E. B. Bigelow

Sheet 1, 5 Sheets.

Power Loom.

No. 4,696. Patented Feb. 18, 1846.

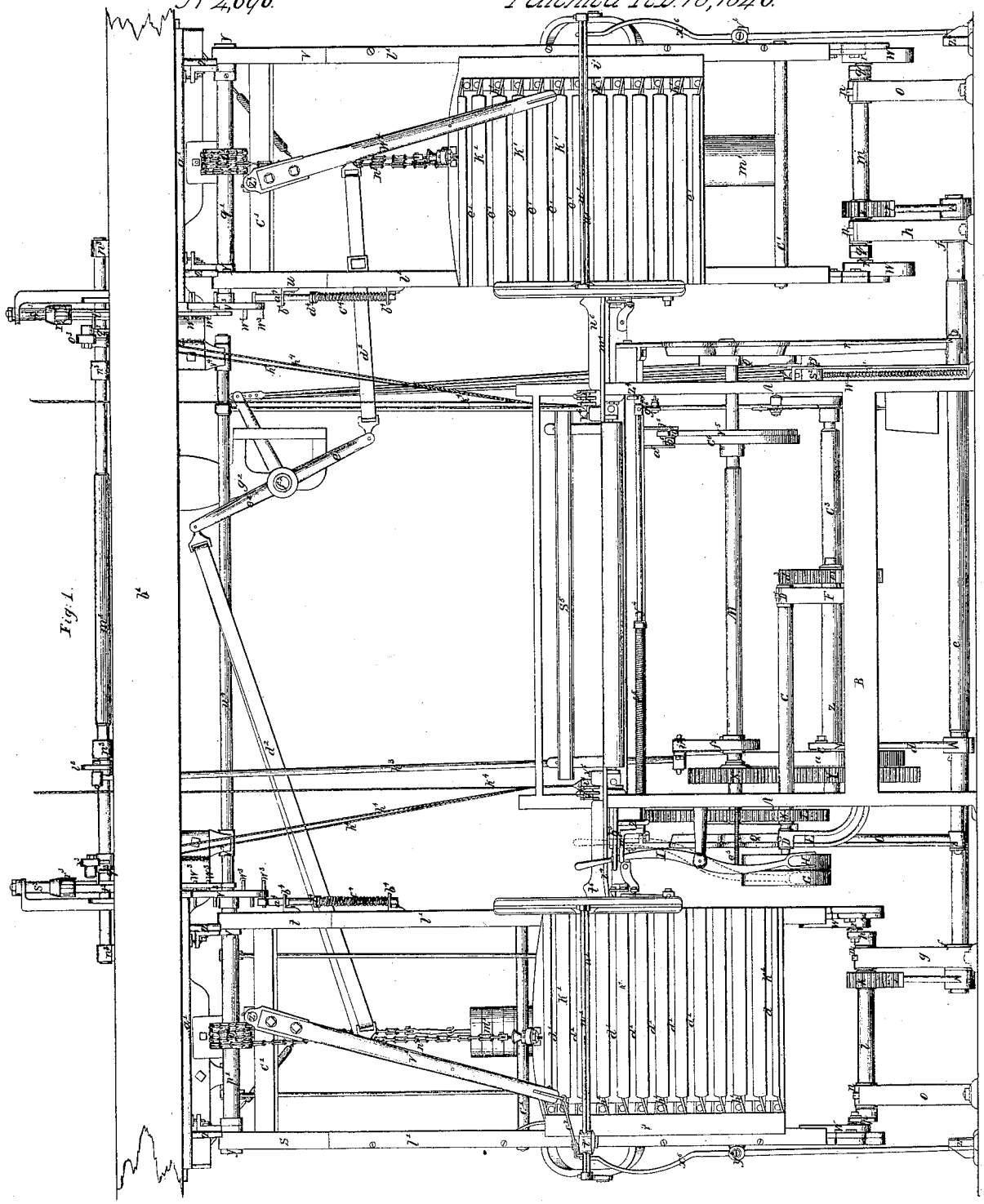


Fig. 1.

E. B. Bigelow

Sheet 2, 5 Sheets.

Power Loom.

No. 4,696. Patented Feb. 18, 1846.

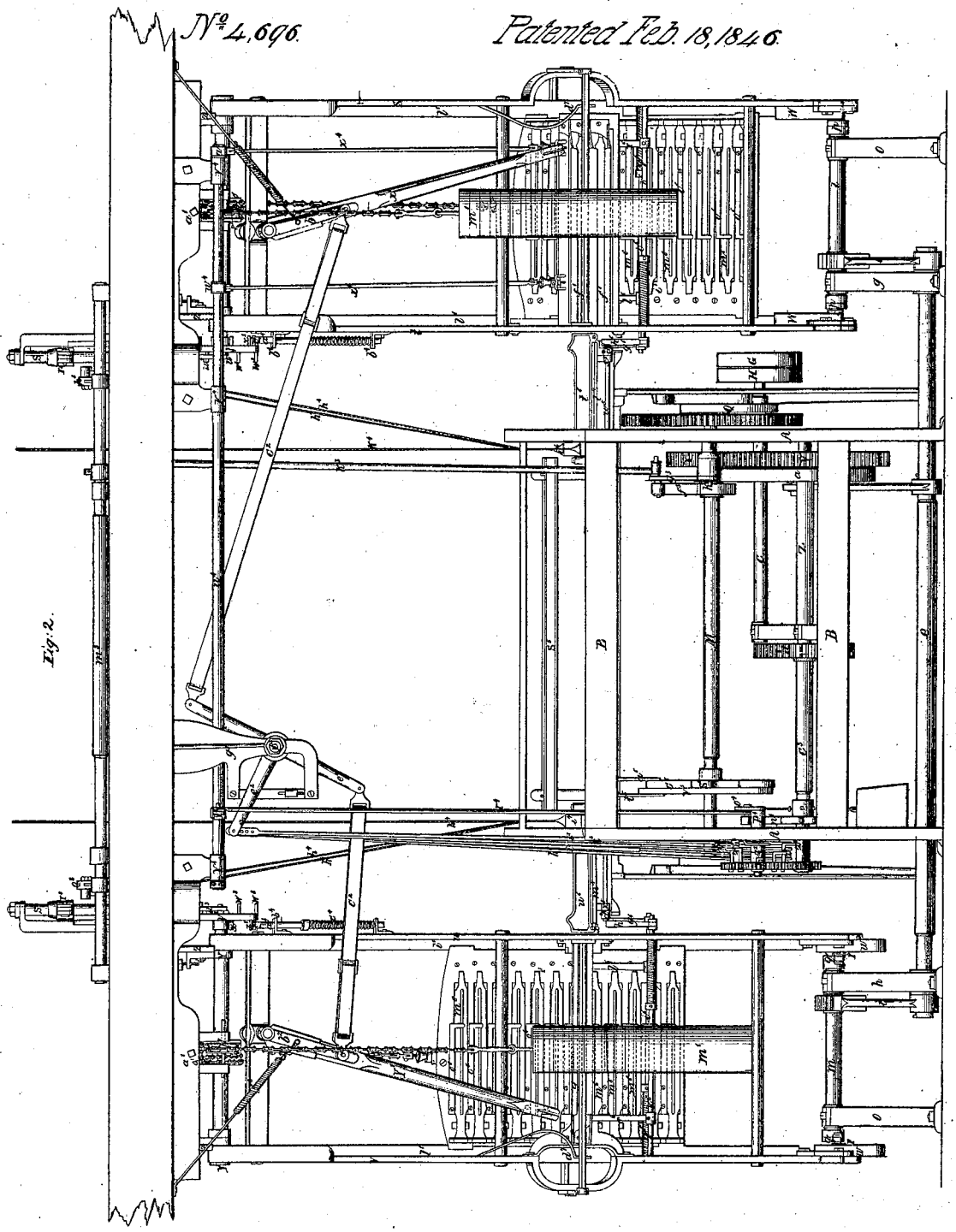


Fig. 2.

