July 23, 1929. E. H. BALLOU 1,721,940

PNEUMATIC WEFT INTRODUCING MECHANISM FOR LOOMS

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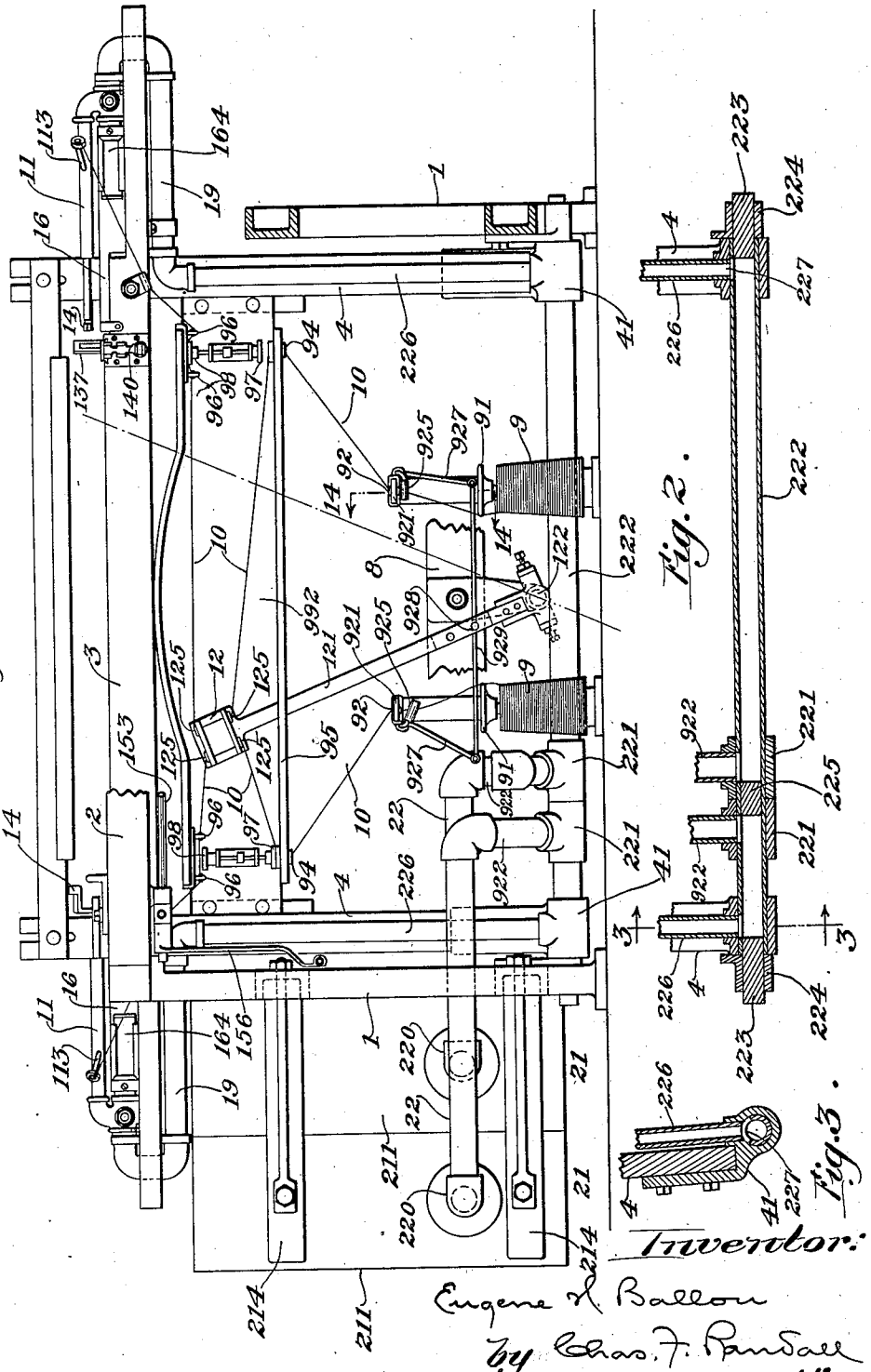


Fig. 1.

Fig. 2.

Fig. 3.

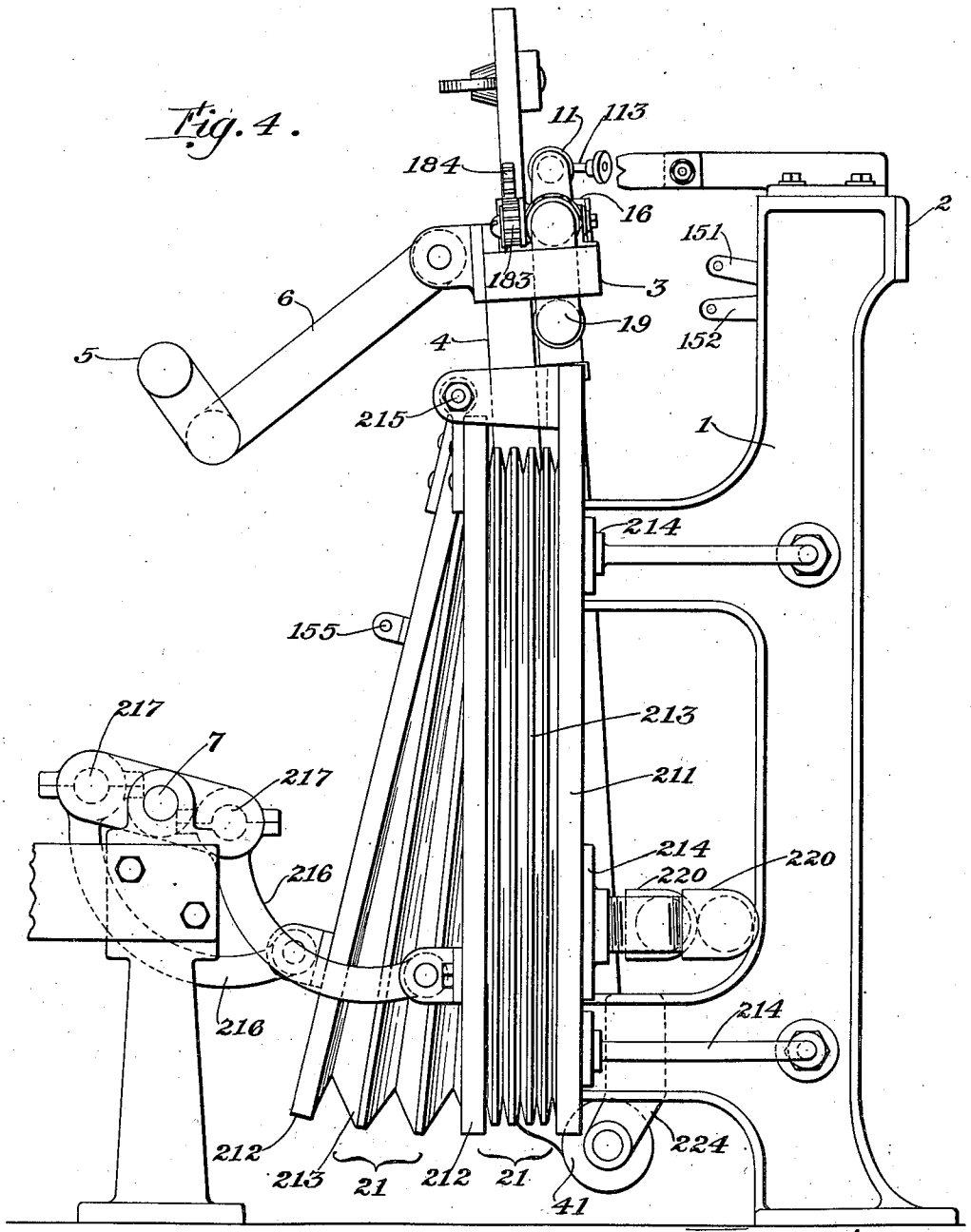
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PNEUMATIC WEFT INTRODUCING MECHANISM FOR LOOMS

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Fig. 4.



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PNEUMATIC WEFT INTRODUCING MECHANISM FOR LOOMS

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Fig. 8.

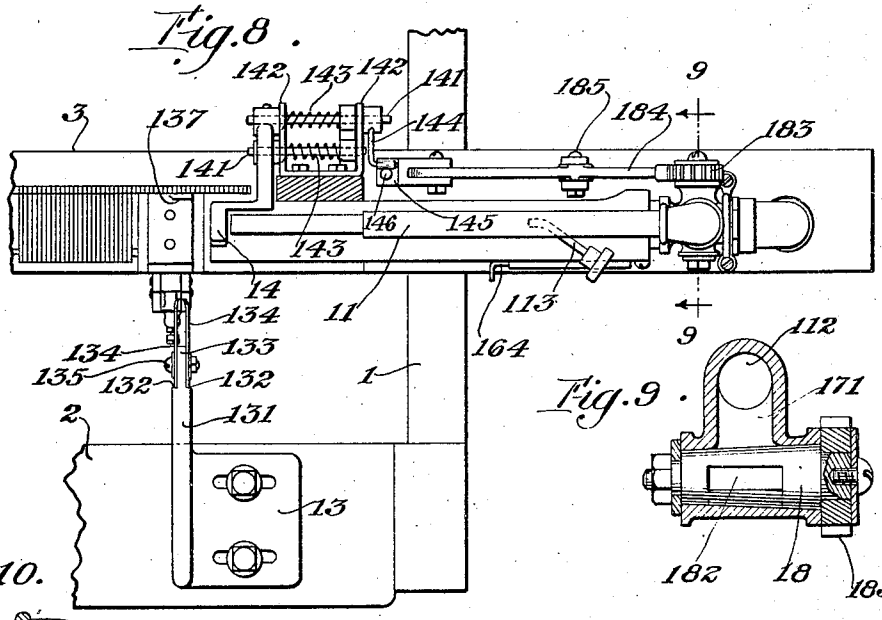


Fig. 9.

