification of the invention.

Generally described, the invention is indicated in a loom wherein the picker stick is checked by causing it to actuate a positive pressure hydraulic brake that drives a liquid through an orifice, the checking bringing the picker stick to rest at a precise point although the orifice may remain open until the picker stick actually comes to rest. Such checking, being hydraulically performed, is free of rebound of the shuttle. The point at which the picker stick comes to rest is easily adjusted by varying the flow area of the orifice, but once this adjustment has been made, no deviation in the position of rest will occur, except for causes residing in the condition of wear of the loom itself. More specifically, the relation of the novel checking device to the picker stick is believed to be such that the liquid pressure is indicated by a curve whose slope is substantially constant from maximum to zero pressure, the former occurring when checking begins, and the latter occurring when the picker stick comes to rest. This curve may vary somewhat as will appear hereinafter, but it differs radically from curves for springs and pneumatic devices because a liquid is substantially incompressible, and because the energy of the shuttle is consumed in fluid friction in the said orifice. This device may be double acting to check the picker stick at both end portions of its path of travel. To prevent the device from otherwise impeding the picker stick, a lost motion engagement is pro-

vided between the picker stick and the device, such engagement being adjustable for varying lengths of travel for different looms. The double acting lost motion feature is of value in restoring the device to its initial position, even if the picker stick is checked at only one end of its path of travel. The speed of operation of the loom can be increased and the binder spring omitted.

Referring in detail to the drawings, 20 denotes a device embodying the invention and comprising means for hurling and/or receiving a projectile-like element and for rapidly absorbing the momentum involved, without rebound of the element. The device 20 is best exemplified in a loom having a base 21, having a frame 21a, in which is mounted for oscillation a conventional rocker shaft 22, said rocker shaft having the lower end of a loom sword 23 fixedly secured thereon. This loom sword extends upwardly and is adapted to support a lay 24, which in turn supports a shuttle box 25.

Rocker shaft 22 also has fixedly secured thereto a base member 26, upon which a picker stick shoe 27 is adapted to rock back and forth. The shoe 27 supports an upwardly extending picker stick 28, which passes through a slot 29 in the lay 24. The upper projecting end of the picker stick 28 is disposed within the shuttle box 25, and has a picker 30 secured thereon, said picker being adapted to receive and expel a conventional loom shuttle 31 during the normal operation of the loom.

In order for the picker stick 28 to be moved in clockwise manner about the shoe 27, when the shuttle is to be expelled from the shuttle box, it is necessary to provide some suitable means such as a conventional lug strap 32. One end of this lug strap encircles the intermediate portion of the picker stick and is held in position by means of a notched hold-up strap 33. The other end of this lug strap is connected as at 34 to a lever 35, said lever being pivoted at 36 to the loom frame 21a. A conventional means, not shown, is employed for oscillating the lever 35 back and forth about pivot 36 to thereby impart the necessary sudden thrust upon the picker stick and cause the shuttle 31 to be powerfully expelled from the shuttle box 25.

Disposed beneath the base member 26 is a torsion spring 137 acting on a strap 138 to cause counterclockwise movement of the picker stick to the position shown in full lines in Fig. 1.

When the loom is in operation, the members 23 to 30 inclusive are adapted to rock back and forth toward and away from the observer in Fig. 1, about the rocker shaft 22 as an axis. At the same time, the picker stick 28 and its picker 30 oscillate back and forth in a plane disposed substantially at right angles to the plane of oscillation of the members 23 to 30. In each loom there is an opposite-hand structure to that shown in Fig. 1 disposed at the opposite end of the loom, to thus cause reciprocation of the shuttle between the ends of the loom.

The conventional traverse of the picker stick is indicated in dot dash lines, 28a denoting the outer, and 28b the inner position. Normally, the picker stick receives the impact of the shuttle on the picker 30 at some intermediate position to which the picker stick is moved by the spring 137 in readiness to receive the impact of the shuttle. According to the present invention, and speaking in more or less general terms this intermediate or neutral position N is predetermined to that shown in full lines, being closer to the position 28a than heretofore. Accordingly, the checking movement at the picker 30 is about 3 inches, as indicated at A. A checking action also occurs on the inward power stroke of the shuttle beginning at the position indicated at 28c; hence the checking movement is indicated at B. The checking movements at A and B may be equal, but I have discovered that a higher speed is obtainable with satisfactory results by making the checking movement at B about half that at A; at the same time the checking movement at A has been substantially reduced for the same reasons. Preceding each of the checking paths A and B, there is a section of the path along which the picker stick is preferably free of the hydraulic check both on the outward and inward strokes of the stick. On the outward stroke this free section includes the section B plus a section C, which lies intermediate the checking sections A and B, and on the inward stroke the free section includes the section C plus the checking section A, as will be apparent hereinafter. Accordingly, the full power and maximum velocity of the system is available with the picker stick traveling the path A to position 28a to bring the shuttle to rest without rebound. Although the picker stick receives the impact of the shuttle at position N, its power stroke may be from the position 28a and when the picker stick reaches the position 28c, or slightly before, the shuttle has left the picker stick, and checking of the picker stick occurs along path B to avoid vibration and shock in the loom and to bring it rapidly to rest, for quick return to position N. A full detailed description of one complete cycle of operation of the picker stick, etc., will be given hereinafter.