E. B. Bigelow

Sheets, 5 Sheets.

Power Loom.

No. 4,696. Patented Feb. 18, 1846.

Fig. 3

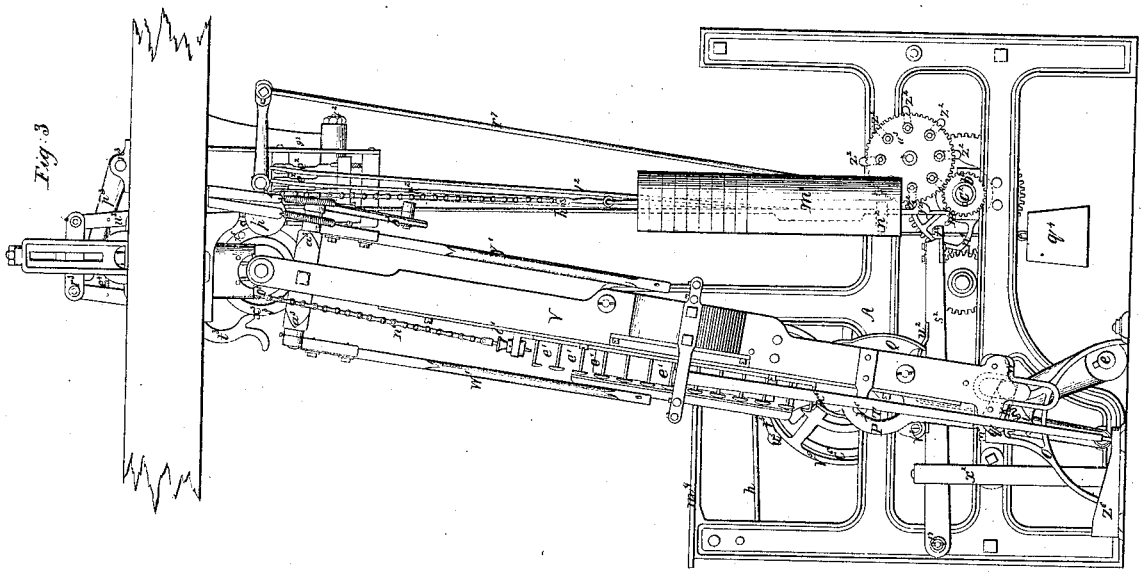
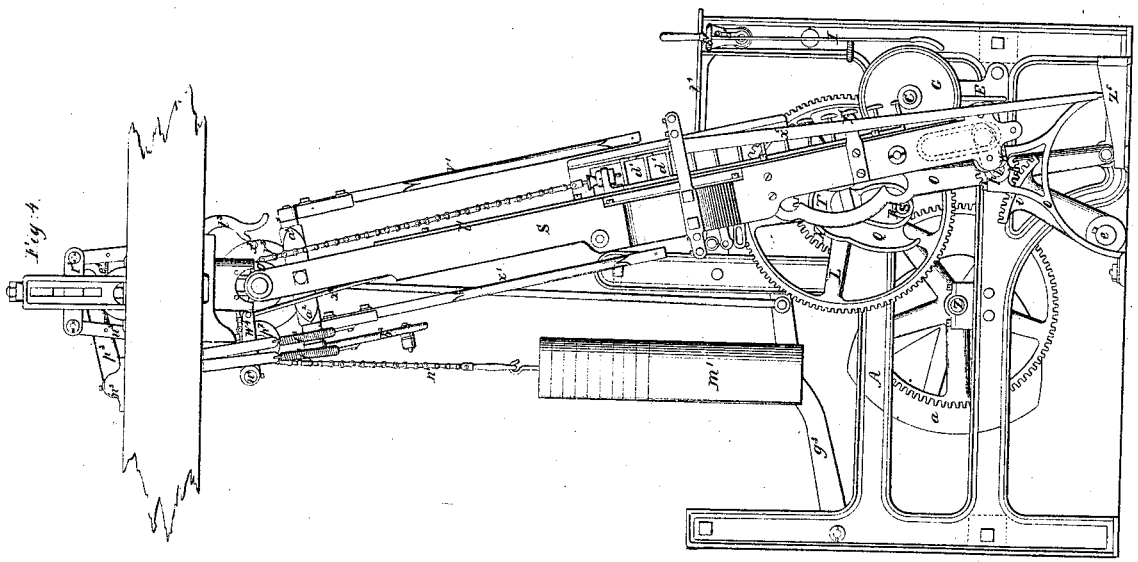


Fig. 4.



E. B. Bigelow.

Sheet 4, 5 Sheets.

Power Loom.

No. 4,696. Patented Feb. 18, 1846.

Fig. 5.

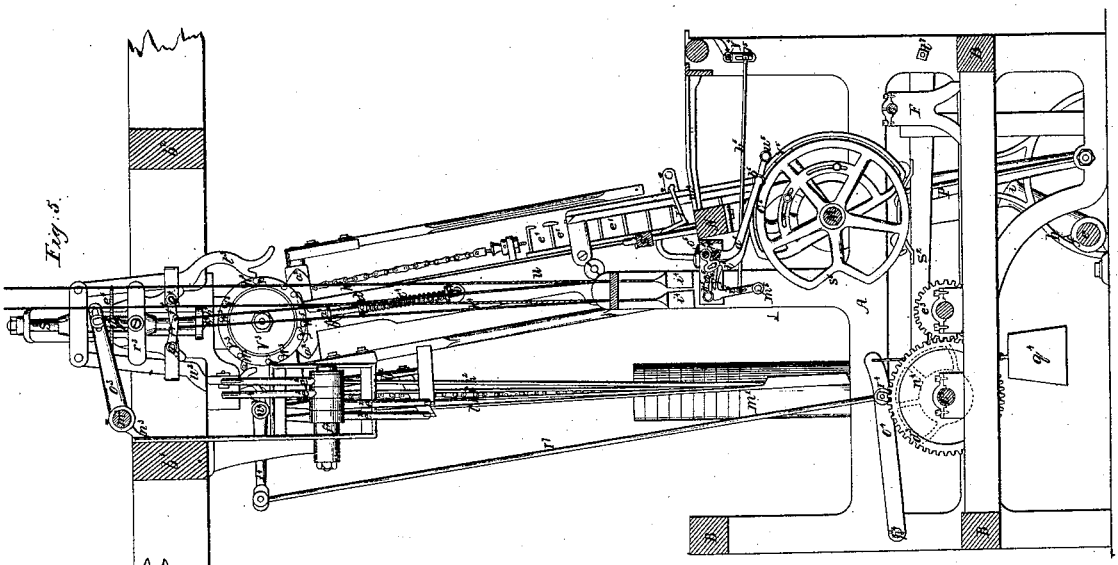
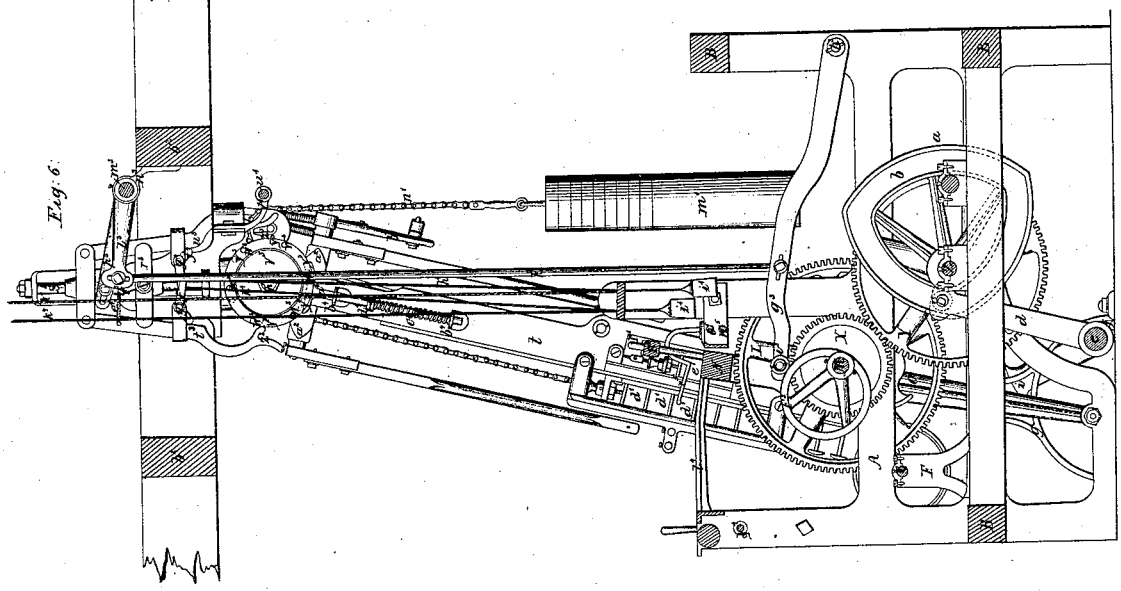