Fig. 10.

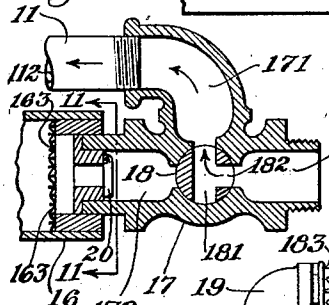


Fig. 7.

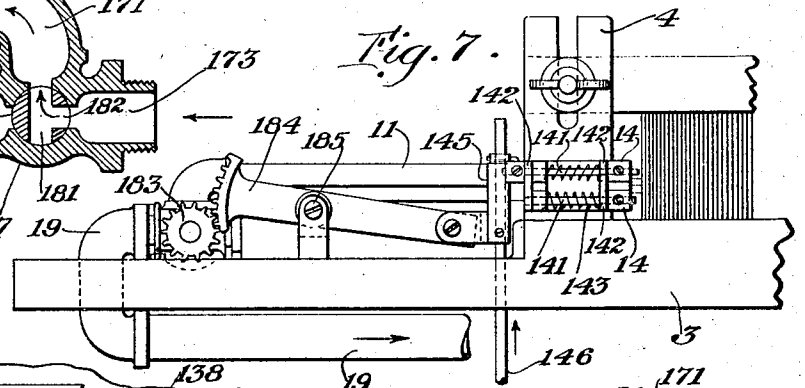


Fig. 6.

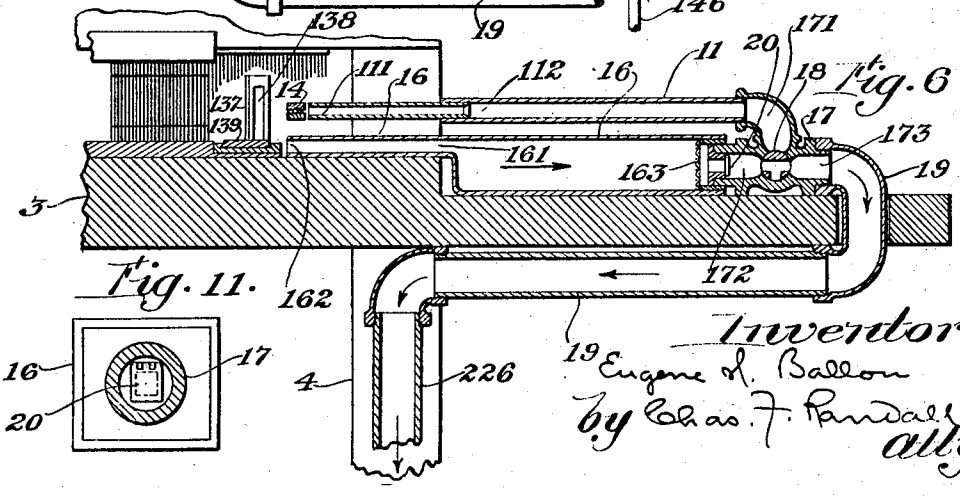


Fig. 11.

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PNEUMATIC WEFT INTRODUCING MECHANISM FOR LOOMS

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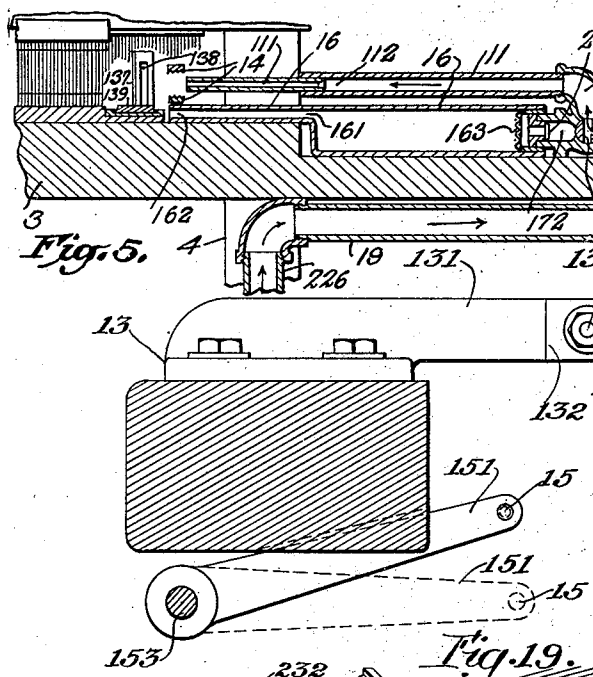
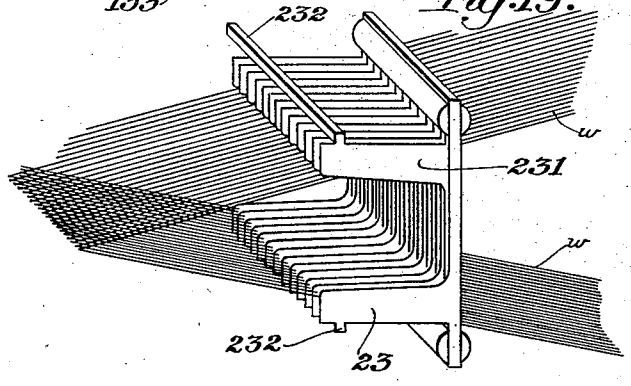


Fig. 5.

Fig. 18.

Fig. 19.



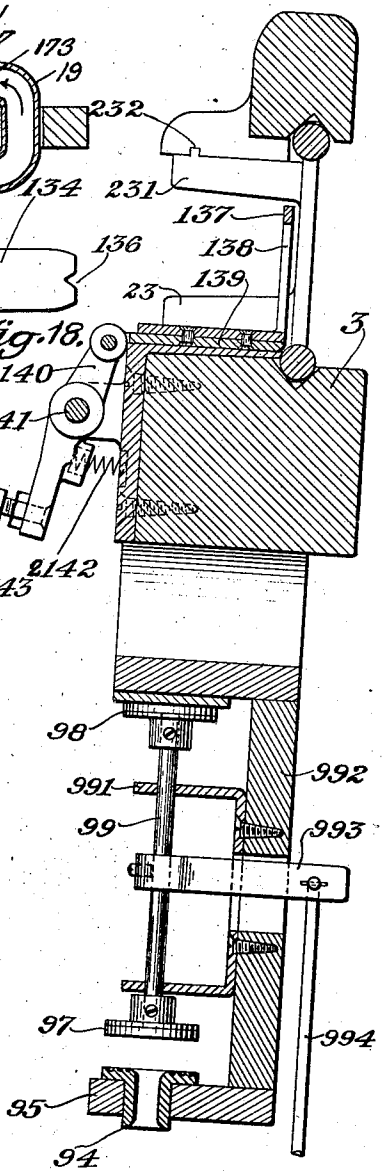
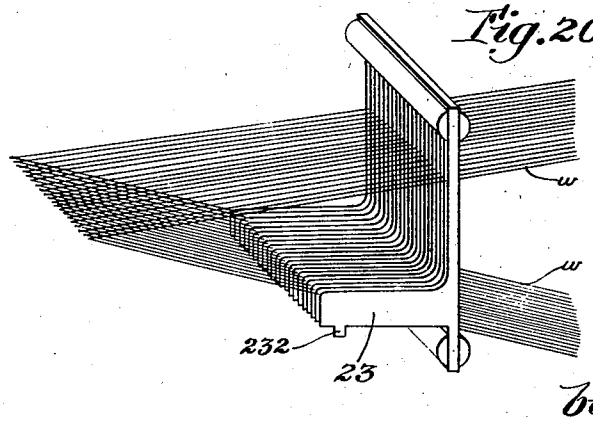


Fig. 20.



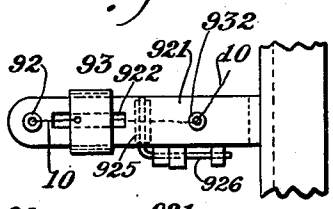
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PNEUMATIC WEFT INTRODUCING MECHANISM FOR LOOMS

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Fig. 15.



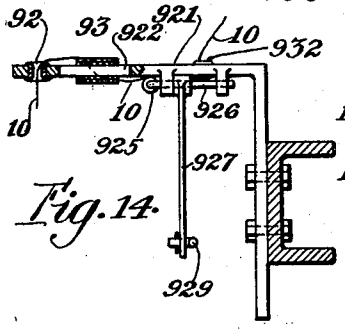
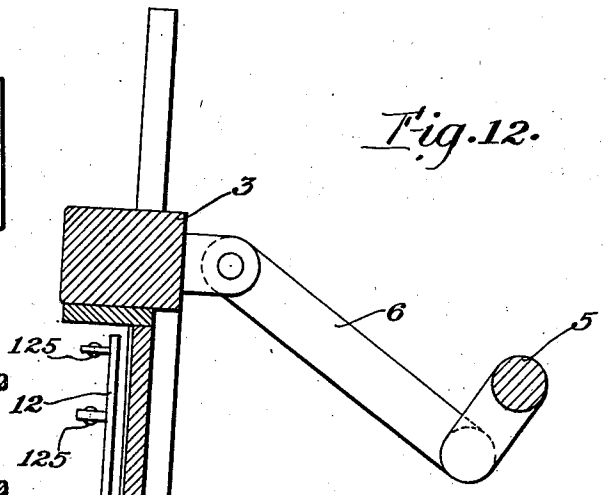


Fig. 14.