Referring now to the checking device, 37 denotes a hydraulic unit embodying the invention. A hydraulic means is employed because it affords a pressure curve that is directly proportional to the diminishing momentum of the mass that is to be checked, which curve is believed to be substantially a straight line. This is in direct contrast with the haphazard action of a check strap, and with the operation of pneumatic devices wherein the fluid pressure first increases while the momentum decreases, after which the fluid pressure must gradually taper off on a long path if it is not to cause rebound of the shuttle or a premature or incorrect projection of the shuttle by varying the position at which the impact is imparted to the shuttle by the picker stick. Such gradual tapering off of pneumatic pressure is not feasible because it would require a longer loom and would result in a loss of speed in loom operation. On the other hand, a sharp cut off is impractical for the reasons stated, and because the results would be erratic, and automatic bobbin changing which requires precise positioning of the shuttle in its outer position of rest could not be obtained. These difficulties are avoided by hydraulically checking the momentum of the rapidly moving mass that includes the shuttle and at least part of the weight of the picker stick. When the latter attains the outer position of rest at 28a, the liquid pressure is zero and the hydraulic device 37 is relieved substantially of all stresses. Yet the precise position for 28a may be adjusted with nicety, as by adjusting a restrictive liquid outlet which may be only about $\frac{1}{16}$ of an inch in diameter with the total liquid displaced for the checking at A measuring only about two to ten teaspoonfuls. And all this is effected despite the substantial mass of a shuttle that may be 15 inches in length or longer and, in

which the deceleration for bringing the shuttle to rest at its high speed may be terrific, as hereinbefore indicated.

The hydraulic unit 37 may include a casing 38 comprising a pair of identical casing sections 39 having arcuate flanges 40 extending into straight flanges 41, as shown in Fig. 8. Interrupting the flanges are a pair of identical alined hubs 42, 43, each of which is split along the plane of the flanges. Engageable with the hubs 42, 43 are the respective fittings 44, 45, the threads of which may have a slight taper for powerfully drawing or clamping the casing sections together so that a fluid tight engagement is obtained between the sections by placing a cement on the meeting faces of the flanges 40, 41. Alining pins (not shown) may be used between the casing sections to facilitate the engagement mentioned. Bolts 46 passing through holes 47 in the straight flanges may be used to clamp the casing 38 to a standard 48 fixedly connected to or forming a part of the loom frame, or directly connected to the building floor, in such a manner to avoid vibrations. Bolts or screws may also be provided for clamping together the flanges 40.

Formed in the casing sections are the alined cylinders 49, secured to their respective casings by radial webs 50, 51, see Figs. 7 to 11, thus forming passages 52 between these cylinders and the walls of the casing 38. Each cylinder terminates in spaced relation to the outer ends of the casing, and these cylinders are also spaced from each other. A double acting one-piece piston means 53 may comprise identical hollow pistons 54, 55 between which is formed an annular recess providing a central connecting neck 55*a*. For reciprocating the piston means there is provided a shaft 56 and a stub shaft 57 interchangeably journaled in the hubs 42, 43. Integrally formed on this shaft is a crank portion 58 having a central cut out at 59, see Fig. 8, sufficient to clear the piston means upon oscillation of the crank portion. Slidingly engaged in the recess of the piston means at opposite sides of the neck 55*a* are the drivers 60, see Fig. 7, and as these are desirably flat to snugly fit the said recess, they are journaled by means of stub shafts 61 in the arms of the crank portion 58, so that the axes of the stub shafts lie in a plane with the axis of the piston means. To allow for clearance for the crank portion, the cylinders 49 are spaced apart sufficiently and the casing sections 39 are formed with tapered offsets 62, as clearly shown in Fig. 9, to conform to the oscillation of the crank portion. These offsets may be continued at 63 to afford clearance for the shafts 56, 57. To receive the shaft 56, the cap 44 is formed with a central opening. At its upper end portion, the shaft 56 is provided with an undercut threaded portion 64 and with flats at 65, non rotatably receiving a hub 66 of an actuator member 67 that serves to oscillate the shaft. This member is retained by a perforated threaded washer 68 and a nut 69 both engaged with the threaded part 64 of the shaft.

Closing the outer ends of the cylinders 49 are the removable identical check valve units 70, see Figs. 7, 10 and 12. Each unit comprises a circular casing 71 having a lip 72 for centering it in its cylinder 49 and having an annular flange 73 bearing against the outer end of the cylinder in precision contact therewith to afford a liquid tight seal. Each unit is clamped tightly in such sealing engagement by a plug 74, see Fig. 13, having an interrupted circular flange 75 on its inner face to abut the unit 70, without interfering with the operation of the check valve unit. The latter may have an inlet opening 76 normally closed by a ball valve 77 actuated by an expansion coil spring 78 housed within the casing 71. That portion of said casing 71 which projects into the cylinder 49 is perforated or foraminous as at 79, and is sufficiently small in diameter to be received within the open end of the confronting piston, as shown at the left in Fig. 7. Sufficient clearance is provided between the casing 71 and the side wall of said piston for a free flow of liquid therebetween. It is noted that the inlet 76 of the check valve unit communicates through the interrupted flange 75 with the passages 52 that lie between the casing 38 and its cylinders 49. Upon retraction of a piston, the check valve is opened by suction to admit liquid into its cylinder.

