3 Sheets--Sheet 1.

C. RICHARDSON.

Pneumatic Looms.

No. 133,386. Patented Nov. 26, 1872.

Fig. 1.

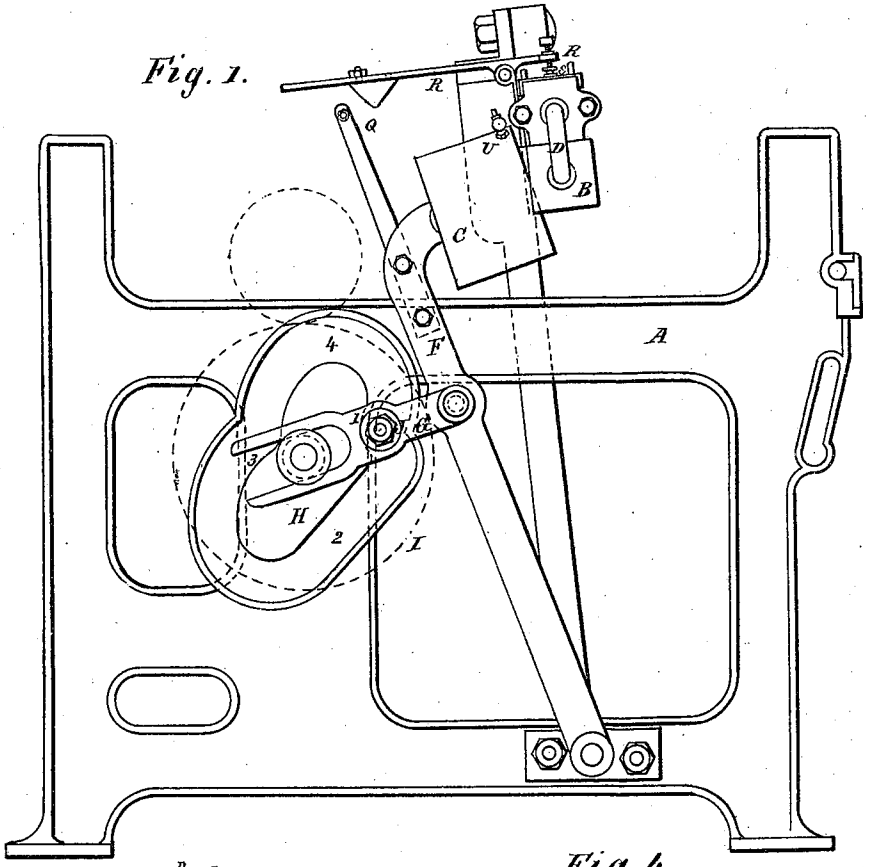


Fig. 3.

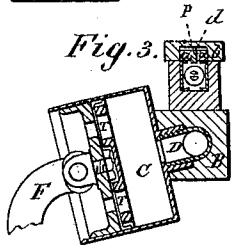


Fig. 4.

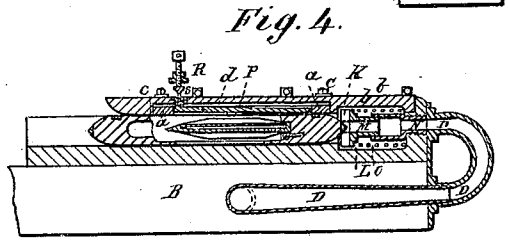


Fig. 6.

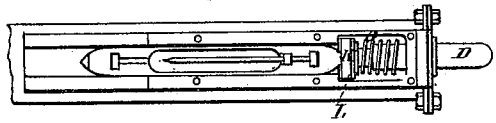


Fig. 5.

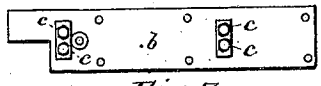
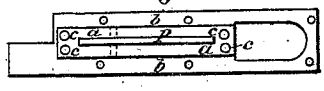


Fig. 7.



Witnesses

C. A. Beck

Dewey

Inventor

Charles Richardson

3 Sheets--Sheet 2.

C. RICHARDSON.

Pneumatic Looms.

No. 133,386. Patented Nov. 26, 1872.

Fig. 2.