Fig. 12.



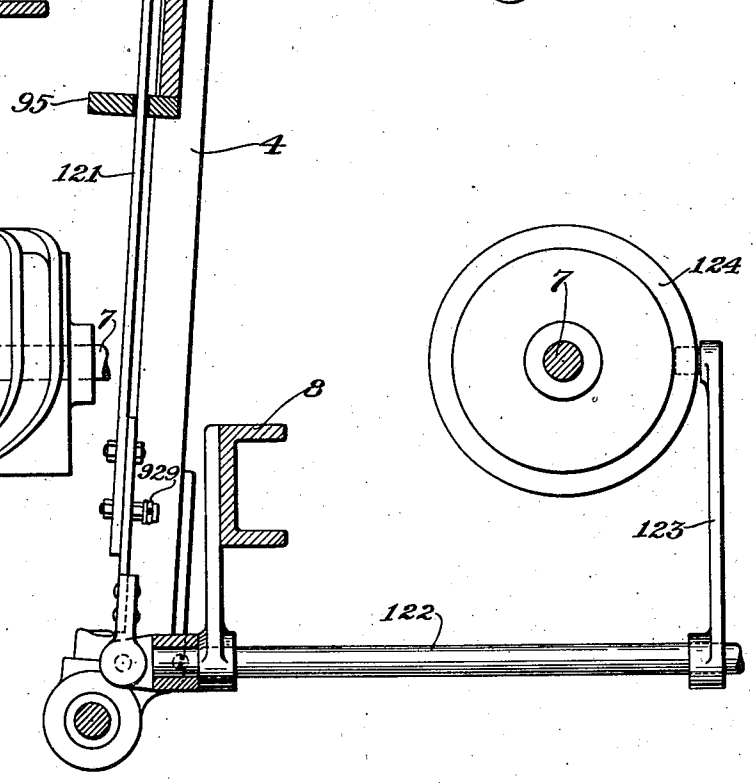
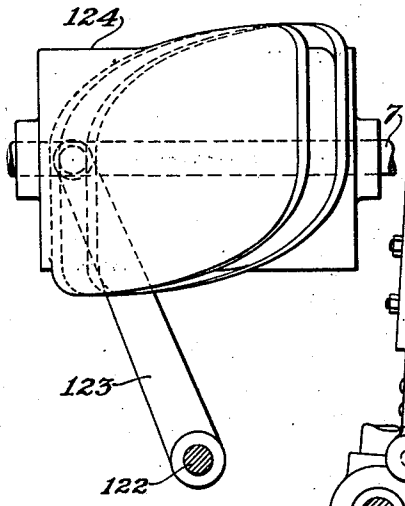


Fig. 13.



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PNEUMATIC WEFT INTRODUCING MECHANISM FOR LOOMS

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Fig. 16.

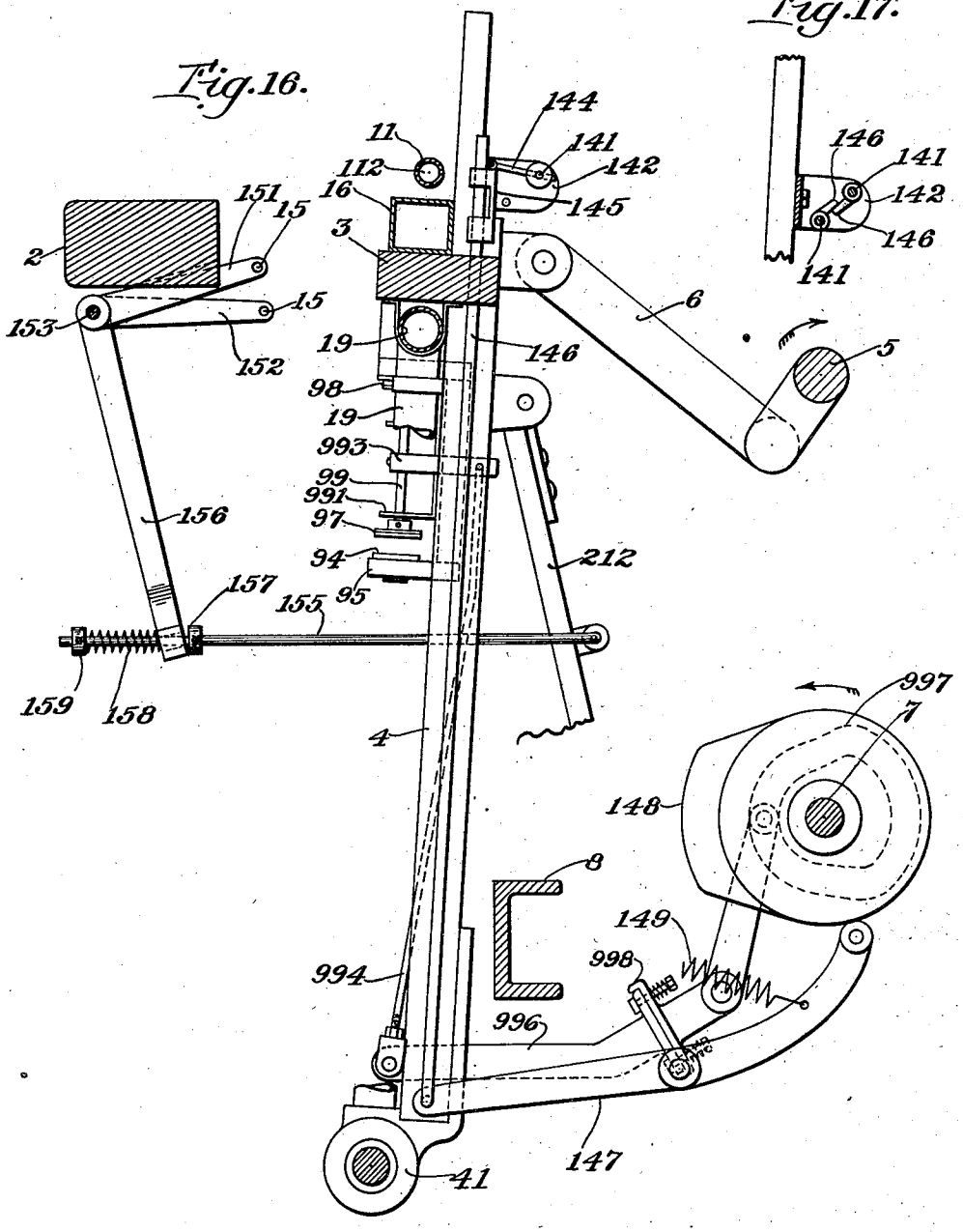


Fig. 17.

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UNITED STATES PATENT OFFICE.

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PNEUMATIC WEFT-INTRODUCING MECHANISM FOR LOOMS.

Application filed June 28, 1928. Serial No. 288,836.

The invention consists in improved devices designed for employment in looms, for effecting, through ultilization of the carrying power of a stream of air, the introduction of picks of weft or filling into the successive sheds that are formed in the warp-threads in a loom for the reception of such picks.

An embodiment of the features and principles of the invention is shown in the accompanying drawings, in which latter,—

Fig. 1 illustrates the application of the said embodiment in connection with the frame and lay of a loom, the view being on the order of a front elevation, partly sectional, with portions of certain parts broken away.

Fig. 2 is a view representing in section in a vertical plane the feet of the swords of the lay of Fig. 1, and the tubular support on which such feet are mounted.

Fig. 3 is a view in vertical section in the plane indicated by the dotted line 3, 3, in Fig. 2.

Fig. 4, Sheet 2, is a view in side elevation showing chiefly parts which are involved in the invention, looking from the left in Fig. 1, and on a somewhat larger scale.

Fig. 5, Sheet 3, is a sectional view, looking toward the rear of the loom, showing the propelling air-nozzle and adjacent parts, and illustrating flow of air in the direction for propelling a pick of weft or filling through a shed.

Fig. 6, Sheet 4, is a similar view illustrating flow of air through the suction nozzle for the purpose of extending the terminal portion of a pick of weft or filling and taking up slack therein.

Fig. 7, Sheet 4, is a view corresponding in subject matter with Fig. 6, in elevation as viewed from the rear.

Fig. 8, Sheet 4, is a partly sectional plan view of the parts of Figs. 6 and 7, and certain adjacent parts.

Fig. 9, Sheet 4, is a view on a still larger scale showing certain parts in vertical section in the plane indicated by dotted line 9, 9, Fig. 8, with the valve-plug in elevation.

Fig. 10, Sheet 4, is a view on the same scale as Fig. 9, showing the valve devices in vertical section in a plane at right angles with that of Fig. 9.

Fig. 11, Sheet 5, is a view in vertical section in the plane indicated by dotted line 11, 11, Fig. 10.

Fig. 12, Sheet 5, is a view on the same scale as Fig. 4, partly in vertical section in a plane extending from front to rear in the loom, showing chiefly the lay, the pull-off, and the means for imparting a reciprocatory movement to the pull-off.

Fig. 13, Sheet 5, is a front view of the actuating cam for the pull-off, and the arm that is engaged by the said cam, with the intermediate rockshaft shown in section.