Fig. 6.



E. B. Bigelow.

Sheet 5, 5 Sheets.

Power Loom.

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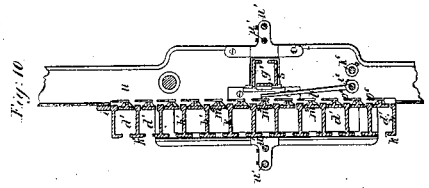
Fig. 10.

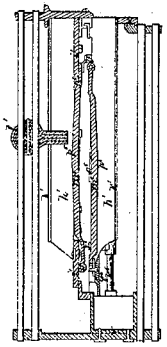
Fig. 23.

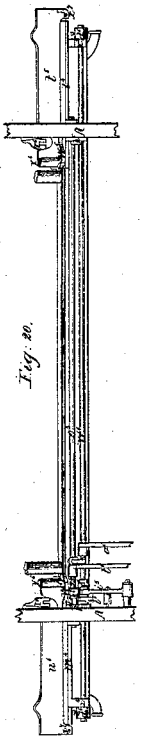
Fig. 20.

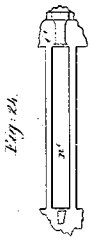
Fig. 24.


Fig. 15.


Fig. 26.

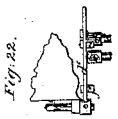
Fig. 22.

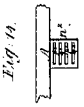
Fig. 14.

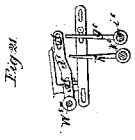
Fig. 21.

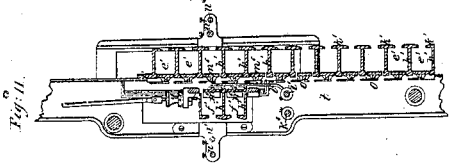
Fig. 11.

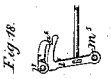
Fig. 16.


Fig. 17.


Fig. 25.

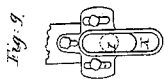
Fig. 9.

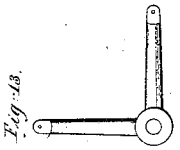
Fig. 13.


Fig. 8.

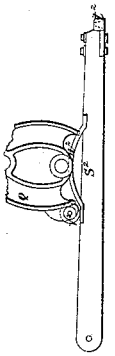
Fig. 18.

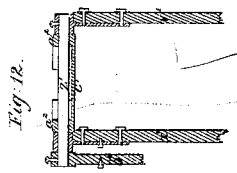
Fig. 12.

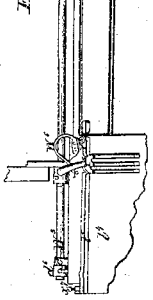
Fig. 19.

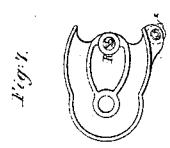
Fig. 7.

UNITED STATES PATENT OFFICE.

E. B. BIGELOW, OF BOSTON, MASSACHUSETTS.

POWER-LOOM.

Specification of Letters Patent No. 4,696, dated August 18, 1846.

To all whom it may concern:

Be it known that I, ERASTUS B. BIGELOW, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful improvements in looms for weaving two or three ply ingrain carpeting or such other figured fabrics as may be successfully woven by the said looms; and I do hereby declare that the nature of my improvements and the manner in which they operate are fully described and represented in the following specification, accompanying drawings, letters, figures, and references thereof.

The nature of my improvements in machinery for weaving two or three ply ingrain carpets, consists, first in the manner in which I construct and combine the cams for operating the lay, so as to give to it a vibratory intermittent motion; second, in the manner in which I combine and operate four sets or series of shuttle boxes; said four sets or series being so arranged as to enable me to operate two of said sets or series only, or the four together, as the fabric to be woven, may require; the number of shuttle boxes in each set or series, being varied at pleasure; third, in the combination or organization of mechanism for raising and lowering certain of the aforesaid series of shuttle boxes in the manner required to produce any given pattern or figure to be wrought; fourth, in a certain combination or new organization of mechanism for operating the picker staffs or levers by which the several shuttles are thrown in the order required; fifth, in a certain peculiar mechanism or combination of parts, by which I am enabled to arrest the operation of the loom whenever the shuttle is thrown and does not properly enter the shuttle box intended to receive it; sixth, in certain movable or turning guide plates applied to certain parts of the loom frame in order to prevent accidents from occurring to the loom or a shuttle, whenever the latter projects from a shuttle box.

Having thus premised, I shall now proceed to describe the several parts of my improved loom.

Of the aforementioned drawings, Figure 1 denotes a front elevation of a carpet loom constructed so as to contain my improvements. Fig. 2 is a rear elevation thereof. Fig. 3 is an elevation of the right end of it. Fig. 4 is an elevation of the opposite or left end of it. Fig. 5 is a vertical, central and transverse section of it taken as though the eye of the spectator was directed toward its right end. Fig. 6 is another central, vertical and transverse section of the said loom, taken as though the spectator was looking toward its left end. Such other figures as may be necessary to more fully exhibit the construction of various parts of the mechanism will be hereinafter mentioned and described.

In the several drawings of my said loom for weaving ingrain carpets or various other fabrics, I have not exhibited the Jacquard machine, the harnesses, nor the cams and treadles, by which they are operated. Neither have I represented the let off and take up machinery or motions, as my mode of constructing and operating each of said parts, are fully described in the specification of my Letters Patent for improvements in looms for weaving carpets and other figured fabrics; the said Letters Patent being numbered 2625, and dated the first day of May A. D. 1842.

A, A (Figs. 1, 2, 3, 4, 5, 6) represent the two vertical cast iron ends of the main frame of the loom, the said ends being connected together by any suitable number of horizontal cross bars B, B &c.