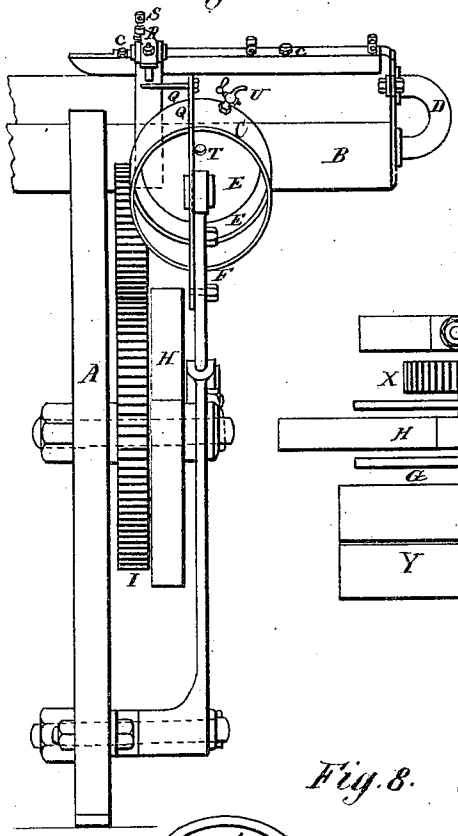


Fig. 10.

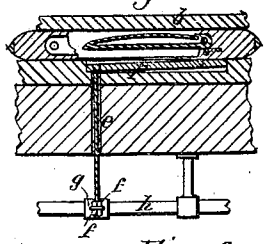


Fig. 11.

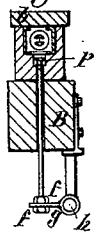


Fig. 9.

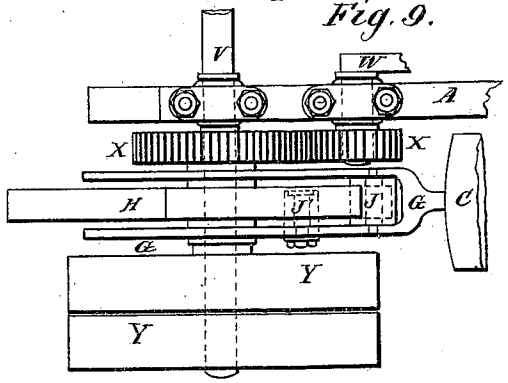
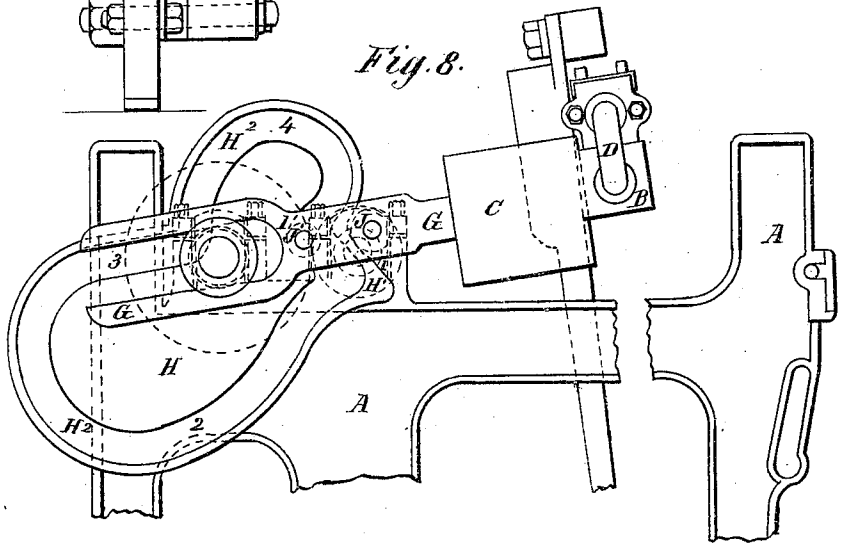


Fig. 8.



Witnesses

M. L. Beck

H. C. Davey

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Charles Richardson

3 Sheets--Sheet 3.

C. RICHARDSON.

Pneumatic Looms.

No. 133,386. Patented Nov. 26, 1872.

Fig. 12.