Fig. 14, Sheet 5, shows in side elevation, partly in vertical section in the plane indicated by dotted line 14, 14, Fig. 1, the device employed adjacent the source of supply of one of the weft or filling yarns for preliminary control of such yarn.

Fig. 15, Sheet 5, shows the said device in plan.

Fig 16, Sheet 6, is a sectional view on the same order as Fig. 12, Sheet 5, showing the interrelations of many of the parts which cooperate in weft-introduction, &c.

Fig. 17, Sheet 6, is a view of certain details of the grippers at the delivery end of the propelling air-nozzle.

Fig. 18, Sheet 7, is a sectional view on a much larger scale than the preceding views, showing chiefly the check-devices for one of the weft or filling yarns, and the cutter-devices for such yarn.

Figs. 19 and 20, Sheet 7, are isometric views showing different forms of the means for guiding the picks of weft or filling through the sheds in the warp.

Having reference to the drawings,—

The side-frames of a loom are indicated at 1, 1, and the breast-beam thereof at 2; the lay-beam is indicated at 3, the lay-swords at 4, 4, and the loom crank-shaft at 5, and at 6, 6, are indicated the pitmen connecting the cranks of the said crank-shaft to the lay; at 7 is the loom cam-shaft; and at 8, Figs. 12 and 16, is a cross-girth constituting an element of the loom-frame.

The weft-introducing devices which are shown at the opposite sides of the loom are coordinated to effect weft-introduction from the respective sides, alternately. The improvements which I have made in these devices are explained hereinafter.

At 9, 9, in Fig. 1, are shown two large wound packages of weft or filling yarns 10, 10, from which packages the said yarns proceed, in so-called continuous length, to the

said weft-introducing devices. One of the said wound packages 9 serves as the source of supply of the weft or filling yarn 10 that is introduced at one side of the loom; the other thereof serves as the source of supply for the weft or filling yarn 10 that is introduced at the opposite side of the loom. Successive pick-lengths of the respective yarns are introduced from the opposite sides of the loom, alternately, into the successive sheds which are opened for their reception in the warp-threads. Intermediate the supply packages 9, 9, and the weft-introducing devices the weft or filling yarns 10, 10, are controlled by means of devices for controlling the drawing-off from such packages, pull-off means for pulling the respective yarns 10, 10, from the sources of supply and paying them respectively to the weft-introducing devices, and check-devices, all of which are described later herein, next succeeding the following general description of the weft-introducing devices and their operation. Novel and improved features are embodied in the said intermediate means, as explained.

The devices for introducing successive pick-lengths of the weft or filling yarns 10, 10, into the sheds that are opened in the warp-threads for the reception of such pick-lengths include, at each side of the loom, a propelling air-nozzle 11, that is carried by an extension of the lay-beam projecting laterally of the loom outward beyond the selvage warp-threads. The said propelling air-nozzle has its air-discharging orifice 111, Figs. 5 and 6, trained transversely of the loom, toward the opposite side of the latter, and so disposed that when the lay is rearward from front center the said orifice is presented in line with the opening formed by a shed in the warp-threads. The leading end of the yarn 10 that is supplied to a propelling air-nozzle 11 is entered into the longitudinally-extending air-passage 112, Figs. 5, 6, 9, 10, and 16, of such air-nozzle through an induction-tube 113, Figs. 1, 4, 8, set in the shell of the nozzle and opening into the said air-passage. In operation, the pull-off is caused to pay out a sufficient length of such yarn 10 for a pick, and a blast of air, indicated by the arrows in Fig. 5, sent through the said air-passage 112 as the lay moves rearward, takes the said leading end with it into and through the shed-opening, thereby extending a pick-length across the warp-series within the shed-opening. This action performed in connection with one shed-formation in the warp by means of the propelling air-nozzle at one side of the loom is succeeded for the following shed-formation by the like action performed in connection with the propelling air-nozzle at the opposite side of the loom, and so on in an alternating succession. The paying-out of the requisite amount of each yarn 10 in succession is accomplished through the yielding-up action of the pull-off device 12, Figs. 1 and 2. The said device is in engagement with the weft or filling yarns 10, 10, intermediate the air-nozzles 11 and the wound packages 9, 9, from which the said yarns are drawn. Such pull-off device is actuated, in manner hereinafter explained, to draw the required amount of each yarn in turn from the source of supply thereof, and then yield it up to be carried by the moving air through and from the appropriate nozzle 11, into a shed-opening in the warp, and across beyond the selvage warp-threads at the other side of the loom.

With each air-nozzle 11 is associated means whereby after the weft or filling yarn has been propelled from such air-nozzle through a shed in the warp-threads, such yarn is parted at a point intermediate the air-nozzle and the adjacent selvage-warps, close to the latter. Also, with the air-nozzle and the said weft-parting means is associated means whereby between the place of parting and the air-nozzle the yarn-end projecting from the discharge-orifice of the air-nozzle is held to prevent such yarn-end from being blown back into the air-passage 112 by the air-movement from the nozzle at the opposite side of the loom by which the next pick is introduced into the next shed; also to prevent it from being retracted accidentally into the air-passage 112 of the air-nozzle and out through the induction-tube 113. My invention comprises, in part, novel and improved weft-parting means and end-clamping means, and novel combinations into which the same enter, as described later.

Referring, now, to the devices by which the weft or filling yarns 10, 10, are controlled intermediate the source of supply and the weft-introducing devices:

Fig. 1 shows a paying-off disk 91 of well-known character above the upper end of each wound supply-package 9, such disk being mounted upon the retaining spindle or pin of such package, and being arranged to keep the unwinding portion of the yarn 10 extending outward so as to reduce the tendency of such portion to catch upon the periphery of the upper portion of the package in manner to interfere with free delivery of the yarn from the package. Above each yarn-package and its paying-off disk a drawing-off guide-eye 92 is provided in connection with a stationary horizontal bar 921, Figs. 1, 14, and 15. Back of such drawing-off guide-eye, a tension-device 93 is provided upon the said bar, such tension-device consisting of a small plate surfaced with material capable of offering a slight frictional resistance to the movement of yarn contacting therewith. The yarn 10 extends from the drawing-off guide-eye 92 rearward to the tension-device 93 and down through a hole 931 in such tension-device and through a slot 922 in the bar 921, and then extends rearwardly along the under side

of bar 921 to, and upward through, a guide-eye 932, Fig. 15, in the bar. At each end of the lay a guide-eye 94 is provided upon a support 95 carried by the lay. One yarn 10, after passing upward through its guide-eye 932, Figs. 15 and 16, extends to the laterally-displaced guide-eye 94 at one side of the loom, and after passing such guide-eye 94 extends inwardly, and is engaged with the pull-off 12, from which it extends to guide-eyes 96, 96, in connection with secondary check-devices adjacent such guide-eye 94, on its way to the weft-introducing devices at such side of the loom. The other yarn 10, after passing upward through its guide-eye 932 extends to and through the guide-eye 94 at the other side of the loom from that at which the guide-eye for the yarn 10 first mentioned is located, and then upward through such guide-eye, it extending inwardly to and being engaged with the pull-off 12, from which it extends to guide-eyes 96, 96, in connection with secondary check-devices located adjacent its guide-eye 94, on its way to the weft-introducing devices at the second side of the loom.

The pull-off 12 is constituted of an arm 121, Figs. 1 and 12, extending upward from a rockshaft 122 located in the lower part of the loom and extending in the direction from front to rear, the said rockshaft having an upwardly-extending arm 123, that is operatively engaged with a grooved cam 124 upon the loom camshaft 7, by means of which cam the pull-off is actuated so as to cause it to swing transversely of the loom, from its position indicated in Fig. 1 by the inclined dot and dash line to its illustrated position, and vice versa.

As illustrated in Fig. 1, one yarn 10 extends from its guide-eye 94 inwardly crosswise of the loom to the pull-off 12, passing through a pair of eyes 125, 125, in connection with the pull-off and then outwardly on its way to guide-eyes 96, 96, on the lay adjacent the weft-introducing devices at the side of the loom at which such guide-eye 94 is located. The other yarn 10 passes in like manner from its guide-eye 94 inwardly to the pull-off, then through a pair of eyes 125, 125, in connection with the pull-off, and then outwardly to guide-eyes 96, 96, on the lay adjacent the weft-introducing devices at the other side of the loom.

Secondary checking devices for the yarns 10, 10, are employed in connection with the guide-eye 94 and the pair of guide-eyes 96, 96, at each side of the loom. These devices, in the form illustrated in Figs. 1, 16, and 18 comprise a presser 97 for coaction with guide-eye 94, and a presser 98 for coaction with the pair of guide-eyes 96, 96, the said pressers being mounted upon the lower and upper ends, respectively, of a spindle 99 working vertically up and down within guides in connection with arms of a bracket 991 carried by a support 992 upon the lay. At each side of the loom, presser 97 is arranged for coaction with an annular seat around guide-eye 94, to clamp against such seat at the required times in the working of the loom the yarn 10 passing through such guide-eye on the way to the pull-off; and presser 98 is arranged for coaction with a surface between the pair of guide-eyes 96, 96, to clamp against such surface, at the required times, the portion of the said yarn which extends outward from the pull-off through the guide-eyes 96, 96, to the weft-introducing devices. The pressers are provided, as indicated in Figs. 16 and 18, with surfacings of yielding frictional material for cooperation with the said seat and surface in holding the yarn clamped against such seat and surface. For the actuation of the respective pairs of pressers, each spindle 99 has affixed thereto an arm 993, which is connected by means of a rod 994 to a lever 996 which is engaged with a grooved cam 997, Fig. 18, upon camshaft 7. The lever 996 is shown constructed with a give-away joint 998 which yields when the pressers bring up firmly against the seat and surface with which they coact, so as through such yielding to avoid cutting of the yarn 10.