C is the main or driving shaft whose journals are supported and revolve in boxes D, D, applied to the tops of two standards E, F. The said main shaft has one fast pulley G and one loose pulley H, arranged upon or near one end of it, as seen in Fig. 1. The band which proceeds from the moving power and actuates the loom is caused to pass around, and made to turn one or the other of the said pulleys, it being thrown upon the fast pulley when the loom is to be put in action, and upon the loose pulley when the loom is to be stopped. The said band is to be moved from one to the other by a shifting fork or lever I, such as is generally used in looms. A toothed pinion K on the driving shaft engages with a large toothed wheel L, fixed upon a horizontal cam shaft M, and consequently, when revolved, imparts a rotating movement to the said cam shaft. Upon the cam shaft M is another cogged wheel X (see Figs. 1, 6) which engages with a cogged wheel Y, fixed upon another short horizontal shaft Z, and thereby when it (the cogged wheel X) revolves, it imparts motion to the said shaft Z. The shaft Z has a cogged pinion e^3 af-

fixed upon or near one end of it. The said pinion engages with a gear wheel d^3, fixed upon a horizontal cam shaft c^3. The cams by which the Jacquard apparatus is operated, are to be placed upon this latter shaft. They are not represented in the drawings, as they constitute no part of my new improvements. The said shaft c^3, also imparts motion, by means of two gears b^3, a^3, to the mechanism (hereinafter described) by which the picker staffs are thrown or operated. In order that the relative rotatory movements of the several cogged wheels and their shafts may be more fully understood, I would remark that the pinion K is constructed with sixteen teeth, the wheel L, which is actuated by the said pinion, with one hundred and eight, the gear X with fifty, the gear Y with one hundred, the gear c^3 with thirty, the gear d^3 with sixty, the gear b^3 with twenty five, and the gear a^3 with fifty of said teeth.

The first improvement to be described is the mechanism by which the lay is operated. In this loom, the shuttle boxes being disconnected from the lay, require the latter to be moved quickly when it beats up the cloth, also, to remain at rest, while the shuttles are thrown, all of which is effected by mechanism which I shall now proceed to explain.

N, denotes the race beam of the lay, and O, P, the swords thereof, the same being attached to the loom frame in the usual manner. The said lay is operated or moved forward and backward by means of two grooved cams Q, Q, fixed upon the ends of the cam shaft M, there being one of said cams on each end of the said shaft, as seen in the drawings. Each of the said cams is grooved upon its outer face, as seen in Figs. 3, 4 and more particularly in Fig. 7, which denotes an external or side view of one of the cams as detached from its shaft. Each cam has a small roller R placed upon it in the position as seen in Figs. 4 and 7, the said roller being made to turn or revolve upon a cylindrical pin S, inserted in and projecting from the cam, and between the two extremities of its groove, as denoted in the last named figure. The said roller projects entirely beyond the groove of the cam and enters and moves in a curved groove or opening T made through the sword of the lay, as seen more particularly in Fig. 8, which denotes a view of that part of the inner side of the right sword of the lay, in which said groove or passage T is formed. The passage T has an opening V at top and another V, at bottom, the said openings being for the purpose of allowing the roller R to enter into and depart from the passage T, during the revolution of the cam Q. There is another and similar roller W, similarly applied to the rear side of each sword, in the position as seen in the drawings, the said roller being received or acting within the groove of the cam Q, during a portion of its revolution. It is by means of the grooves of the two cams, the passages of the two swords, and their respective rollers, as above described, that the lay is caused to advance, retreat and remain stationary during proper intervals of time, in order to allow of the change of the warps and operation of the shuttles. The main object in the employment of two cams and two rollers at each end of the lay, is to prevent, as far as possible, wear of the roller W, which moves in the groove of the cam Q, for it is by means of the said roller that the lay is kept perfectly stationary during the throw of a shuttle, the roller then moving or passing through the semicircular part of the groove of the cam Q. This roller should fit well and play so closely in the said semicircular part of the groove as to keep the front face of the reed perfectly still and in its proper place, during a throw of a shuttle; as, were it not so, a very trifling movement forward of the reed or lay, would cause the shuttle to be thrown out of the loom, or to miss the shuttle box into which it is to be thrown. When the lay beats up, the roller R moving in the central part of the passage T, drives or forces the reed against the filling, and performs such office in the place of the other roller. Therefore, all or most of the friction which tends to wear the rollers is thrown upon the roller R, and the difficulty which would soon arise from a reduction of the diameter of the roller W, is thus avoided.

The next or succeeding improvement to be described is the manner in which I combine and operate four sets or series of shuttle boxes. By means of the same, arranged and working together as hereinafter described, I am enabled to adapt my improved loom to the weaving of a great variety of styles and descriptions of goods.

The peculiar nature or character of my improvement to be now explained consists in a combination of four sets or series of shuttle boxes. By means of the same, arranged and working together as hereinafter described, I am enabled to adapt my improved loom to the weaving of a great variety of styles and descriptions of goods.

The peculiar nature or character of my improvement to be now explained consists in a combination of four sets or series of shuttle boxes, applied to two pendulous vibrating or moving frames, which are respectively arranged so as to have the lay between them and to be disconnected from it, and to alternately move backward and forward in directions parallel to those in which the lay moves; the said sets of shuttle boxes, or two or three of them being made at suitable times, to rise and fall or move

upward and downward, so as to change the positions of the respective shuttle boxes of the one to those of the other, in the manner as will be hereinafter explained.

The four sets of shuttle boxes are represented at d', d', d', &c. e', e', e', &c. (as seen in Fig. 1) and at f' f' and g' as seen in Fig. 2. The two former sets (viz. d', d', d' &c.—e', e', e' &c.) are disposed in front of the others respectively. Each two adjacent sets is applied to one of two vibrating frames, each of which is composed of two rails or bars s, t or u, v, which are kept in their parallel positions by any number of cross rods, or bars c', c' extending from one of the said rails to the other (of either two thereof) as seen in Fig. 1, and being properly secured to the same.

Fig. 10 is a vertical and central section of the two series of shuttle boxes d', d', &c., g', while Fig. 11 is a similar section of the series e', e', e', &c., f', f', each section being taken as if the eye of the spectator was directed toward the lay. The said sections, therefore, exhibit parts of each of the rails or bars t, u. The shuttle boxes of each set d', d', &c., e' e', &c., are made of a series of shelves h', h', arranged with regard to one another and projecting from a plate i', as represented in the drawings. Each shelf has a plate k' affixed to its outer or front edge so as to extend above and below it, as seen in Figs. 1, 10, 11. Each plate i', should be applied to its rails s, t, or u, v in such manner as to slide freely up and down between plates or secondary rails l', l', fastened to the said rails s, t, or u, v in the positions as seen in the drawings. A counterbalance weight m' is applied to each of said series of shuttle boxes d', d', &c., e' e', &c., by means of a chain n' which is attached, at one end, to the top part of the plate i', from thence extends upward, and is wound several times around a helical grooved pulley o', upon a shaft p' or q', thence passes over a grooved pulley p^r (in rear of pulley o') and is fastened to the depending counterbalance weight m', as seen in the drawings. The series f', f' of shuttle boxes is also to be applied to the frame or rails s, t, so as to be capable of being raised and lowered by mechanism, such as I shall hereinafter describe. The shuttle box g' is made stationary between its rails u, v, or, instead thereof, a series of boxes made to operate like the series f', f' may be employed, when the fabric to be wrought requires the same.

The vibrating frames which sustain the four series of shuttle boxes are each to be made by their mechanism to advance and retreat a sufficient distance, and in such manner as to alternately bring one of the shuttle boxes of each series attached to it, into range with the race beam of the lay when the said race beam has retreated to the utmost allowable extent. The said vibrating frames should be so moved in connection with one another that, whenever any one shuttle box of the front series of shuttle boxes of the one frame is in range with the race beam of the lay some one shuttle box of the rear series of shuttle boxes of the other frame shall be also in line with the lay. Openings, suitable to permit the passage of a shuttle from each shuttle box of the two series f', f', g', should be made through the inner rails t, u. One of the said openings, or that which belongs to the shuttle boxes f', f' is partially exhibited at r' in Fig. 6. The other opening is represented at s' in Fig. 10.