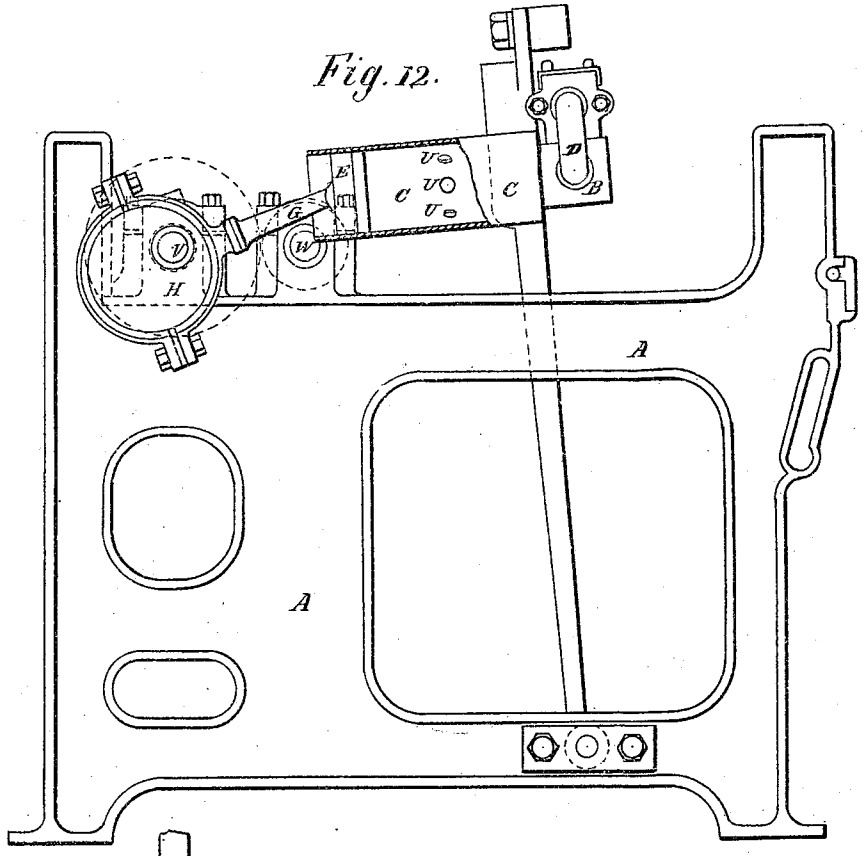
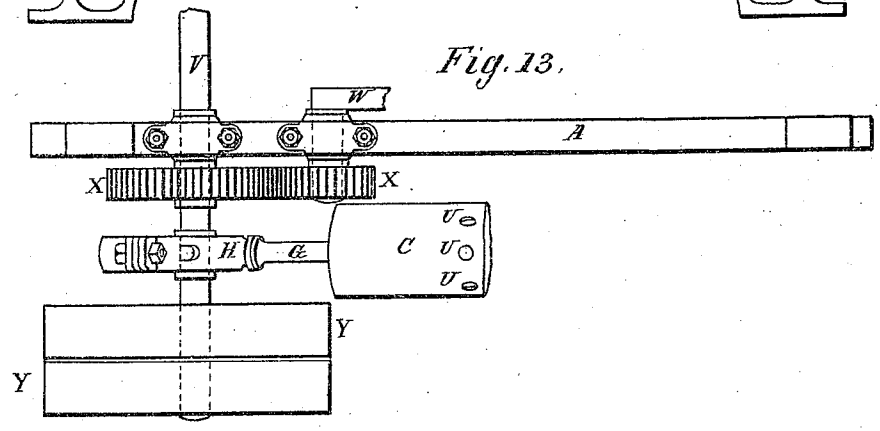


Fig. 13.



Witnesses

M. M. Beck.

H. C. Davey

Inventor

Charles Richardson

UNITED STATES PATENT OFFICE.

CHARLES RICHARDSON, OF LONDON, GREAT BRITAIN.

IMPROVEMENT IN PNEUMATIC LOOMS.

Specification forming part of Letters Patent No. **133,386**, dated November 26, 1872.

To all whom it may concern:

Be it known that I, CHARLES RICHARDSON, of 75 Gracechurch street, in the city of London and Kingdom of Great Britain, have invented certain Improvements in Looms for Weaving, of which the following is a specification:

My invention relates to improvements in looms for weaving, in which the shuttles are actuated by compressed air, and especially to apparatus such as that for which English Letters Patent were granted to me, bearing date the 3d day of February, 1868, No. 366, and the 17th day of November, 1868, No. 3,499. I employ cams placed in suitable positions on the loom, and driven in any suitable manner, so arranged and adapted in relation to the air-compressing instruments that they shall cause them to act at the exact times and in the exact manner required; the cams being so formed that not only shall the air-compressing instruments be caused to act at the proper times, but when they are required not to act their moving parts shall be retained by the cams in a quiescent or nearly quiescent state relative to the sley-beam, notwithstanding the motion of the latter.