At 80 are restrictive by-pass or bleeder outlets for the different cylinders 49, shown in Figs. 7, 9, 10, 11 and 14. These outlets may be identical in size for reversibility of the device 37 for interchangeable use at either end of the loom. In a loom of the size and speed hereinbefore mentioned, each of these outlets may be about $\frac{3}{32}$ of an inch in diameter, and being reduced to about ⅓ of cpacity by needle valves hereinafter described, assuming that the liquid employed is a good quality of lubricating oil, such as is adapted to properly lubricate the moving parts in the casing 38, at the speed at which they operate. Incidentally, it may be mentioned that bearings such as those for the driver stub shafts 61 of the crank mechanism are perforated to assure proper lubrication. It may now be mentioned that copper or brass plugs 79*a* may carry permanent magnets 79*b* communicating with the liquid for abstracting minute particles of metal therefrom. Preferably the outlets 80 are placed at an acute angle to the horizontal, but this is merely a matter of convenience. These outlets 80 are shown in dot dash lines in Fig. 7. It may be desirable, however, that these outlets be positioned below the top portions of the cylinders so as not to be affected by any air that might be present. Later, it will be clear that the casing 38 may be so filled with liquid as to obviate the presence of air.

Formed in the webs 50 are short passages 81 which communicate the outlets 80 through the interrupted flange 75 of adjacent plugs 74 with the passages 52 that lie between the webs 50, 51. It is desirable to provide for adjustment of the outlet openings 80 and hence devices 82, 83 are employed. The device 82 is clearly shown in Fig. 14 and it is used to adjust the liquid resistance to absorb the momentum of the shuttle along the path A. The device 83 may be a simple plug having a tapered pin or valve 84 alined with its outlet opening 80 for adjusting the liquid resistance and cushioning action for the picker stick at the end of its inward stroke along the path 13. The device 82 may be adjusted as the condition of the loom requires. Device 83 need be given only one initial adjustment. The adjustments of both devices may take care of numerous conditions including the viscosity of the oil, the weight and speed of the shuttle or picker stick, the range of checking action for these elements at A and B, and various other factors. These devices 82, 83 are interchangeable on the casing 38 according as the device 37 is used at one or an opposite end of the loom.

More particularly described, the device 82 com-

prises a housing member 85 having a central bore which is constricted at 86 and threaded at 87, this bore leading into a chamber 88 that is externally threaded at 89. At its inner end, the housing member 85 is provided with an undercut threaded portion 90 whereby the housing member can be screwed into an opening in the casing 38 to directly communicate with the adjacent passage 81. A needle valve 91 alined with the cooperating valve opening 80 is mounted on a stem 92 that snugly slidingly closes the bore 86. At 93 the stem is enlarged and engaged with the threaded bore 87, and at its outer end the stem has a turning head such as a pinion 94 in the chamber 88. For remote control, a flexible shaft 95 shown in Fig. 1, may be connected to the housing at the thread 89, in engagement with the head 94, this shaft leading to a head 96 which may be mounted on a stationary frame portion 97. For turning the flexible shaft, a removable key 98 may be provided for the head 96. The device 83 is secured in the identical manner of the device 82 and both operate in the same manner.

In order to permit a desired amount of free travel of the piston means 53, with its pistons 54, 55, before the bleeder devices 82, 83 become effective, it is necessary to afford openings for the rapid flow of liquid in the cylinders 49 until the capacity of the cylinders has been reduced to a predetermined volume. Such openings may be provided in the pistons themselves, subject to cut off by the cylinders when the pistons have penetrated the respective cylinders to a predetermined degree. In the instant case, these openings are shaped so that the said flow of the liquid may cause rotation of the pistons by repeated reciprocations thereof, whereby wear on the pistons in the cylinder and at their region of engagement with the crank shaft is equalized and rendered uniform. More particularly, these openings are shown in Fig. 7 at 99, 100, the piston 54 having a plurality of diametrically opposed elongated slot openings 99 sloped to conform to a right hand thread, and the openings 100 in the piston 55 being sloped to conform to a left hand thread. It will now be seen that an advance of the piston 54 into its cylinder creates a clockwise torque and an advance of piston 55 into its cylinder causes a torque in the same direction, so that there is a relatively constant tendency for rotation of the piston means 53.

Modifications of the device 82 are shown in Figs. 15 and 16. In the former the device 102 comprises a casing 103 for a needle valve 104 which is like that at 91 except that it is normally urged to closing position by an expansion coil spring 105 which is adjustably tensioned by a head 106 like that at 94 but having threaded engagement with the casing 103.

The device 107 comprises a casing 108 having a needle valve 109 actuated to normally closed position by an expansion coil spring 110 whose tension is adjustable by a head 111 like that at 106. Carried by said head is an axial set screw 112 which is snugly threadedly secured to the head for movement therewith. The relation between the head and the set screw may be adjusted so that the set screw may afford a positive stop for opening movement of the valve 109.

The devices 102 and 107 by closing the ports 80, prevent any creeping flow of liquid such as may be caused by mere frictional forces in the mechanism hereinafter described which engages the piston means with the picker stick. Moreover, there is a small increase in cushioning action at the instant of initial movement of the piston means due to the yielding action of the springs as the valves open. In the device 102, the spring must be sufficiently powerful to sustain the maximum liquid pressure on the valve, whereas in the device 107 that maximum pressure is exerted on the positive abutment or set screw 112. Hence the range of opening movement of the valve 104 may be greater than that of the valve 109 to afford more yield during maximum shock. On the other hand, if it be assumed that the spring 110 is weaker than that at 105, the valve 104 will tend to close more rapidly and afford an increased follow-up cushioning action as compared with the valve 109, and hence bring the picker stick more rapidly to rest as the momentum of the shuttle is reduced. In connection with these observations, it is to be noted that each opening 80 may be constructed like the so-called perfect orifice so that the coefficient of friction in such opening may be constant; although the friction at the edges of these openings is not severe because the true area of discharge is determined by the needle valve.