As shown in Fig. 1, one yarn 10 extends inward across the loom from its guide-eye 94 to the pull-off and then outward to the guide-eyes 96, 96, on its way to the weft-introducing devices at one side of the loom, such yarn being thereby formed into an inwardly-extending loop. The other yarn 10 in like manner, through its engagement with the pull-off, is formed into an oppositely-extending loop on its way to the weft-introducing devices at the opposite side of the loom. In every stroke of the pull-off the loop of one yarn 10 is extended, thereby drawing off from the source of supply enough of such yarn for another pick of weft or filling, while the loop of the other of said yarns is paid out to permit the end portion of the yarn to be carried into a shed in the warp by a stream of air projected from the weft-introducing devices. During the extension of the loop of a given yarn, the presser 97 for such yarn is opened away from the yarn so as to permit free rendering of the yarn through the associated guide-eye 94 from the source of supply, but the companion presser 98 is closed upon the yarn between the pull-off and the weft-introducing devices, to prevent the end-portion of the yarn from being withdrawn from the nozzle 11. At this same time, in the case of the loop that is being paid out by the pull-off to the action of the stream of air by means of which its end-portion is being carried into a shed in the warp, the presser 98 is opened away from that part of the yarn which extends from the pull-off to the weft-introducing devices, to permit free movement of such portion in response to the action of the mov-

ing air, while that part of such yarn which extends through the guide-eye 94 is clamped by presser 97 to guard against additional yarn being drawn during this weft-inserting action from the source of supply.

I have shown in Figs. 1, 14, 15, primary yarn-checking devices located between the pull-off and the respective yarn-packages 9, 9. These primary yarn-checking devices comprise a presser 925 adjacent each leading-off guide-eye 92. Such presser is constituted by a jacketed arm of a rockshaft 926 mounted alongside the arm 921. Each rockshaft has a downwardly-extending arm 927, the two arms 927, 927, being connected together and to the pull-off at 928 by a rod or wire 929. These parts and connections provide for actuation of the primary checking pressers 925, 925, by means of the pull-off, and in synchronism with the movements of the latter, so that as the pull-off approaches either end of its working stroke the presser 925 for the yarn which is being drawn out into a loop will be closed against such yarn adjacent the corresponding drawing-off eye 92, to prevent overrunning of the yarn from the source of supply under the momentum acquired by it in its movement while being drawn by the action of the pull-off. At other times the pressers 925, 925, remain open with the respective yarns 10, 10, uncontrolled thereby.

My novel and improved weft-parter means includes coacting elements 134, 134, and 137, Figs. 5, 6, 8 and 18, which are mounted upon the loom-frame and the lay, respectively. Through the movements of the lay these elements are made operative to part the weft or filling yarn as just mentioned. The novel and improved yarn-end holding means includes a pair of nippers 14, 14, Figs. 5, 6, 7, and 8, carried by the lay and arranged to work adjacent the discharge-orifice at the inner end of a propelling air-nozzle 11.

Referring to the weft-parting means: At each side of the loom, upon the breast-beam 2 a stand 13 is mounted, as shown by Figs. 8 and 18, such stand being provided with a rearwardly-extending arm 131 having its rear end-portion reduced in thickness to form vertical shoulders 132, 132, and an intermediate projection 133, Fig. 8, having vertical side-faces. To the said vertical side-faces of the said reduced rear end-portion a pair of spring-blades 134, 134, is secured, with the said blades applied against the said side-faces at opposite sides of said projection and held thereto by means of a bolt 135. The front ends of the blades are in contact with or close to the vertical shoulders 132, 132. The blades extend rearward from the projection 133, and their rearmost portions converge. Their rearmost extremities are notched, as at 136, Fig. 18, to receive the yarn 10 which is to be parted, the notching serving to prevent the said yarn from slipping upward or downward so as to escape the parting action.

Upon the lay-beam, between the inner end of each propelling air-nozzle and the position of the adjacent warp-threads, a slotted pusher-member 137 is mounted. The vertical slot, 138, of this pusher-member is alined with the blades 134, 134, of the stand 13, at the same side of the loom, so that in the cooperation of the parts the blades may enter the said vertical slot 138 as the lay advances toward front center. In virtue of this alinement it results that, as the lay advances after a pick-length of weft or filling yarn 10 has been blown from the discharge-orifice of the adjacent propelling air-nozzle 11 into and across within a shed in the warp-threads, the portion of such yarn which extends outward from the selvage warp-threads to the said discharge-nozzle will be carried by the pusher-member 137 against the rear ends of the spring-blades 134, 134, and in consequence of becoming lodged in the notches of the rearmost extremities of such blades will be caused to enter with such extremities into the slot of the pusher-member. By means of the side-portions of the pusher-member portions of such yarn will be carried forward at opposite sides of the spring-blades, and will be clamped against the exteriors of the spring-blades by the said side-portions. The effect of the interaction of the elements thus far described will be to part the yarn 10, by either a shearing action or a breaking action.

The elements may be so coordinated, &c., that at each side of the loom the weft-pusher member 137 and spring-blades 134, 134, shall coact at every beat-up of the lay. Preferably, however, I provide a construction and combination of parts so contrived that at each side of the loom the coaction of the weft-pusher member 137 with the spring-blades 134, 134, is intermitted, it not being necessary that the parts at a given side of the loom should coact as for weft-parting purposes at those times when pick-lengths of weft or filling are introduced from the opposite side of the loom. Herein the intermitting is provided for by arranging so that in the normal position of the weft-pusher member 137 upon the lay it is so far back thereon that at the beat-up the side-portions of such member do not coact with the spring-blades 134, 134. To provide for bringing about such coaction, the weft-pusher member 137 is mounted movably upon the lay-beam, so that when the weft-parting action is called for the said member may be shifted forward upon the lay-beam far enough for the required coaction with the spring-blades 134, 134. In the present instance the foot of each weft-pusher member 137 is attached to a carrier 139, Fig. 18, which occupies a guideway on the lay-

beam extending forwardly and rearwardly, in which guideway the said carrier 139 is capable of sliding forwardly and rearwardly, taking with it the weft-pusher member 137. The shifting movements of the respective weft-pusher members at the opposite sides of the loom relative to the lay-beam are brought about automatically. Herein such movements are provided for in the case of each weft-pusher member by means of a lever 2140, Figs. 1, 8, and 18, which is mounted pivotally at 2141, Fig. 18, upon the front of the lay-beam. The upper arm of such lever is connected pivotally with the forward portion of the carrier 139 for such weft-pusher member. A spring 2142, Fig. 18, acting upon the said lever operates to hold the carrier 139 and weft-pusher member normally in the rearward position upon the lay-beam that is shown in Fig. 18. For the purpose of moving the weft-pusher member 137 forward relative to the lay for a weft-parting action, I provide suitable means for turning the associated lever 2140 around its pivot in opposition to the spring 2142. Herein, such means comprises a bunter 15, constituted by a transversely-extending pin carried by an arm 151 or 152 extending rearward from a rockshaft 153 mounted conveniently in a position below the breast-beam. The said rockshaft extends transversely of the loom, from one side of the latter to the other, and carries at each end thereof one of the said arms 151 or 152 and its bunter 15, as in Fig. 16. When the carrying arm and bunter at a given side of the loom occupy a position in which as the lay swings forward the notched head of a screw 2143 adjustably mounted upon the lower arm of the lever 2140 at such side is not engaged by the bunter, lever 2140 is not actuated, and consequently the associated weft-pusher member at such side remains in its normal rearward idle position upon the lay. This is true in the case of arm 151 and its bunter 15, Fig. 18, carried by the right-hand end of rockshaft 153, when such arm and bunter occupy the full line position of said figure. When the carrying arm occupies a position in which, as in the dotted line position, Fig. 18, of the arm 151 and its bunter 15, such bunter is presented in the path of the said notched head of the adjustable screw 2143, the engagement of the bunter with said notched head as the lay goes forward actuates the lever to produce forward movement of the weft-pusher member 137 upon the lay, into coaction with the spring-blades 134, 134, thereby effecting a weft-parting action. It is to be observed that in this action the forward movement of the weft-pusher member is accelerated considerably relative to that of the lay, thereby producing a sharper and more effective weft-parting action in connection with the spring-blades 134, 134.

In order to provide for actuation of one weft-parter at a time, and for actuation of the weft-parters at the opposite sides of the loom in an alternating order of succession, the arm 151 at one side of the loom is fixed upon rockshaft 153 in an angular position different from that of the arm 152 at the other side of the loom. See Fig. 16. Hence, only one bunter 15 at a time can occupy a working position or an idle position, as the case may be; when one bunter is in working position, the other is in idle or temporarily inoperative position, and vice versa. In Fig. 16 and in full lines in Fig. 18 the arm 151 and its bunter 15 are shown in idle position, namely, with said bunter above and clear of the path of the head of the screw 2143 which is designed to coact therewith, so that the weft-parter at the right-hand side of the loom will remain inoperative, while in Fig. 16 arm 152 and its bunter are shown in working position, namely, in a position to render the weft-parter at the left-hand side of the loom operative. It will be obvious that when the rockshaft 152 is rocked clockwise, arm 151 and its bunter 15 will be placed in the dotted-line working position indicated in Fig. 18, whereby the weft-parter at the right-hand side of the loom will be rendered operative, while arm 152 will be carried down into its idle position, in which its bunter 15 is below the path in which the head of the screw 2143 with which it cooperates travels, so that the weft-parter at the left-hand side of the loom will be rendered inoperative.