In weaving common two ply carpeting, the shuttles containing the various colored filling, required to form the first or ground ply of the carpet, are placed in one of the front series of shuttle boxes, and the shuttles containing the filling required to form the second or figured ply of the carpet are placed in the other front series of shuttle boxes, and a thread of filling from each class of colors is alternately introduced into the warps, first a thread for the ground ply and then a thread for the figured ply then one for the ground, and so on. Now by moving the vibratory frames simultaneously in opposite directions, and causing the shuttles of either of the front series of boxes to work into their respective back box or series of boxes, as aforesaid, the said two classes of colors are kept separate from each other during the process of weaving, and changing the shuttle boxes.

In weaving the styles of two ply carpets known as "plain and pillared ground," an even number of threads of any given color is always introduced; consequently a shuttle thrown from any one of either of the front series of shuttle boxes, always returns to it again before a change is required. Therefore by moving the front series of shuttle boxes up and down at proper intervals of time, as hereinafter to be described (the said front series containing the filling for the second or figured ply) and allowing the other front series and the two back series of boxes to remain unchanged as to their vertical position we can produce any variety of two ply carpeting of the style known as "plain ground." By moving both of the front series of shuttle boxes up and down at proper intervals of time, as aforesaid and allowing the two back series of boxes to remain unaltered as to their vertical positions, we can produce all, or nearly all the changes required to weave the various patterns of carpeting of the style known as "pillared ground."

In weaving the style of carpets known as "shot about" or "shot and shot," the ground

ply is formed of two or more colors of filling, one thread of each being thrown successively one after the other. This requires that the back set or series of boxes opposite to or working in connection with the front series containing the filling for the ground ply, should be moved up and down, as hereinafter to be described. A still greater variety of changes may be made by moving the vibratory frames backward and forward simultaneously and working the two front series together, and the two back series together. Especially is this desirable in weaving some styles of three ply carpeting. In weaving more simple styles of goods I sometimes allow the vibratory shuttle frame to remain at rest and work only the front series of boxes.

Having thus described the manner in which the various sets of shuttle boxes operate with respect to each other, I shall now explain the mechanism by which they are moved not only back and forth but upward and downward.

The rails or bars s, t or u, v, before mentioned as composing part of the vibrating shuttle box frames are each supported at its upper end by and so as to turn or vibrate upon one of four center pins y, y, &c., projecting respectively from four standards, z, z, &c., which extend downward from horizontal frames a', a', bolted or otherwise properly fastened to the timbers of the top frame b' extended over the loom. The vibrating shuttle box frames are vibrated or moved by mechanism as follows. A grooved cam a is fixed upon the shaft Z in the position as seen in Figs. 1 and 6, the shape of the said cam and its groove being represented in the latter figure. The groove b of the said cam receives a roller c which projects from the upper part of an arm d extending upward from and being affixed to a long horizontal shaft e, whose journals near its ends are supported so as to turn in suitable bearings f, f (see Figs. 5 and 6) projecting from two standards g, h. Upon the ends of the said shaft two toothed sectors i, i, are fixed as seen in Figs. 3, 4. The said sectors engage with two toothed wheels k, k, arranged and fixed upon horizontal shafts l, m. The journals of the said horizontal shafts are supported and turn in boxes n, n, n, n, applied to the tops of four vertical standards g, h, o, o, see Fig. 1, there being two of the said standards to each shaft as seen in the drawings. Each shaft l, m, has two cranks or arms p, p, or q, q, extending from its ends, there being one of the two cranks upon each end of said shaft. Each of the said cranks has a roller r projecting from its outer side, the said roller turning upon a round pin inserted in the side of the crank. When it is desired to move the vibratory frames simultaneously in opposite directions as aforesaid, the cranks p, p, of one shaft (l) projects from it in directions opposite to those in which the cranks q, q, of the other shaft extend therefrom as will be seen by inspection of Figs. 3 and 4, but when it is desired to move the vibrator frames simultaneously in the same direction said cranks are made to project from their respective shafts in the same direction. Each roller of each of said cranks plays in one of four upright grooves formed or made in the lower parts of four rails s, t, u, v, or in plates w, w, &c., screwed thereto; a view of the interior face of one of the said plates and grooves being represented in Fig. 9, in which x denotes the groove or passage for the roller r, the roller being also exhibited therein by dotted lines. Now, when the grooved cam a imparts motion to the shaft e the toothed sectors i, i, will act upon the cogged wheels k, k, and thus partially turn the shafts l, m, in their bearings, and in such manner as to cause the outer ends of two of the cranks p, p or q, q, to move toward the front, and the outer ends of the other two cranks to move toward the rear of the loom. Such movements of the said cranks will create corresponding movements of the rails s, t, u, v.

The next portion of the machinery to be described, is that by which the two front series of shuttle boxes d', d' &c., e', e', &c., are elevated and depressed in the order required, during the process of weaving. Upon the cam shaft M is a cam or wiper f^3 the same being in the position and of the form as seen in Figs. 1 and 6. Above the said cam f^3 a lever g^3 is arranged as seen in the drawings, the said lever turning on a pin or fulcrum h^3 at its inner end, and having a friction roll i^3 applied to its front end, and resting upon the cam f^3. The said lever has the lower end of a vertical rod k^3 jointed to it, in rear of its roll, as seen in Fig. 6, the upper end of the said rod being jointed to the extremity of an arm l^3, which projects from a horizontal shaft m^3, whose journals rest and move in bearings n^3, n^3 arranged as seen in the drawings. The said shaft m^3 should have two more arms o^3, p^3, projecting from it, in the positions thereon as seen in Figs. 1, 2, and of the form and length as denoted in Figs. 5, 6, the arm o^3 being represented in the former figure, and the arm p^3 in the latter. As the machinery intervening between the arm o^3 and the right series of shuttle boxes to be moved is substantially similar to that which intervene, between the arm p^3, and the left series of such boxes, as will be seen by inspection of the drawings, it will be only necessary to describe that which is immediately connected with the arm p^3. The arm p^3 has one end of a small connecting link q^3 jointed to it (see Fig. 1) the form of the same corre-

sponding to that of the link q^3 of the arm o^3 represented in Fig. 5. The other end of the said link is jointed to a frame r^3 which is supported by so as to slide up and down upon a vertical rod s^3, properly sustained in position. The said frame r^3 carries two depending levers t^3, u^3, which are jointed to it at their upper ends, or so that the lower end of each may move freely back and forth toward or from a circular wheel or plate v^3, disposed with respect to the lower ends of said levers as seen in Figs. 1 and 6, and fixed upon the inner end of the shaft p', which has fixed upon it the helical grooved pulley o', as before described. The said circular plate or wheel has a series of six pins v^3, w^3 &c., inserted in and projecting from its inner edges, as seen in Figs. 1, 2 and 6. The said plate has also another series of six pins x^3, x^3 &c. (see Fig. 2,) projecting from the opposite side of it, and arranged equidistant from each other, in a manner similar to that in which the pins w^3, w^3, in the other side of the plate are disposed, but in position with regard to said pins w^3, w^3, as exhibited by dotted circles y^3, y^3 &c., in Fig. 6.