In each of the bleeder devices, the openings 80 may be about $\frac{3}{32}$ of an inch in diameter, and in each case the capacity thereof is reduced to about one third by the needle valves. This applies to the open positions of the valves 104 and 109. For the device 83 the reduction in area may be much less.

The mechanism whereby the rocker shaft 56 is engaged with the picker stick 28, as in Figs. 1 to 6 inclusive, will now be described. Rigidly secured to the picker stick as by shackle bolts 113, is a plate 114 having an ear 115 rigidly carrying a stud or stub shaft 116 to which is affixed the ball-like portion 117 of a ball and socket joint 118 which may have a capacity for rather limited universal movement. Rigidly connected to the ball and socket joint, or the casing thereof, is a pin 119 on which there may be secured a hub 120 forming an end of an L shaped lever 121. The latter may include an arm 122 adapted to be alongside of the picker stick, and an arm 123 extending back of an edge of the picker stick, at which it carries a hinge structure 124 affording pivotal action about axes that are at right angles to each other indicated by the bolts or screws 125, 126, and serving to connect a bent or curved lever 127 to the lever 121. The opposite end of the lever 127 is freely journaled at 128 on the hub of the actuator plate 67, as shown in Fig. 8. This plate, which is more particularly shown in Fig. 6, is a sector of a circle and is provided on its underside with arcuate members 129 carrying individual teeth 130. For angular adjustment of the stops, the members 129 have arcuate slots 131 through which extend bolts 132 for clamping the members to the sector 67. These teeth are adapted to be engaged by a lug 133 on the lever 127 which oscillates between the teeth. Preferably the lever 127 is provided with identical lugs 133 on its upper and lower faces, although only the lug on its under face is operative. The reason for providing an extra lug is to permit the linkage between the shaft 56 and the picker stick to be reversed for use at either end of the loom. Such reversal is accomplished by disengaging the lever 127 from the shaft and turning the linkage upside down so that the top lug 133 at the left of a loom becomes the bottom lug 133 at the right of the loom, and vice versa, the casing and sector 67 being always in the upright position shown.

It will be noted that the lever 127 closely overrides the sector 67, and that the levers 121 and 127 lie in the same horizontal plane as clearly shown in Fig. 5. Hence the path of the teeth 130 and of the lug 133 is clear. The extreme positions of the sector 67 are shown in Figs. 2 and 3, the former corresponding to the picker stick position at 28a and the latter corresponding to the picker stick position at 28b. Between these positions, there is a path of lost motion corresponding approximately in length to that at C in Fig. 1, in which the lug 133 is out of contact with both teeth 130. More specifically, in Fig. 2, the lug 133 engages the left tooth 130 and turns the sector and hence the piston crank shaft 56 only along a path corresponding to that at A in which the momentum of the shuttle is reduced to zero. In Fig. 3 the lug 133 engages the right tooth 130 and turns the sector 67 clockwise, moving the piston means rightward only for a distance corresponding to the path B in which the picker stick is brought to rest after expelling the shuttle. Hence the following adjustments are possible:

1. By changing the angular distance between the teeth 130, the degree of lost motion between the lever 127 and actuator 67 is changed to adapt the device to looms of different sizes.

2. By varying the position of the left tooth 130, the position N may be changed thereby changing the length of the path A.

3. By varying the position of the right tooth 130, the position 28c may be changed, thereby changing the length of the path B.

It is noteworthy that the entire device 37 lies within the area of the loom, so that there are no projecting parts to interfere with a closely adjacent loom. For this reason, the ball and socket joint has been brought to the right side of the picker stick, this joint permitting the picker stick to oscillate with the lay 24 in a plane at right angles to the drawing in Fig. 1, and as indicated in Fig. 4, this motion occurring intermediate of the end portions of the travel of the picker stick. The resistance afforded to the picker stick upon impact with the shuttle is taken up by the hinge 124 which lies in the plane of the picker stick in Fig. 2 to avoid any tendency to twisting of the picker stick such as occurs with check straps that are mounted at one side thereof and hence have greater yield at the opposite side. The pivotal motion about the axis at 125 allows for any small variations in the elevation of the picker stick as it rocks about the shoe 27. In Fig. 6, the teeth 130 are positioned somewhat differently than in Fig. 2, and more particularly the right hand tooth of Fig. 2 is shown moved further rightward, in the inverted view of Fig. 6, to thus cause the checking travel B to be less or about one half that at A. The elevation of the linkage 122, 127 is preferably such that it lies somewhat above the midpoint of the picker stick to avoid deflection and rebound at the lower end of the picker stick.

The shuttle box 25, although generally or schematically illustrated, may be considered to represent such a box modified by omission of the shuttle retarding frictional binder spring which is a metallic strip extending along a substantial portion of the length of the shuttle box at the rear side thereof in Fig. 1. At the front side of the shuttle box there may be retained the relatively small light strip spring which actuates a movable wall or part of the shuttle box to take up for wear in the shuttle box and cause the shuttle to be snugly held. It is estimated that the binder spring may absorb possibly as much as one half of the momentum of the shuttle, whereas the action of the second spring mentioned is relatively insignificant in this regard.