For the purpose of causing the rockshaft 153 to be rocked about its longitudinal axis in timely coordination with the successive introductions of weft or filling from the opposite sides of the loom, I combine the said rockshaft operatively with an element of the loom having itself properly timed movements. In this instance I utilize the movable side, 212, Fig. 16, of one of the bellows employed for the production of air-movement. Such movable side is shown as having engaged therewith one end of a rod, 155, the said rod extending through a hole in the free end of an arm 156 fast upon rockshaft 153. Upon rod 155 a collar 157 is fixed at one side of the end of arm 156, and at the other side of such end an expanding spiral spring 158 is mounted between the arm and a collar 159 fixed upon the rod. This spring gives way at the time of engagement of the head of a screw 2143 with a bunter 15, to accommodate the depression of carrying arm 151 or 152 and forward movement of arm 156 resulting from the downwardly curved path of movement of the said notched head.

Referring to the yarn-end holding means there is, as aforesaid, for each propelling air-nozzle a pair of nippers 14, 14, Figs. 5, 6, 7, and 8, carried by the lay and arranged to work adjacent the discharge-orifice at the

inner end of the given propelling air-nozzle 11. In this instance the said nippers are constituted by arms fixed upon small shafts 141, 141, Figs. 7 and 8, mounted in bearing-supports 142, 142, attached to the lay at the rear of the propelling air-nozzle 11 with which the given pair of nippers coacts. The said arms project forward from the said supporting-shafts, and their coacting portions or jaws work at the inner end of the said air-nozzle, as shown in Figs. 7 and 8. The means for closing the nipper-jaws together, as for the purpose of clasping a yarn extending from the discharge-orifice of the air-nozzle toward the middle of the loom, comprises helical torsion springs 143, 143, applied in connection with the shaft 141, 141. For the purpose of opening the nipper-jaws by separating them from each other, a finger 144, Figs. 8 and 16, is fixed upon one of said shafts, such finger extending above a vertically-movable block 145, Figs. 7, 8, and 16, to which at the proper time upward movement is communicated for the said purpose. As block 145 goes upward it raises finger 143 and through doing so effects the raising of the upper nipper; as the said nipper swings upward a finger 146 on its shaft acts against a like finger on the shaft of the lower nipper to swing the said lower finger downward. As the block descends, it allows the finger 144 to swing in the same direction as the springs operate to close the nippers together.

My invention includes provisions by means of which the leading end of a pick-length of weft or filling introduced from the opposite side of the loom into a shed-opening in the warp is drawn onward and outward during and immediately following the introduction, so as through such drawing action to locate the said end properly with reference to the corresponding margin of the cloth that is being woven, as well as to straighten out bends or kinks in the said pick-length, and to prevent the pick-length from being displaced within the shed-opening, prior to being beaten up to the cloth-making line by the reed carried by the lay, by currents of air produced by the movements of the lay and other working parts, &c. Such provisions include a suction-nozzle 16, shown best in Figs. 5 and 6, having an air-passage 161 therethrough, and having a suction-inlet 162 that is located adjacent the position occupied by the marginal warp-threads of the series being woven into cloth, as well as close alongside the weft-parter devices.

When withdrawal of air from within the suction-nozzle takes place, through the agency of the means employed for effecting such withdrawal, the inflow of air at the inlet-orifice 162 causes movement of external air toward such orifice in the neighborhood of the latter, so that the predetermined air-movements thereby produced attain the desired results, just specified.

The constructional characteristics of the organization, in general, providing for propelling air-flow from discharge-orifice 111 of the propelling air-nozzle 11, and for suctional inflow at suction-inlet 162 of suction-nozzle 16, may vary in practice. A preferred combination of working elements is illustrated in Figs. 5 to 11, Sheets 3, 4 and 5. This preferred combination comprises a three-way valve-device comprising a body 17 and a rotary plug 18. The said valve-body 17 has three ducts, namely 171, 172, and 173, all communicating with a valve-chamber that is occupied by the rotary three-way valve-plug 18.

Propelling air-nozzle 11 is in communication with duct 171; suction-nozzle 16 is in communication with duct 172; duct 173 is in combination with a conduit 19 leading to the valve-device from air-motivating mechanism. I employ air-motivating mechanism combining air-forcing action and air-withdrawing action in a continuous alternation.

The valve-plug 18 has a diametrical passage 181 therethrough, and a radial passage 182 intersecting the said diametrical passage. When the valve-plug is given the position of angular adjustment that is represented in Figs. 5 and 10, thereby presenting the outer end of radial passage 182 to the duct 173, and one end of diametrical passage 181 to the duct 171, air under pressure forced through conduit 19 is permitted to flow into and through propelling air-nozzle 11 so that, issuing through discharge-orifice 111 of the said nozzle, it may be utilized to impel a pick-length of weft or filling into and through a shed-opening in the warp-threads. The air-movement is indicated by the arrows in Figs. 5 and 10. When the valve-plug is given the position of angular adjustment that is represented in Fig. 6, thereby closing the inner end of duct 171 and establishing communication between ducts 172 and 173 by means of diametrical passage 181, the exhaustion of air from conduit 19 in the direction indicated by arrows in Fig. 6 will induce exhaustion of air from the interior of suction-nozzle 16, with resulting suctional inflow through suction-inlet 162 of the suction-nozzle, so that said suctional inflow may be utilized for the special purposes that have been set forth.

The means whereby the required rotary or angular adjustments of the valve-member 18 are effectuated may vary in practice, the chief essential being that the timing must be correlated properly with the movements of the weaving instrumentalities of the loom in which the invention is incorporated. As a convenient organization for the purpose I have provided the valve-plug with a pinion 183, and have combined with the said pinion a toothed sector-lever 184, pivotally mounted at 185 upon the outstanding portion of the

lay-beam, and engaged by the inwardly-extending arm thereof with the block 145. This block serves in effecting the actuation of the valve-plug, as well as in effecting the opening movement of yarn-end nippers 14, 14, in virtue of having up-and-down movements imparted to it by means of an upright rod 146, Figs. 7 and 16, upon which it is mounted, a lever 147, Fig. 16, to which the lower end of such rod is connected pivotally, a cam 148 upon the camshaft 7 of the loom, and a spring 149 acting to hold one end of the lever in contact with the periphery of the said cam.

Air flowing into suction-nozzle 16 through suction-inlet 162 will carry lint, short pieces of yarn, &c., with it into the interior of the said suction-nozzle. To prevent such material from finding its way into the conduit 19, and through the latter to the air-moving mechanism, I provide within the suction-nozzle, adjacent the valve 17, 18, an air-filtering diaphragm 163. This may be composed of any material suitable for use in this connection, as, for instance, wire cloth. In order to enable the interior of the suction-nozzle to be emptied of its contents from time to time, I form in the front of the suction-nozzle a clean-out opening, which I furnish with a sliding (or other) closure 164, Figs. 1 and 8. To lessen the frequency of the cleaning-out, the main portion of the suction-nozzle is made comparatively capacious by being made relatively large, as indicated in Figs. 5, 6, and 16.

As a safeguard against accidental flow of air under pressure through duct 172 of the valve into and through the suction-nozzle 16, out through the suction-inlet 162, I provide in connection with the said duct a check-valve 20, Figs. 5, 6, 10, and 11, opening inwardly. This valve, which may be of any approved character, is intended to open freely to permit suctional inflow of air through suction-inlet 162 and the suction-nozzle, but to close promptly in case of air-movement in the reverse direction through duct 172 toward the suction-nozzle.

It is within the scope of my invention to employ air-moving mechanism of any approved character and construction capable of producing air-movement of competent energy within conduit 19, first in one direction therethrough to cause a weft or filling propelling blast from the air-discharging orifice of the air-nozzle 11, and then in the other direction therethrough to produce the required suctional inflow through the suction-inlet 162 of the suction-nozzle 16. Figs. 1 and 4 illustrate the mechanism which I prefer to employ, such preferred mechanism comprising as its leading features two members 21, 21, which are, respectively, on the order of a bellows, the two bellows-members being located side by side. The said bellows-members occupy in this instance a position at one side of the loom. One of the said members is in communication with the propelling air-nozzle and suction-nozzle which are located at one side of the loom; the other thereof is in communication with the like elements which are located at the opposite side of the loom. Each of the members is, in the main of bellows-construction, comprising the rigid front 211, the rigid back 212, and the flexible connecting material 213 formed into well-known bellows-folds. The fronts 211, 211, of the two bellows-members are held fixed in position through being bolted to arms 214, 214, projecting from the adjacent loom-side 1. The rigid backs 212, 212, are hung pivotally at 215, Fig. 1, at their upper ends from fixed supports, and are connected by means of pitmans 216, 216, Fig. 1, with cranks 217, 217, on camshaft 7, spaced 180° apart angularly. The two bellows-members 21, 21, are unlike ordinary bellows, in the respect that they have no air-inlets and air-inlet valves. Consequently the air which fills one of such members as it is expanded is air which flows through the connecting piping from the suction-nozzle 16 with which the said member is associated in operation, plus such leakage into the piping as may incidentally occur. The action of the air-moving equipment is a pulsating action, air being sucked into a bellows-member through the connected piping and corresponding suction-nozzle 16, and being expelled from such bellows-member through the said piping and the corresponding propelling air-nozzle 11.