By inspection of Fig. 6, it will be seen that the lower ends of the levers t^3, u^3, are notched, as seen at z^3, z^3. It will also be seen, that, directly below the wheel v^3 there is a stop a^4, which is shaped as seen in the drawings, and plays vertically between guides b^4, b^4, fastened to the vibrating shuttle box frame. The said stop is forced upward or against such pins x^3, x^3, as it may rest in contact with, by a helical spring c^4, which rests upon the lower guide b^4 and presses against a shoulder or button d^4 fixed upon the shank of the stop. The object of the said stop is to hold the series of shuttle boxes in their correct position, after either of the depending levers t^3, u^3, has been moved downward and partially revolved the wheel v^3. The said correct position is insured by the stop pressing at one and the same time against two of the pins x^3, x^3, &c., and while it so presses against them, it prevents the wheel v^3 from being turned around by any other power than that of the depending levers t^3, u^3, whose action upon said plate I shall now proceed more particularly to describe. The two depending levers t^3, u^3, are connected by a helical spring e^4, one end of which is secured to one, and the other end to the other of them, the said spring operating by its contractile force, in such manner as to draw the levers t^3, u^3 toward each other. Each of the said levers has a small bent lever f^4 arranged with respect to it as seen in the drawings, and turning upon a fixed fulcrum g^4. One arm of the said bent lever f^4 bears against the lever to which it belongs, and when raised upward, (which takes place when the other arm is depressed) it throws the depending lever away from the wheel v^3. The other arm has a chain or cord h^4, attached to it, to which (chain or cord) a weight i^4 is appended as seen in Fig. 6, the said weight being of sufficient size to pull down the said arm of the lever, and overcome the contractile power of the spring e^4, and thereby throw its lever t^3 or u^3 so far beyond the wheel v^3, as not to act upon it (the wheel) when it (the lever) descends, as will be hereinafter described. There being two of the said bent levers f^4 f^4, each is to be provided with its cord h^4 and weight i^4, as seen in the drawings.

As a common jacquard apparatus is to be applied to this loom, for the purpose of raising the warp threads, in order to weave figured fabrics, it is intended that the up and down movements of the two series of front shuttle boxes shall be regulated and determined by the same. In order to accomplish the said movements it will only be necessary to connect the four cords h^4, h^4 Figs. 1, 5, 6 or their weights with four of the cords of the Jacquard apparatus, and to prepare the pattern card or cards of said Jacquard apparatus, so as to permit of the elevation of the cords h^4, h^4, h^4, h^4 or their weights in the order required. In Figs. 1, 2, 5 and 6, the aforesaid Jacquard cords are shown at k^4, k^4 &c., the Jacquard apparatus being supposed to be disposed over the loom. Now, whenever, by the operation of the Jacquard apparatus, one of the cords k^4 is pulled upward, so as to raise the weight appended to it, the spring c^4 being relieved of the action of the weight will contract and draw inward or toward the wheel v^3, the lower end of that lever, to the cord of whose bent lever f^4, the cord k^4 may be attached. It should draw the lower part of the said lever so far inward or toward the vertical line passing through the center of the inner face of the wheel v^3, as to bring the notch z^3 of said lever perpendicularly over one of the pins w^3 which project from the inner face of the wheel v^3. Consequently, when the said lever is forced downward with a sufficient degree of power, its lower end will be pressed against the pin w^3 directly beneath it, and will partially turn the wheel v^3, the shaft p' and the helical grooved pulley o', and in such manner as to either allow the series of shuttle boxes, suspended to the chain which passes around said pulley o' to descend, by the action of gravity, a distance equal to that which exists between the bottoms (that is to say, those parts in which the shuttles rest) of either two consecutive shuttle boxes of the series, or to cause the said series of shuttle boxes to rise upward a like distance. The said elevation or depression of the series of shuttle boxes depends upon whether the front or rear depending

lever t^3 or u^3 is put in action upon, so as to turn, the wheel v^3. If the front lever t^3 is made to operate on the wheel v^3, the series of shuttle boxes will descend.

When the rear lever u^3 operates upon the wheel v^3, it causes the said wheel and its shaft p' and pulley o' to partially revolve in an opposite direction, and therefore elevate the series of shuttle boxes.

Whenever the wheel v^3 is partially revolved as above described, one of the two pins x^3 which may be directly over the stop a^4 will be caused to bear against the top of the said stop, and by so doing depress the stop until the pin passes the central part of the top of it, when the stop will be raised by the action of the spring c^4, and will abut against the said pin, and the pin which may be next to it, and which may have been brought into a horizontal or nearly horizontal line with the former.

As the pickers, during the process of weaving, sometimes fail to free themselves from the shuttle boxes, and as the shuttles sometimes project from the shuttle boxes so as to prevent them from being easily moved, it is very important, in order to prevent accident to or breaking of the machinery, that the power which moves the shuttle boxes up and down be applied in such a way as to cease to act beyond a certain extent, when said contingencies arise. This I effect in the following manner. The cam f^3 is employed simply to elevate the lever g^3 and thereby raise the frame of depending levers t^3, u^3, or, in other words, as said cam f^3 produces no depression of the frame of depending levers (they being made to fall by the action of gravity as described) no accident can occur to the mechanism of the loom, should a picker at any time project into one of the shuttle boxes of one of the front series thereof in such maner as to prevent it from moving either up or down. In such a state of things, one of the depending levers in its descent would meet and rest upon some one of the pins w^3 of the wheel v^3 and would remain thereon without exerting any injurious effect upon the series of shuttle boxes. As a substitute for the simple cam and weight, operating as above described, I sometimes employ a double or grooved cam and make the rod k^3 in two parts or sections or lengths, joined together in such manner as to readily pull apart or separate from one another, whenever the picker so prevents the series of shuttle boxes from moving either up or down, as the case may require.

Having thus described the mechanism for elevating or depressing the two front series of shuttle boxes, I shall now proceed to set forth and explain that by which the rear series of shuttle boxes are operated.

A cam n^4, Figs. 2, 5, of the shape denoted in Fig. 5 is placed upon the shaft c^3. Directly over the said cam a lever o^4 which turns on a fulcrum p^4 is arranged as seen in Figs. 2, 5. The said lever has a weight q^4 hung upon its front end of sufficient size to raise the shuttle boxes, when the said weight is allowed to descend. It also has a suitable friction roller r^4 applied to its side, and so as to revolve and rest upon the periphery of the cam. A rod r^7 is jointed to the lever o^4 near the friction roller, and extends upward and is jointed to an arm t^4, (Figs. 2, 3) which projects rearward from a horizontal shaft u^4, arranged so as to be supported and turn in bearings v^4, v^4, v^4 situated as represented in Fig. 3. The said shaft u^4 has two arms w^4, w^4 projecting from it as seen in Fig. 2, and toward the front of the loom, as exhibited in Fig. 4, in which one of the said arms may be seen. Rods x^4, x^4, are respectively jointed at their upper ends to said arms, and at their lower ends to the system f', f' of rear shuttle boxes.

In the back series of shuttle boxes there is the same liability to break the machinery, when the pickers or shuttles prevent their free movement, as in the front series of shuttle boxes afore mentioned. To avoid accident thereby, I raise said boxes by the power of the weight q^4 applied in the manner above described, and allow them to descend again by their own gravity, when the action of said weight is overcome by the cam n^4 as aforesaid. As the back series of boxes are required to rise and fall at different times relative to the other motions of the loom, according to the style of goods to be wrought, it is obvious that corresponding changes should be made in the cam n^4, and as the time in which said boxes are required to operate will be apparent to every practical weaver, I do not think it necessary to describe them in detail. The cam should be so shaped as to raise the weight q^4 when the boxes are to be depressed, and to allow said weight to descend when the boxes are to be raised. Although I have described the cam and weight as applied to moving the back series of boxes, it is obvious that they may be applied to moving the front series also, when the fabric to be wrought requires but few changes.