In Sheet 1 of the drawing, Figure 1 represents an elevation of a loom side frame with my improvements attached; Fig. 2, a back view of same, showing the apparatus as arranged at one end of the loom, it being understood that similar apparatus is applied to each end thereof. In Sheet 2, Fig. 3, a section through the air-cylinder, sley-beam, and shuttle-box; Figs. 4, 5, 6, and 7, respectively, longitudinal section of shuttle-box and part of sley-beam, top plan of shuttle-box lid, plan of shuttle-box with lid removed, and under-side view of shuttle-box lid.

A is the side frame of the loom; B, the sley-beam; C, the air-compressing cylinder fixed on the back of the sley-beam, communicating by the pipe D with the end of the shuttle-box; E, a piston receiving its motion in the cylinder C from a lever F working on the swing-rail center. This lever is jointed to and operated by a slide-link, G, receiving motion from the cam H, which is, by preference, fixed to and revolves with the second motion wheel I, so as to revolve once for every two movements of the sley backward and forward. A bowl, J, on the slide-link G, takes into the groove of the cam H, which is so formed that, at the time when the shuttle is to be thrown across the shed, the part 1 of the cam operates on the bowl J, forcing in the piston E and compressing the air which passes by the pipe D into the end of the shuttle-box, so as to throw the shuttle or to effect the "pick." The part 2 of the cam next operates to keep the piston thus pressed into the cylinder during the further outward motion of the sley-beam, during its forward motion to beat up the weft, and during its second outward motion, until just before the time of the arrival of the shuttle from the opposite side of the loom into the box on the side under description, when the part 3 of the cam operates to draw out the piston, and thus to suck the shuttle completely into the box, where it is then locked by the pawl P, Fig. 4 and Fig. 7. The part 4 of the cam then operates to retain the piston drawn out in the cylinder in the position shown in Fig. 3 during the further outward motion, the beating up of the weft, and the next outward motion of the sley, until the moment of again "picking" from the side under description, when the part 1 of the cam once more comes into operation to force the piston inward, and the cycle of operations is repeated. If preferred, this cam may be arranged, as shown in Fig. 8, to operate directly on the piston, without the intervention of the lever F. The shuttle-box is provided with a sliding spring-buffer, which receives the shock of the entering shuttle on a disk of India rubber or other elastic material, K, fixed to a metal disk, L, on which is formed a stem, M, capable of sliding in the cylindrical recess, N. A spring, O, keeps the buffer pressed out until the shuttle enters the box. A hole is formed through the buffer corresponding to the pipe D leading from the compressing-cylinder.

When the shuttle enters the box the buffer is compressed and the pawl drops into a notch in the shuttle, locking the shuttle, to prevent its rebounding. The point of the shuttle enters the hole in the elastic disk on the buffer, as shown in Figs. 4 and 6, thus forming a valve to store up the air or to prevent its passage from the cylinder until the finger Q, fixed on the lever F, Fig. 1, acts by the lever R and pin S upon the shorter end of the pawl P, raising the longer end, so as to liberate the shuttle at the exact moment

required. In order to regulate the amount of the exhaustion or suction to draw the shuttle into the box, one or more adjustable relief-valves, T T, Fig. 2, opening inward during the outward motion of the piston, may be inserted into the said piston E. The strength of the "pick" or force of air to drive the shuttle is regulated to any degree of nicety by a small tap, U, Fig. 2, applied to each of the air-compressing instruments, by opening which to a proper extent more or less of the air may be allowed to escape when the stroke is given. In Sheet 2, Figs. 8 and 9 represent, respectively, an elevation and plan of a cam designed to effect the same purpose as that before described. In this cam a projecting nose, H^1, is made to act as an edge-cam upon the bowl J on the slide-link G, which is connected by a joint direct to the piston, and gives the "pick" at the proper time. At other times the bowl J need not be in contact with the cam H, as the bowl J^1 on the slide-link takes into a groove, H^2, in the cam, by which the other relative motions of the piston with respect to the sley-beam are effected. This cam is shown mounted on a shaft, V, which revolves in bearings behind the crank-shaft W, being connected thereto, by gearing X X, so that it shall revolve once for every two revolutions of the latter shaft, and in this case it will be found most convenient to place the fast and loose pulleys Y Y for driving the loom on the shaft V. The cam last described may be readily applied to a loom in which the sley is moved in a manner now well known by a double cam instead of by the ordinary crank-shaft. In this case the cams for actuating the compressing instruments are fixed on the straight shaft carrying the double cams, which makes only one revolution (like the back shaft V, already described) for each two movements of the sley backward and forward. It will be understood that other forms of compressing instruments—such, for example, as flexible bellows—may be employed instead of cylinders and pistons, and that other means than those described may be used to convey motion from the cam to the air-compressing instruments.