I prefer to dispense with flexible hose for connecting the bellows-members with the propelling air-nozzles and suction-nozzles. Such hose is not durable, is susceptible to injury, degenerates in quality rapidly, and soon develops leaks. When subjected to continued bending as a result of the vibrating movements of the lay it speedily disintegrates and becomes useless. I have shown the bellows-members combined with the propelling air-nozzles and suction-nozzles by rigid piping. In the case of the illustrated construction, 22, 22, are two lengths of piping disposed horizontally, each having its outer end connected by means of pipe-connections, &c., 220, of well-known types with the stationary front of one of the bellows-members 21, and its inner end connected by means of one or more short pipe-sections 922, and known types of pipe-connections with one of two T's 221, 221, mounted side by side upon a length 222 of pipe extending across the lower portion of the loom from one side-frame 1 of the loom to the other side-frame. The ends of the pipe 222 are stopped up by means of plugs 223, 223, which occupy holes in brackets 224, 224, attached to the two side-frames. The pipe

222 is held so that it is incapable of turning, and the T's 221, 221, are fixed upon the said pipe so that they cannot turn thereon. The bore of the pipe 222 is occupied by a plug 225, located intermediately between the two T's, so that there is no communication between that portion of the interior space of the pipe which is located at one side of the said plug and the portion which is located at the other side thereof. The feet, 41, 41, of the lay-swords 4 are bored to fit the exterior of the pipe and to turn thereon as the lay is swung forward and rearward in the working of the loom. From the said feet, upright sections 226, 226, of pipe extend upward to near the bottom of the lay-beam 3, and are joined to the inwardly-extending horizontal portions of the conduits 19, 19, carried by the lay-beam.

The outer ends of pipe-sections 22, 22, are respectively in communication with the interior spaces of the respective bellows-members. The connection-members at the inner ends of the said pipe-sections 22, 22, are respectively in communication with the interior of the stationary pipe 222 at opposite sides of plug 225, through holes in the said stationary pipe. The interior spaces of pipe 222 are in communication with the interiors of the upright pipes 226, 226, at the respective lay-swords, through slots 227, 227, in the upper side of pipe 222 in line with the lower ends of the said upright pipes. Such slots 227, 227, are formed in those portions of pipe 222 which are surrounded by the feet 41, 41, of the lay. Thus, through the piping-connections one of the bellows-members is, without the employment of flexible tubing, in working communication with the nozzles which are located at one side of the loom, and the other of the bellows-members is in working communication with the nozzles which are located at the other side of the loom.

My invention includes provisions for guiding the pick-lengths through the shed-openings without frictional contact with the warp-threads; also, for directing the pick-carrying air-movement; also, for confining and thereby concentrating the pick-carrying stream of air. Such provisions facilitate greatly the introduction of successive pick-lengths by means of moving air. Figs. 18, 19 and 20 illustrate this portion of my invention. In accordance with such portion I provide at the front of the reed pieces which are spaced apart to permit vertical play of the warp-yarns therebetween. Thus the said views show fingers 23, 23, Figs. 18, 19, and 20, projecting forwardly with respect to the reed, in a range, i. e., a line or series, located at or about the level of the lower plane of a shed-opening in the wrap, and preferably having associated therewith a second range, line or series 231, 231, as in Figs. 18 and 19, located at about the level of the upper plane of the shed-opening. In Figs. 18, 19, 20, the upper edges of the fingers composing the range 23 are disposed at a height to stand a little above the warp-threads of the lower plane of the shed in the warp-threads, *w*, so that the said fingers provide a kind of filling-race adapted to keep the inwardly moving pick-length out of contact with the lower warp-threads. In Figs. 18 and 19 the lower edges of the fingers composing the upper range, 231, are located at a height to stand a little below the upper plane of the shed, so that such upper series constitutes a race or guide adapted to keep the said moving pick-length out of contact with the upper warp-threads. Thereby the moving pick-length is relieved from the impedance which would result from contact with the warp-threads. Also, I eliminate the tendency to the holding of the pick forward relative to the reed which would result from contact of the pick with warp-threads. By reason of close setting of the fingers to one another in the range or ranges, each range acts as a species of guide by which the movement of a stream of air from one of the nozzles 11, 11, is directed straight through a shed-opening, and such stream is controlled so as to restrain the moving air from flowing downward or upward, as the case may be, through the warp-threads. The spacing of the fingers 23, 231, apart from one another in a range may vary in practice. In Fig. 20 they are closer together than in Fig. 19. The concentration of the moving stream of air from a nozzle 11 effected by means of the two ranges of fingers enhances the carrying power of the said stream. Like concentration occurs in the case of the moving air flowing toward a suction-nozzle, with similar enhancement of the carrying power of such air.

Through the employment of the suction-devices and of the guides for preventing contact of the pick-length which is in course of being carried through the opening of a warp-shed with the warp-threads, I secure greater certainty that every pick shall be extended completely its full length, in a straight condition free from kinks. Thereby I am enabled to produce woven fabrics free from irregularity and roughness in the wefting, so that they are smooth and otherwise undistinguishable from fabrics woven through the empioyment of shuttles.

For the purpose of holding the forward ends of the fingers 23, 231, spaced apart from one another, I employ spacing means such as indicated at 232, 232, in Figs. 18, 19 and 20. Such spacing means may be constituted by a tie of solder, in the form of a small bar formed on the under sides of the series of fingers 23 and joining such fingers together with the required spacing; and a like bar

formed on the top sides of the series 231; or a wire may be soldered in each of the said places to serve the purpose indicated.

What is claimed as the invention is:—

1. A pneumatic loom having a pneumatic jet-device by which a pick of weft or filling is blown through a warp-shed, and having, oppositely located with reference thereto a suction-device by which the movement of the leading portion of said pick through the shed is aided and the pick is straightened.

2. A pneumatic loom having at each side of the warp a pneumatic jet-device by which a pick of weft or filling is blown through a warp-shed, and a suction-device by which the movement of the leading portion of a pick blown through a shed-opening from the opposite side of the warp is aided and the latter pick is straightened.

3. A pneumatic loom having at each side of the warp a pneumatic jet-device by which a pick of weft or filling is blown through a warp-shed, and a suction-device by which the movement of the leading portion of a pick blown through a shed-opening from the opposite side of the warp is aided and the latter pick straightened, air-moving means, and valve-devices by which a propelling flow through the jet-device and a suction-flow through the suction-device are produced in alternation.

4. A pneumatic loom having at each side of the warp-space a pneumatic jet-device by which a pick of weft or filling is blown through a warp-shed, and a suction-device by which the movement of the leading portion of a pick blown through a shed-opening from the opposite side of the warp is aided and the latter pick straightened, a pneumatic conduit in communication with both of said devices, means for inducing pneumatic movement within said conduit in opposite directions in alternation, and valve-devices by which said jet-device and said suction-device are placed in communication with said conduit in an alternating succession.

5. A pneumatic loom having at each side of the warp-space a pneumatic jet-device by which a pick of weft or filling is blown through a warp-shed, and a suction-device by which the movement of the leading portion of a pick blown through a shed-opening from the opposite side of the warp is aided and the latter pick straightened, a pneumatic conduit with which both of said devices are joined, means for inducing pneumatic movement within said conduit in opposite directions in alternation, and valve-devices including a three-way valve by which said jet-device and said suction-device are placed in communication with said conduit in an alternating succession.

6. A pneumatic loom having at each side of the warp-space a pneumatic jet-device by which a pick of weft or filling is blown through a warp-shed, a suction-device by which the movement of the leading portion of a pick blown through the shed-opening from the opposite side of the warp is aided and the latter pick straightened, a pneumatic conduit in communication with both of said devices, means for inducing pneumatic movement within said conduit in opposite directions in alternation, valve-devices by which said jet-devices and said suction-device are placed in communication with said conduit in an alternating succession, and a check-valve by which reverse flow through the suction-device is prevented.

7. A pneumatic loom having at each side of the warp a pneumatic jet-device by which a pick of weft or filling is blown through a warp-shed, and a suction-device by which the movement of the leading portion of a pick blown through a shed-opening from the opposite side of the warp is aided and the latter pick is straightened, said suction-device having a clean-out opening and a closure therefor.

8. A pneumatic loom having at each side of the warp-space a jet-device by which a pick of weft or filling is blown through a warp-shed, and a suction-device by which the movement of the leading portion of a pick blown through a shed-opening from the opposite side of the warp is aided and the latter pick straightened, a pneumatic conduit with which both of said devices are joined, an air-mover by which a pulsating flow of air through said air-conduit is produced, and valve-devices by which the flow in one direction is caused to take place through one of said devices and the flow in the other direction is caused to take place through the other thereof.

9. A pneumatic loom having at each side of the warp-space a pneumatic jet-device by which a pick of weft or filling is blown through a warp-shed, a suction-device by which the movement of the leading portion of a pick blown through a shed-opening from the opposite side of the warp is aided and the latter pick straightened, and a pneumatic conduit with which both of such devices are joined, and having combined with each of said conduits a bellows-like element for producing pulsating pneumatic movement within the particular conduit in opposite directions in alternation, and valve-devices including a three-way valve by which said jet-device and said suction-device are placed in communication with such conduit in an alternating succession.

10. A pneumatic loom having at one side of the warp-space a jet-device for blowing a pick of weft through a warp-shed, and a suction-device by which the movement of the leading portion of a pick projected through a shed-opening from the opposite side of the warp is aided, a rigid pipe extending across the loom at the axis of vibration of the lay, an

air-mover for producing a pulsating flow of air in opposite directions alternately, and rigid piping connecting said pipe with the air-mover and with the said jet- and suction-devices.