The next portion of my improvement is that by which the picker staffs are operated, in the order required to throw the shuttles. A picker t' is to be applied to each series of shuttle boxes, the said picker being arranged and made to traverse toward and from the lay on horizontal rods u', u', disposed in a proper manner with respect to the shuttle boxes, and secured to the vibrating shuttle box frames s, t, u, v. The several pickers are each operated by one of four picker staffs v', w', x', y', arranged as seen in the drawings. Each of the front picker staffs v', w'

is attached to one of two shafts z', z', Fig. 1, the same being more particularly exhibited in Fig. 12, which represents a vertical and longitudinal section of one of the said shafts, its bearings and the upper cross bar c' of the rails u, v. The said shaft is sustained in bearings a^2 a^2 applied to the cross bar. At its opposite end, it has an arm b^2 extending downward from it; the strap c^2 by the aid of which the picker staff is thrown forward, being attached to the lower end of the said arm b^2. The back picker staff x' or y' of each of the rear pickers, is supported at its upper end and turns upon the shaft z'. The said rear picker staffs have straps d^2, d^2, see Fig. 1, attached to them. Each of the straps of the picker staffs is attached to one arm of one of a series of four bent levers e^2, arranged upon a transverse shaft or common fulcrum f^2, see Figs. 1 and 2 which projects from a standard g^2 secured to the framework over the loom. One of the said levers, as detached from the shaft or fulcrum is represented in Fig. 13. One arm of each of the said levers extends from the fulcrum toward the right.

Two arms of two of the levers project above their fulcrum and two arms of the other two levers project below it. The said bent levers, in conjunction with other mechanism to be described, are intended to operate the picker staffs, which they do through the straps thereof, each of which straps is connected to the extremity of one of the arms of some one of the said bent levers, the right picker staffs having their straps attached to those two levers which project downward below the fulcrum, while the left picker staffs have their two straps connected to the arms (of the levers) which project upward or above the fulcrum, as above described. h^2, i^2, k^2, l^2 are a series of rods jointed to and depending from the ends of those arms (of the aforesaid bent levers) which have no straps connected to them. The lower part of each of said rods should have a small hook or shoulder formed upon it, as seen at m^2 in Fig. 3.

The several hooks or lower parts of the rods, are arranged side by side and kept in their correct positions, with regard to the frame and other parts of the mechanism, by means of a small guide block n^2, fastened to the end of the main frame. A top view of the said guide block is represented in Fig. 14, wherein it will be observed that it is drawn with four elongated slots or passages o^2, p^2, q^2, r^2. The rod h^2 passes through the passage o^2. So, with regard to the rods i^2, k^2, l^2, they pass in the same manner through the passages p^2, q^2, r^2 respectively. The passages are made sufficiently long, and arranged parallel to one another and to the end of the cast iron frame, in order to allow the lower end of either of the rods h^2, i^2, k^2, l^2 to move forward in a direction toward a lever s^2, arranged so as to move up or down in vertical directions, and upon a fulcrum or pin t^7 at its front end, as seen in Fig. 3. A top view of the said lever s^2 is represented in Fig. 15, and a side view in Fig. 16, the latter also exhibiting a portion of the lower part of the cam Q, situated directly above the lever, as seen in Fig. 3. The said lever s^2 has a projection t^2 extending horizontally at right angles to its front end, as seen in Fig. 15; also a curved piece of metal u^2 affixed upon its top at or near its central part, the said piece u^2 being of the shape as seen in Fig. 16. A small roller v^2 projects from the left side of the cam Q, as seen in Fig. 1 and also in Fig. 16, and when the cam is revolved it carries the said roller in contact with and raises it entirely over the curved cam piece of metal u^2, and, by so doing, depresses the rear end of the lever. The lever is elevated, after the roller v^2 ceases to depress it, by a spring w^2 (see Fig. 1) arranged within a case x^2, situated as seen in Fig. 3.

Each of the rods h^2, i^2, k^2, l^2 has a small cam or projection y^2 extending from its rear side a short distance above its hooked end. The said cams operate in connection with a series of cams or bent arms z^2, z^2, &c., which project from that side of a cogged wheel a^3 which is nearest to the main frame of the loom, as seen in Fig. 2, and by dotted lines in Fig. 3. There are two bent arms z^2 to each rod h^2 &c., the object of said arms or cams being when the wheel a^3 is revolved, to throw the lower ends of the rods h^2, i^2, k^2, l^2 forward, in regular and proper succession, and far enough to carry the hook of each, under the projection or bent end t^2 of the lever s^2, so that when said lever is depressed, the said projection, acting upon the said hook, shall, at the same time, depress the arm of the bent lever e^2 (hereinbefore described) to which it may be hung, and thereby cause the opposite arm of said bent lever, to pull upon its picker staff strap, and operate the picker staff or cause its lower end to advance toward the lay. Each picker staff is drawn back or away from the lay by a spring f^3, properly applied to it, as seen in the drawings.

The order in which the shuttles are to be thrown, varies according to the fabric to be wrought, and by transposing the bent arms z^2, z^2, a corresponding change will be effected. The cogged wheel a^3 is revolved by a toothed pinion b^3, fixed upon the end of a horizontal shaft c^3 (see Figs. 1, 5). The said shaft has another cogged wheel d^3, fixed upon it, which engages with a cogged pinion e^3 on the shaft z before described. Consequently, when the shaft z is revolved, motion will be imparted by its pinion e^3 to the wheel d^3 and the shaft c^3.

The next portion of the mechanism to be

explained, is that by which the driving belt is moved from the fast pulley G toward and upon the loose pulley H of the driving shaft, in order to stop the operations of the loom, whenever, during the passage of any of the shuttles from one series of their boxes or receptacles to another, its weft thread may break, or to effect the same, whenever a shuttle thrown out of one box on one side of the loom is not properly received into its other box or receptacle upon the opposite side thereof.

In Fig. 1, a horizontal shaft y^4 is represented as extending across the front part of the loom and being supported by bearings at z^4, z^4. The said shaft has a bent arm a^5, fixed upon its left end, which arm is shaped and extends in front of the shifting lever I, as exhibited in the drawing. The upper arm of the shifting lever passes through a horizontal plate b^5 projecting from the loom frame. A top view of the said plate is represented in Fig. 17, in which c^5 denotes a passage formed or made through the said plate for the lever I to pass through and move in. There is a small shoulder or notch d^5 cut or formed in the front side of the said passage. The upper arm of the shifting lever is to be thrown toward the right and rest against the said shoulder or notch, whenever the loom is to be put in action, the position of said lever being maintained by said notch, while the loom is in operation. The said shifting lever has a spring e^5 applied to its lower arm and the frame of the loom, and made to act upon it so as to always draw its fork or lower arm, toward the loom frame. Consequently, whenever the upper arm of the said lever is thrown out of the notch d^5, the lower arm thereof will be drawn toward the loom frame or from being directly in front of the fast pulley G, into being directly in front of the loose pulley H.

As the driving band passes through the fork at the lower end of the shifting lever, it will be thus moved from one pulley to the other, all of which will be well understood by manufacturers of looms, as it is a common and well known mechanical device for changing the driving belt from one pulley to the other. The arm a^5 is pressed against the shifting lever by the action of a wound spring f^5 properly applied to it. Near the right end of the shaft y^4 a small arm g^5 projects downward from said shaft, as seen in Figs. 1 and 5. To the lower end of the said arm a rod h^5 is jointed, and is also jointed to a small sectoral lever i^5, arranged so as to vibrate back and forth upon a center pin m^5, as seen in Fig. 5.