Referring to Figs. 17 to 23, inclusive, and taking the outer full dead stop position 28a of the picker stick as a starting point for describing one complete cycle of operations of the hydraulic checking device 37, it will be noted in Fig. 17, that the lug 133 of the lever 127 is in engagement with the inside surface of the left hand tooth 130 of the actuator sector 67, and that the piston structure 54—55 is in a position with the outer end of the piston 54 lying substantially in line with the bleeding port 80 in the cylinder 49.

When the picker stick 28 is operated to throw the shuttle 31 across the loom, from left to right as seen in Fig. 1, the picker stick 28 will move freely through the initial power stroke of said stick and carry with it the lever 127, from position #1 through a corresponding segmental portion of the stroke of said lever, which, as seen in Fig. 17, is designated as "Power stroke, stick free," until the lug 133 on the lever 127 strikes the inside surface of the right hand tooth 130 of the actuator sector 67, whereupon the actuator sector 67 will begin to be rotated clockwise by the lever 127.

In that part of the travel of the lever 127 designated in Fig. 17 as "Stick checking," it will be noted that the stick checking zone of operation of the lever 127 is subdivided into three parts; namely, "Initial," "Advanced," and "Final."

At position #2, where the lever 127 picks up the actuator 60, the angular ports 100 are fully open. However, as the piston structure 53 moves to the right, Fig. 17, into position #3, Fig. 18, initial retardation of the lever 127, and consequently the stick 28, takes place by reason of the displacement of the liquid fluid contained in the apparatus, from the inside of the hollow piston 55 to the outside thereof, through the ports 100 in said piston.

As the piston 55 moves to the right from position #3, Fig. 18, to position #4, Fig. 19, the ports 100, in the hollow piston 55, are gradually closed by passing the inner edge 49a of the right hand cylinder 49, said edge functioning as a valve or cut-off which gradually reduces the area of the ports 100 in the hollow piston 55. As the area of the ports 100 is gradually reduced, the escape of the fluid from the interior of the hollow piston 55 is accordingly reduced and results in a corresponding increase in the resistance to the movement of the piston 55 in the right hand cylinder 49. As the resistance to the movement of the piston 55 in the right hand cylinder 49 increases, a corresponding increase in the resistance to clockwise rotation of the lever 127 ensues, and this is reflected in the resistance to clockwise rocking of the picker stick 28. The movement of the lever 127 from position #3, Fig. 18, to position #4, Fig. 19, is therefore termed "Advance" as noted in Fig. 17.

"Final" checking of the picker stick 28 occurs as said lever moves from position #4, Fig. 19, into position #5, Fig. 20, as the escape of fluid from the inside of the hollow piston 55 is through the bleeding port 80 in the right hand cylinder 49, solely. The rate of escape of fluid through the right hand bleeder port 80 is minutely controlled by the needle valve 84 operating in conjunction therewith. Consequently, the stick 28 may be brought to a dead stop at any desired place within

the "Final" checking segment of movement of the lever 127, wherein the momentum of the stick is completely spent in driving the fluid out of the right hand cylinder 49 through the controlled port 80 therein.

From the foregoing it will be clear that during the power stroke of the stick 28 through A plus the greater portion of C, as shown in Fig. 1, the stick 28 will be free of any retarding effect by the hydraulic checking device 37. In that portion of C approaching and adjacent B, preliminary checking of the stick 28 will take place; and during that portion of the stroke designated as B, final checking of the stick will take place.

In Figs. 21, 22 and 23, the return stroke of the lever 127 in accordance with the return stroke of the stick 28 is shown. From position #5, previously noted, the stick 28 will swing in a counterclockwise direction to position N, Fig. 1, under the influence of the torsion spring 137 and the strap 138. The position N corresponds substantially with position #7 of the lever 127. From position #5, Fig. 21, to position #6, the stick 28 travels free of any retarding effect set up by the hydraulic device 37, as the lug 133 of the lever 127 travels from the right hand tooth 130 of the actuator 67 until said lug engages the left hand tooth 130 thereof.

At position #6, the lever 127 begins to turn the actuator 67 in a counterclockwise direction and initially moves the piston structure 53 to the left from position #6 to position #7 as shown in Fig. 21. During this initial movement of the actuator 67 and piston structure 53, the fluid within the hollow piston 54 escapes rather rapidly through the wide open ports 99 therein until the leading upper left hand corners of the angular ports 99 arrives at the cut-off edge 49b of the left hand cylinder 49, as shown in Fig. 22, nevertheless such displacement of the fluid through the ports 99 does apply a minor retarding effect to the movement of the lever 127 and consequently to the stick 28.

During the travel of the shuttle 31 from the right side of the loom to the left side thereof, under impetus of the picker stick located at the right side of the loom, the forwardly moving front end of the shuttle 31 will engage the picker 30 on the picker stick 28, at such time as the picker stick is approximately at position N, Fig. 1, while the lever 127 is being moved from position #6 to position #7, Fig. 21, by the outwardly moving picker stick 28, whereupon "Initial" retardation of the lever 127 and stick 28 will be inaugurated.

As the lever 127 reaches position #7, Fig. 21, the advance corners of the angular ports 99 in the piston 54 will have arrived at the cut-off edge 49b of the left hand cylinder 49, as shown in Fig. 22.