By the means above described, not only the compression of the air to drive the shuttle out of the box, and the exhaustion of the air to draw the shuttle into the box, are effected at the right time and to the required extent, but the air-compressing instruments are retained under control at all times, whether while acting or not, and the air is stored in the compressing instruments and the shuttle retained in the box until the proper moment for its liberation. When it is not required that the piston in the air-compressing cylinder shall remain in a quiescent, or nearly quiescent, state, therein, at the times when not required to act, eccentrics may be employed to give motion to the pistons, instead of the cams above described. In Sheet 3, Figs. 12 and 13, the eccentric H is fixed on the back-shaft in a similar position to that of the cam in Figs. 8 and 9, the eccentric rod G being, by preference, jointed directly to the piston E, as shown. In this case the cylinder is made of such a length as to allow of the supplementary motion of the piston therein; but in order to prevent an excessive amount of compression being thereby produced before the liberation of the shuttle, holes U U are made in the cylinder, or a small tap or taps inserted in such positions as will allow of the escape of the air therefrom until the piston has moved to the position at which compression should begin to give the "pick." In shuttle-boxes fitted with pawls or other locking or holding instruments intended to retain the shuttle, I so arrange the said pawls that the shuttle-boxes may be adjusted to compensate for the vertical wear of the shuttle, the horizontal wear being compensated for by the ordinary well-known means. In order to effect this, (see Figs. 4, 5, 6, and 7, Sheet 1,) I mount the said pawl, marked P, in a plate, *a*, which is recessed into the under side of the lid *b* of the shuttle-box, being raised or lowered therein by means of nuts and screws *c c*, from the exterior of the lid, in such manner as to expand or contract the space between the lid and the bottom of the box at will, an elastic material, *d*, being, by preference, interposed between the plate *a* and the lid of the box. I also connect the pawl in the shuttle-box in looms of this description with the "frog-pawl," in cases where the looms are of the kind known as "fast reed looms," by a direct attachment in such manner that when the shuttle misses the box or sticks in the shed, the pawl, not being acted upon by the shuttle, allows the "frog-pawl" to operate on the stop-lever, and thus to stop the loom. Fig. 10 is a longitudinal section of a shuttle-box, fitted with this arrangement. Fig. 11, a cross section of the same. P is the shuttle-box pawl, disposed at the bottom of the box. *e* is a rod passing down through the sley-beam and having an adjustable nut or nuts, *f f*, at its lower end, on which rests the end of an arm, *g*, fixed on the "frog-pawl" rod *b*. When the shuttle enters the box it depresses the shorter end of the pawl P, raising the other end, which lifts by the rod *e* the end of the arm *g*, turning the "frog-pawl rod" *h* on its center. The "frog-pawl" is thus raised clear off the "knocking-off" projection on the stop-lever; but if the shuttle does not enter the box, the long end of the pawl P, and, consequently, the arm *g* and the "frog-pawl," remain down. The latter then comes in contact with the "knocking-off" projection on the stop-lever, pushing it out of its retaining-notch, and allowing it to act to stop the loom in the ordinary manner, which is well understood. The notch in the shuttle must be of such a depth that the longer end of the pawl P cannot drop lower after the shuttle is "boxed" and locked than will allow the "frog-pawl" to miss the "knocking-off" projection. The pawl may be acted on to liberate the shuttle at the right time in a similar manner to that before described.

I claim as my invention—

1. In a pneumatic loom, the cams or eccentrics H, in combination with the cylinder C, piston E, and sley-beam, all operating together, as and for the purpose set forth.

2. In combination with the shuttle-box of a pneumatic loom, the adjustable plate *a*, carrying the pawl P, as and for the purpose set forth.

3. In combination with the pawl P, the lever F, finger Q, lever R, and pin S for actuating the pawl P, as set forth.

In witness whereof I have hereunto subscribed my hand this eleventh day of July, one thousand eight hundred and seventy-two.

CHARLES RICHARDSON.

Witnesses:

H. C. DAVEY,

T. W. FRIGOUT.