11. A pneumatic loom having at opposite sides of the warp-space thereof devices for blowing picks of weft through successive sheds in the warp from the opposite sides alternately, guiding means for a continuous weft or filling-yarn on its way to the weft-introducing device at one side, guiding means for a continuous weft or filling-yarn on its way to the weft-introducing device at the other side, and a reciprocatory pull-off which engages with both yarns, acting in its stroke in one direction to extend a pick-length from the supply of one yarn, preliminary to the next insertion of such yarn as weft, and simultaneously therewith paying out to the proper blowing device the pick-length of the other yarn which was extended by the preceding stroke of the pull-off in the opposite direction, and in its succeeding stroke in the latter direction reversing the pulling-off and paying-out actions.

12. A pneumatic loom having at opposite sides of the warp-space thereof devices for blowing picks of weft through successive warp-sheds from the opposite sides alternately, upper and lower guides at one side for a continuous weft or filling-yarn on its way to the weft-introducing device at one side, upper and lower guides at the other side for a continuous weft or filling-yarn on its way to the weft-introducing device at the other side, and a reciprocatory pull-off which engages with the respective yarns between the upper and lower guides therefor and in its movement in one direction extends loop-wise a pick-length of one yarn from the supply of the latter and simultaneously therewith pays out to the proper blowing device a previously-formed loop comprising a pick-length of the other yarn which was extended by the movement of the pull-off in the other direction, and in its succeeding stroke in the latter direction reversing the pulling-off and paying-out actions.

13. A pneumatic loom having a jet-device for blowing a pick of weft or filling into a warp-shed so as to extend therethrough, a guide for a weft-yarn on its way from a supply thereof, a guide for such yarn on its way to the jet-device, a pull-off which engages with the yarn intermediate the said guides, extends it in loop-form, and pays out such loop to the jet-device, clamps which respectively coact with the portion of yarn on its way from the first-mentioned guide to the pull-off and with the portion extending from the pull-off to the other guide on its way to the jet-device, a carrier for said clamp, and means by which said carrier is reciprocated to cause said clamp to engage in an alternating succession with the respective portions of the yarn.

14. In a loom, the combination with means located at one side of the loom for extending a pick-length of weft or filling through a shed in the warps a support for a wound package of yarn, a paying-off guide, and a reciprocating pull-off, by the action of which such pick-length is drawn from the said wound package and then paid out for free extension into the said shed of a yarn-check for coaction with the yarn adjacent said guide actuated as the pulling-off stroke is completed to arrest the travel of the paying-off yarn, thereby to prevent overrunning of the yarn from the source of supply under momentum acquired while being drawn by the action of the pull-off.

15. In a loom, the combination with a support for a wound package of yarn, a paying-off guide, and a reciprocating pull-off, of a yarn-check actuated by said pull-off to arrest the paying-off travel of the yarn as the pull-off arrives at the conclusion of its pulling-off stroke, thereby to prevent overrunning of the yarn from the source of supply under momentum acquired while being drawn by the action of the pull-off.

16. In a loom, the combination with a support for a wound package of yarn, a paying-off guide, and a reciprocating pull-off, of a yarn-check pivotally mounted at said guide, and a rod connecting said yarn-check to the pull-off to cause the yarn-check to engage with the yarn as the pull-off completes a pulling-off stroke, to prevent overflow of the yarn from the package.

17. In a loom, pneumatic weft-introducing devices comprising a weft-introducing jet-device carrier by the lay, a weft-engaging parting member mounted independently of the lay, a coacting weft-parting member carried by the lay, and means for actuating said lay-carried member during advance of the lay to carry the weft or filling-yarn forward to the other member and occasion weft-parting through coaction of the two members.

18. In a loom, pneumatic weft-introducing devices comprising a weft-introducing jet-device carried by the lay, a weft-parter member mounted independently of the lay and extending rearward toward the latter, a slotted weft-parter member carried by the lay, and means for actuating said slotted member to carry the weft or filling-yarn forward to the other member and through embracing the latter coact therewith to part the said yarn.

19. In a loom, weft-parter devices comprising a weft-parter member mounted independently of the lay and having laterally yieldable elements extending side by side toward the lay, a weft-parter member carried by the lay having side-portions adapted to receive between them the said yieldable elements as the lay beats up, and to coact with

such elements in parting the weft or filling, said lay-carried member in its normal position not reaching the other member, and means for advancing the lay-carried member during an advance of the lay to bring about coaction and weft-parting.

20. In a loom, weft-parter devices comprising a weft-parter member mounted independently of the lay, a weft-parter member mounted on the lay and movable relative thereto, a lay-carried actuating lever for the latter member, a lever-actuating bunter movable into and out of lever-actuating position, and means for causing the said bunter to assume such position when weft-parting action through coaction of the lay-carried member with the other member is required.

21. In a loom, weft-parter devices at the opposite sides of the loom comprising at each of said sides a weft-parter member mounted independently of the lay, a weft-parter member mounted on the lay and movable relative thereto, a lay-carried actuating lever for the latter member, and a lever-actuating bunter, and having combined therewith a supporting rockshaft extending crosswise of the loom and on which said bunters are mounted in a staggered relation with respect to each other, and means for rocking said rockshaft to present the bunters alternately in working positions so as to occasion weft-parting action at the respective sides of the loom alternately in successive advances of the lay.

22. In a pneumatic loom, weft-introducing devices comprising a weft-introducing nozzle, a weft-parter by which adjacent the selvage of the cloth being woven the inserted pick of weft or filling is parted from the yarn issuing from said nozzle, a pair of nippers grasping such yarn to prevent return of the same into the nozzle, a pair of rockshafts carrying the said nippers, said rockshafts spring-actuated to cause them to close upon the yarn for such purpose, and means for actuating said rockshafts to open said nippers.

23. In a pneumatic loom, weft-introducing devices comprising a weft-introducing nozzle, means by which adjacent the selvage of the cloth being woven the inserted pick of weft or filling is parted from the yarn issuing from the said nozzle, spring-closed yarn-nipping means to prevent return of the protruding portion of yarn into the nozzle, a valve controlling the weft-carrying flow through the nozzle, and a common actuator for said nipping means and valve by which the nipper action is timed properly with respect to the valve-action.

24. In a pneumatic loom, the combination with a jet-device providing a pneumatic stream by which a pick of weft or filling is carried into and through a warp-shed, of means by which said stream and the said pick of weft or filling as it is wafted thereby are guided in front of the reed dents and frictional contact of the pick with the warp-yarns is prevented.

25. In a pneumatic loom, the combination with a jet-device providing a pneumatic stream by which a pick of weft or filling is carried into and through a warp-shed, of means for holding the moving yarn out of contact with warp-yarns as it is wafted by the said pneumatic stream through the shed-opening.

26. In a pneumatic loom, the combination with a jet-device providing a pneumatic stream by which a pick of weft or filling is carried into and through a warp-shed, of a filling-race for guiding the entering pick out of contact with the warp-yarns as it is wafted by the said pneumatic stream through the shed-opening.

27. In a pneumatic loom, the combination with a jet-device providing for pneumatic propulsion of a pick of weft or filling into and through a warp-shed, of a filling-race constituted by pieces in front of the reed spaced apart to permit vertical play of the warp-yarns therebetween, said filling-race serving to guide the entering pick out of contact with the warp-yarns as it is wafted by the pneumatic stream through the shed-opening.

28. In a pneumatic loom, the combination with a jet-device providing for pneumatic propulsion of a pick of weft or filling into and through a warp-shed, of a filling-race constituted of a series of closely-set fingers located at the front of the reed whereby the entering pick is guided through the shed-opening without contact with warp-yarns.

29. In a pneumatic loom, the combination with a jet-device providing for pneumatic propulsion of a pick of weft or filling into and through a warp-shed, of a filling-race constituted of a series of closely-set fingers projecting forward from the reed whereby the entering pick is guided through the shed-opening without contact with warp-yarns.

30. In a pneumatic loom, the combination with a jet-device providing for pneumatic propulsion of a pick of weft or filling into and through a warp-shed, of upper and lower filling-guides between which the entering yarn passes on its way through the shed-opening whereby the entering pick is guided through the shed-opening without contact with warp-yarns.

31. In a pneumatic loom, the combination with a jet-device providing a pneumatic stream by which a pick of weft or filling is carried into and through a warp-shed, of upper and lower guides for confining the said stream and obviating interference by the warp-yarns with the free movement of the filling-yarn.

32. In a pneumatic loom, the combination

with a jet-device providing a pneumatic stream by which a pick of weft or filling is carried into and through a warp-shed, of filling-guiding means at the front of the reed comprising two series of fingers between which the filling-yarn is carried through the shed by the said stream.

33. In a pneumatic loom, the combination with a jet-device providing a pneumatic stream by which a pick of weft or filling is carried into and through a warp-shed, of means supplementing the reed and independent of the warp-yarns for confining and thereby concentrating the pick-carrying stream across the warp-shed.

34. The combination with weft-introducing devices at opposite sides of a loom, supports for yarn packages for supplying weft or filling-yarn at the respective sides, paying-off guides to which the yarns pass as they are drawn off from the said packages, and a pull-off by which the respective yarns are drawn off alternately from such packages and paid out to the weft-introducing devices at the respective sides of the loom, of yarn-checks movably mounted in connection with the two paying-off guides, and connections from said pull-off to said yarn-checks whereby each of the yarn-checks in turn is actuated to check the yarn-supply at the termination of the pulling-off action in connection therewith.

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