As the movement of the piston structure 53 continues to the left, and the angular ports 99 pass under the cut-off edge 49b, the escape of fluid through the ports 99 is gradually reduced and the resistance to the leftward movement of the piston 54 and lever 127 are correspondingly gradually increased until the trailing corners 101 of the ports 99 pass the cut-off edge 49b, and cut off all escape of fluid through said ports. Thus the lever 127, and the stick 28, passes through the "Advanced" stage of checking.

When the trailing corners 101 of the ports 99 pass under the cut-off edge 49b, the escape of fluid from the interior of the left hand cylinder 49 is solely through the bleeding port 80, in said left hand cylinder 49, under control of the needle valve 91 associated therewith.

Thus the lever 127 passes into the "Final" checking stage (Figs. 21 and 23) as the stick 28 passes into the checking stage A (Fig. 1). By manipulating the needle valve 91 associated with the bleeding port 80 of the left hand cylinder 49, the stick 28 may thus be brought to a dead stop at any point desired in the checking segment A, and the lever 127 consequently checked and stopped dead at any point between position #8 and position #1 in Fig. 21.

As the liquid fluid in the hydraulic device 37 is preferably of an incompressible nature, there will be no rebound of the stick from its dead stopping point. Thus, no rebound of the shuttle 31 will take place as it is at such time gripped sufficiently by the laterally acting light spring in the shuttle box 25 to overcome any tendency of the shuttle to rebound from the picker 30 carried by the stick 28.

It will be understood that, as the piston structure 53 moves to the right and the piston 55 becomes effective to check the stick 28 in its movement in the same direction, after having started the shuttle 31 on its way across the loom toward the right side thereof, the interior of the piston 54 is refilling with fluid being drawn through the check valve opening 76, and vice versa, so that each cylinder 49 and its associated piston 54 or 55 as the case may be will be ready for immediate operation when the stick 28, lever 127 and piston structure 53 change direction of movement. So precise is this hydraulic control that the picker stick is accurately and unfailingly stopped at positions 28a and 28b. Actual tests have shown its sensitivity. By placing indicators on the shuttle and shuttle box and manipulating the key 98 while the loom was in operation, it was possible to observe the shift in the position 28a of the picker stick. Such results were obtained with the bleeder valve of Fig. 14. Figs. 15 and 16 are considered to possess the advantages of a normally complete closure to avoid even the most minute movement except under substantial power. Fig. 15 is believed to possess the advantage in that the graphic slope of the resistance increases as the momentum is expended; after a substantial part of the momentum has been absorbed, the danger of rebound of the shuttle is less, and hence the resistance may be proportionally increased, thus diminishing the checking path A and permitting the speed of the loom to be increased. Fig. 16 is like Fig. 14 in affording a predetermined positive bleeding position. It is believed that the full spring control of Fig. 15 has a further advantage over the positive adjustment of Figs. 14 and 16 in that a slight variation in the day by day condition of the loom may be less critical in its effect on the checking along path A so that adjustment of the bleeder valve may occur less frequently or might be wholly obviated; in other words the device of Fig. 15 will have the proper flexibility within the narrow limits permitted by the loom to afford continued satisfactory operation with little or no adjustment. A surprising factor in this invention is that it was possible to omit the binder spring, whereby the speed of the loom directly increased, because more power became available and a source of friction was eliminated. The heat generated in the liquid has been found to be so small, as the temperature need not be more than between 100 and 140 degrees F., that it may be disregarded, as the heat is readily dissipated by

the metallic parts of the device. The hydraulic unit cushions against excessive impact of the lug 133 of the lever 127 on the teeth 130 of the sector 67. Such cushioning is especially assisted by the spring closed bleeder valves. These teeth may be individually and collectively adjusted to vary the paths A, B and C for different looms. Due to the lost motion engagement in which the piston means is at rest, such adjustment is facilitated, and wear on the piston is diminished, because the travel of the piston is greatly reduced. The device may also be made much smaller. Furthermore, there is no impediment to the power thrust of the shuttle on the picker stick because during such motion along paths A and C, the picker stick is free of the piston means. During the movement of the picker stick by the shuttle, the resistance of the hydraulic unit is imparted by the linkage 122, 127 substantially squarely in the plane of the picker stick so that there is no twisting action on the latter. By the provision of angular openings 99 and 100 in the pistons rotation is caused for even distribution of wear. A complete liquid circulatory system is provided for each piston through outlet 80, passage 81, past the interrupted flange 75 of the end plug 74, thence through passages 52 to the openings 99, 100 into the cylinders 49, and also from within the area of the interrupted flange 75 through the check valve unit 70 into the cylinders 49. The hydraulic unit 37 is reversible for use at either end of the loom by interchanging the bleeder devices 82, 83 and by disconnecting the lever 127 from the rocker shaft 56 to position it in upside down relation to the cylinder 38 and the sector 67. Both casing sections 39 are identical and so are the pistons, check valve units, plugs, and even the crank shaft is reversible so that the shaft 56 may be received in either of the identical split hubs 42, 43.

It will thus be seen that a device has been provided which avoids the erratic action of a check strap, which is subject to rapid wear with consequent increase in its haphazard action. It is also seen that the device avoids the resilient action of proposed old pneumatic devices which afford entirely too little resistance when it is most required and afford greater resistance when less is needed, and which store power to prematurely advance the picker stick instead of affording a condition of zero energy as the shuttle comes to rest. It may be added that pneumatic devices cannot afford the accurate positioning of the picker stick herein attained. While it is submitted that pneumatic action is not feasible and has not proved practical, it may be pointed out that certain features of the invention, such as the lost motion action, may be practised with pneumatic devices. Although the device herein disclosed is double acting, it is to be understood that the most important feature of the invention resides in checking the momentum of the shuttle along path A, with or without checking of the picker stick as along path B.

It will be understood that the shuttle loses velocity in traveling across the lay of the loom so that the velocity at which the picker stick receives the shuttle may be substantially less than that at which it is projected. More particularly, the shuttle box with a binder spring may act as an important part of an energy absorbing means for bringing the shuttle to rest. When the shuttle impinges the picker stick, a part of the momentum involved is transferred to the latter, but reference may be made briefly to the momentum

of the shuttle to thus include the energy of both. Because the picker stick lies in an upright plane along the shuttle path, the mean distance of which plane from the vertical axis of the crank shaft of the hydraulic brake is relatively constant, the movement of the piston means is directly proportional to that of the picker stick. In fact, along paths A and B, the picker stick moves almost wholly in a vertical plane. The leverage at the linkage is shown to be approximately 4, and this should be doubled by the leverage of the picker stick. Hence the brake pressure is obviously very high. The bleeders should be of such size that the brake pressure will not become so high as to cause rebound. In any event, the liquid pressure becomes zero instantly with the termination of the checking action along paths A and B. The high pressures involved may also be obtained with rotary positive pressure hydraulic brakes, and the lost motion action furnished by interrupted gears or racks, but that structure does not lend itself to the simplicity and compactness obtained with a reciprocating hydraulic unit as herein disclosed.

I claim:

1. A device including a projectile-like element, means including a member movable to and fro along a predetermined path, said member serving to receive the impact of the element to be thus moved thereby to one end of said path from which position said member is capable of a power stroke for inaugurating movement of and projecting said element freely therefrom at a predetermined velocity, means for causing the power stroke of said member, energy absorbing means for absorbing the momentum of the member including the momentum imparted thereto by said element to quickly bring both to a condition of rest at the said end of said path, said energy absorbing means comprising a liquid filled positive pressure brake adapted to trap said liquid and having a restricted outlet for controlling flow of the liquid therefrom, said brake being actuated by said member so that a principal part of the said momentum is expended in forcing the liquid through said outlet, the pressure on the liquid being reduced substantially to zero instantaneously with the reduction to zero of said momentum by the energy absorbing means, and means rendering said brake incapable of impeding the movement of said member during that portion of the power stroke thereof preceding the projection of said element therefrom, and the said outlet affording such resistance to the liquid that the brake constitutes substantially the sole agency for causing the member and element to stop at said end of said path, without rebound, so that the member is in the position necessary for said movement inaugurating and projecting of the element at said predetermined velocity.

2. A device according to claim 1 wherein said brake is double acting and serves to co-act with the member to absorb the momentum thereof at the other end of said path after the element has been projected by the member, and lost motion means interengaging the member and the brake to cause the brake to exert pressure on the liquid solely when the member approaches the ends of its path.

3. A loom including a shuttle, means including a picker stick movable along a path to receive the impact of the shuttle at a point intermediate of the ends of the path to be moved by the shuttle to an outer end of said path from which position the picker stick is capable of moving toward

the inner end of the path in course of inaugurating movement of and projecting the shuttle freely therefrom at a predetermined velocity, means for absorbing the energy of the picker stick including the energy imparted thereto by the shuttle, comprising a liquid filled positive pressure brake having a flow control outlet orifice and being so coordinated with the picker stick that the brake forces liquid through said orifice in course of travel of the picker stick under the energy of the shuttle to thereby absorb a principal part of said energy and cause the energy absorbing means to bring the picker stick and shuttle to rest at the outer end of said path, the pressure on the liquid being reduced substantially to zero when the said condition of rest is attained, and said orifice being of such size that the brake causes the picker stick and shuttle to stop without rebound at a predetermined point at the outer end of said path, and means rendering said brake incapable of impeding the movement of said picker stick during said movement inaugurating and shuttle projecting of said picker stick.

4. An automatic bobbin loading loom including a shuttle, a picker stick therefor, means for causing a power stroke of the picker stick after the latter has received the shuttle and has been moved by the shuttle to the outer end of its stroke, means for absorbing the momentum of the picker stick including that applied thereto by the shuttle, comprising a liquid filled positive pressure brake for absorbing the principal part of said momentum to bring the picker stick and shuttle to rest, the brake having a flow control outlet orifice such that said brake constitutes substantially the sole means for determining the precise point of rest at said outer end of the stroke, with the orifice causing the liquid to offer a hydraulic resistance of relatively constant slope in bringing the picker stick and shuttle to rest without rebound, whereby the shuttle is capable of automatic bobbin loading and of being projected by the picker stick with a predetermined impulse caused by the first mentioned means, and actuating means for said brake being so related to the picker stick that the latter is free of liquid resistance during the movement inaugurating and shuttle projecting portions of its power stroke.

5. A loom according to claim 3 wherein said brake is also coordinated with the picker stick to cushion the latter as it approaches the inner end of its path after having projected the shuttle, and lost motion means acting between the brake and the picker stick such that the picker stick returns to its intermediate position and moves on the movement inaugurating and shuttle projecting portions of its power stroke free of resistance of the liquid in the brake.

6. A loom according to claim 4 wherein said brake is double acting to also absorb the energy of the picker stick after projecting the shuttle, and lost motion means interengaging the brake and the picker stick so that the brake affords liquid resistance only when the picker stick approaches the ends of its path.

7. A loom having a shuttle, a picker stick therefor, a positive pressure brake having bleeder means for checking the motion of the picker stick as it approaches the ends of its path and being free of the picker stick along its to-and-fro intermediate travel, means for actuating the brake in synchronization with the picker stick, said brake being double acting, and said means including lost motion means comprising spaced elements at least one of which is adjustable to vary its position, said elements co-acting with the picker stick for actuation thereof as the picker stick approaches the respective ends of its path.

8. A loom having a shuttle, a picker stick therefor, actuator means for causing a power stroke of the picker stick and for causing a return movement of the same to shuttle receiving position, and energy absorbing means independent of the actuator means for absorbing the momentum of the received shuttle, and of the picker stick at both ends of the path of the latter, including a liquid filled, double acting positive pressure brake having different bleeder means for checking the picker stick at different ends of its path, a piston means driven by the picker stick and having pistons for the respective bleeder means, individual cylinders for the pistons, check valves for the individual cylinders, a reservoir between the cylinders communicating with the bleeder means and with the check valves, the reservoir having direct communicating means with the cylinders cut off by advance strokes of the respective pistons, a crank shaft in the reservoir engaged with the piston means, and lost motion means engaging the crank shaft with the picker stick to cause movement of the piston means only when the picker stick approaches the ends of its paths.

9. A loom according to claim 8 wherein the bleeder means for the different cylinders afford openings of different sizes, the bleeder means for checking the inward movement of the picker stick after projection of the shuttle cooperating with the said communicating means for its cylinder to cause checking of said inward movement of the picker stick.

10. A loom according to claim 8 wherein the said communicating means including angular openings differently sloped in the different pistons, the latter being hollow, whereby advance movements of the pistons cause the liquid to tend to rotate the piston means for even wear thereon.

11. A loom according to claim 8 wherein the lost motion means includes reversible means detachable from the crank shaft whereby the double acting brake can be interchangeably associated with a picker stick at either end of the loom.

12. A loom according to claim 8 wherein the lost motion means includes an oscillatory member and an element having adjustably spaced teeth between which said member oscillates, the limits of lost motion being determined by engagement of the oscillatory member with said teeth, and the action of the bleeder means serving to cushion the engagement of the oscillatory member with said teeth.

13. A loom having a shuttle, a picker stick therefor, a liquid filled positive pressure brake having bleeder means and being actuated by the picker stick to check the same at a predetermined point, as determined by the bleeder means, without rebound of the shuttle, means for circulation of the liquid so cooperating with the brake that the picker stick is free of brake resistance during an initial predetermined portion of its power stroke, means constantly connecting and acting between the picker stick and the brake to effect delayed return of the latter to initial position after completion of the power stroke of the picker stick, and independent means for adjusting the bleeder means to determine the precise point at which the picker stick comes to rest upon completion of the said checking movement.

14. A loom having a shuttle, a picker stick therefor, a liquid filled double acting positive pressure brake for checking the picker stick as the latter approaches the outer and inner ends of its path of travel, means constantly connecting said picker stick to said brake and including means rendering said brake ineffective during predetermined initial portions of each of said paths, the brake having bleeder means for the different checking actions, the brake having different portions for forcing liquid through respective bleeder means so cooperating with the latter as to afford different checking forces for the picker stick at the different ends of its path of travel, and check valve means associated with said different portions.

15. A loom having a shuttle, a picker stick therefor, a liquid filled, positive pressure brake actuable by the picker stick, the brake having a bleeder means whereby the momentum of the shuttle is absorbed, and a spring pressed valve for the bleeder means.

16. A loom comprising a reciprocable shuttle, an oscillatory picker stick adapted to be engaged and moved in one direction by said shuttle and to drive said shuttle in the opposite direction across said loom, a device for checking the movement of said stick in at least one of said directions, said device comprising a liquid-filled cylinder, a piston operable axially in said cylinder to displace said liquid from one position to another within said cylinder, and means for controlling said displacement including valving means comprising a pair of relatively movable valving surfaces with one arranged substantially at right angles to the axis of said cylinder and the other inclined to said axis, whereby said displacement will be gradually reduced during axial movement of said piston in one of said directions relative to said cylinder.

17. A loom comprising a reciprocable shuttle, an oscillatory picker stick adapted to be engaged and moved in one direction by said shuttle and thereafter drive said shuttle in the opposite direction across said loom, a device for checking the movement of said stick in at least one of said directions, said device comprising an outer liquid-filled cylinder, an inner cylinder fixed in said outer cylinder, a piston axially operable in said inner cylinder, a liquid port in said piston having a valving surface disposed at an incline to the axis of said inner cylinder, a valving surface formed at one end of said inner cylinder substantially at right angles to said axis and cooperating with the first said valving surface to reduce the area of said port and consequently the rate of said displacement during relative axial movement of said piston relative to said inner cylinder.

18. A loom having a shuttle, a picker stick therefor, a liquid filled double acting positive pressure brake for checking the picker stick as the latter approaches the outer and inner ends of its path of travel, means constantly connecting said picker stick to said brake, means rendering said brake substantially ineffective during predetermined initial portions of each of said paths, the brake having by-pass means for the different checking actions, the brake having different portions for forcing liquid through respective by-pass means so cooperating with the latter as to afford different checking forces for the picker stick at the different ends of its path of travel, and check valve means associated with one of said different portions.

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