Fig. 18 denotes a vertical section of the sectoral lever i^5 and hook k^5 over it. The said hook is jointed to the frame of the loom or plays vertically upon a pin l^7 projecting therefrom. It is arranged directly over, and so that its hooked end shall rest upon the sectoral lever, and engages with a notch n^5, made in the top of the curved top part of said sectoral lever, as seen in Fig. 18. Fig. 19 denotes a top view of the said hook and other parts connected with it, which are situated in rear of the lay and between the vibrating shuttle box frames. Fig. 20 is a rear elevation of the same. A long horizontal shaft o^5 extends across the loom in front of the catch or hook k^5, as seen in Figs. 19 and 20. It has an arm l^5, projecting from it, as seen in Figs. 18 and 19, the said arm extending under a small projection q^5, from the side of the catch or hook k^5. Two forks r^5, r^5, shaped as seen in Figs. 5 and 19, are secured to and project from the shaft o^5, near each end of the reed frame s^5 of the lay, as seen in the drawings. The shaft o^5 has another arm t^5 extending downward from it in the position and form as seen in Figs. 5 and 19. The said arm t^5 has a friction roller u^5 applied to its front end and resting upon a cam or wiper v^5 which is fixed upon and revolved by the cam shaft M. The said cam v^5 should be so shaped that by its action on the arm t^5, it will elevate the forks r^5, r^5 to such height above the plates l^4, m^4 as to allow a shuttle when thrown from one side of the loom toward the other side thereof, to freely pass under them (the forks) or between them and the plates l^4, m^4. It should also be so shaped, that, as soon as, or soon after the shuttle has passed by the two forks, it will permit the arm t^5 to fall downward far enough to carry the forks down upon and into or through their respective plates l^4, m^4, there being parallel slots u^5, u^5, u^5 cut through each plate l^4, m^4 to receive the fork and permit it to descend through the plate or below its top surface.

While a thread from a shuttle lies on the plates l^4, m^4, and between them and the forks, it will prevent the forks from descending below the plate or into the slot u^5, &c. Should the shuttle, during its passage from one shuttle box to another, deposit no thread upon the plates l^4, m^4, and in the shed of the warp, the forks will fall into the slots; and when this takes place, the arm l^5 should be so adjusted as to meet the projection q^5, of the hook or catch k^5, and lift the said catch out of the notch n^5 of the sectoral arm. While the hook k^5 is in the notch n^5, it prevents the arm a^5, through the action of the spring f^5, from throwing the shifting lever I out of the notch d^5, but as soon as the hook is elevated out of the notch, the spring f^5 is relieved and presses the arm a^5 against the shifting lever and expels it from the notch, and thus permits the spring e^5 to draw the lower end or fork of the shifting lever I toward the frame of the loom, and

thereby change or move the driving band or belt from the fast pulley to and upon the loose one.

The mechanism last specified is a common and well known "stop motion." It makes no part of my invention, but, as certain other machinery to be described is to be connected with it or its hook or catch k^5, I have thought it advisable to explain, in a somewhat particular manner, the operation of it, in order that the parts to be described may be better understood.

Directly underneath the horizontal shaft o^5, I arrange another horizontal shaft w^5, as seen in Figs. 5, 6 and 20. The said shaft is supported so as to turn in any suitable number of bearings x^5, x^5, and is of the length as represented in Figs. 2 and 20. It has an arm y^5 projecting rearward from it, and underneath a small pin z^5, projecting from the side of the hook or catch k^5 before described. The said shaft w^5 also has another arm a^6 extending downward from it, and toward the front of the loom, as seen in Figs. 5 and 20, the said arm having a suitable friction roller b^6 applied to its front end. The said friction roller rests and travels upon the periphery of a cam or wiper c^6 fixed upon the cam shaft M, and by the side of the cam v^5 before described.

Each extremity or end of the shaft w^5 has an arm d^6 fixed upon it, and extending from it toward the front of the loom; a side elevation of the said arm and certain parts directly below it being represented in Fig. 21. A top view of the said arm is given in Fig. 22. Each arm d^6 has two small studs or projections e^6, f^6, extended from it toward the vibrating shuttle box frame rail t or u next to it. The said arm d^6 is intended to act in conjunction with two upright arms g^6, h^6, which are attached respectively to two horizontal and parallel shafts i^6, k^6, extending between and through the rails s and t or u and v, and in the positions as represented in Figs. 2, 10 and 11.

An arm l^6 extends upward from each shaft i^6 and so that is upper end shall be just in rear of the end of one of a series of spring plates m^6, m^6. Fig. 23 denotes a horizontal or nearly horizontal section taken through the top of the arm l^6, and the shuttle boxes of the two series in front and rear of it. Each shuttle box of the two front and rear series is provided with a shuttle binder m^6, shaped in horizontal section as seen in Fig. 23. Each of the said shuttle binders is hinged at one end to the shuttle box or frame which makes part of it. It is placed in a rectangular aperture n^6 cut or formed through the side of the shuttle box, as seen in Fig. 24, which represents the rear side of one of the shuttle boxes, or a portion of the plate i' composing it, having the aperture n^6 formed through it and without the shuttle binder applied to it. The binders m^6 are forced toward the interior of their respective shuttle boxes by springs o^6, o^6 &c. Fig. 2, each binder m^6 being provided with a spring which has one end secured to the shuttle box, and the other resting and pressing against the binder m^6. Each plate m^6 has its front face shaped to a very obtuse angle, and projects into the interior of the shuttle box, as seen at p^6, in Fig. 23. Whenever a shuttle is thrown into one of the shuttle boxes of either of the two front series thereof, it comes into contact with the angular part p^6 of the shuttle binder which projects into the box, and, as said angular part is made to project into the box or path of the shuttle, and the shuttle is calculated in its width to correspond as nearly as may be, with the width of the box which receives it, it (the shuttle) will force back or move the binder m^6 out of its way, and, by so doing cause the said spring plate to bear against the top of the arm l^6, and thereby turn the shaft i^6 a little in its bearings, and so as to move the top of the arm g^6, a little rearward, or in a direction toward the shaft w^5. The shaft i^6 should have a spring q^6 applied to it and the rail v or s in such manner as to operate upon the shaft and carry or move the top of the arm g^6 forward or away from the shaft w^5, whenever the shuttle leaves the shuttle box, or while there is no shuttle in said box.

Each of the rear series of shuttle boxes has its shuttle binder as seen at m^6, in the section thereof in Fig. 23. The said shuttle binders operate against an arm r^6, which projects upward from the shaft k^6, and is arranged thereon as seen in Fig. 2, the top or upper part of said arm r^6 being exhibited in Fig. 23.

When a shuttle is thrown into one of the rear shuttle boxes, it presses the shuttle binder m^6 of said shuttle box forward or in a direction toward the front of the lay. Consequently, the top part of the arm r^6, will be moved by said plate m^6, in the same direction, and will turn the shaft k^6 a little in its bearings, and thereby move the top part of the arm h^6 forward, or toward the front of the loom.

The cam c^6 should be formed with a circular periphery with the exception of an angular depression s^6, the said angular depression being suitable to allow the arm a^6 to descend far enough to cause the arm v^5 to rise upward and bear against the pin z^5, and throw the hook or catch k^5 out of the notch n^5 of the sectoral arm before described. The said cam should be so adjusted upon its shaft as to admit of the complete fall of the arm a^6, immediately after the instant or time of completion of a throw or passage of a shuttle over the race beam, and the reception of the said

shuttle in the shuttle box into which it may be thrown. While the shuttle passes freely and properly from one shuttle box on one side of the loom, to another on the opposite side thereof, the arm a^6 should be prevented from falling so far as to raise the catch k^5 out of the notch n^5, and thereby stop the loom from operating. It is for this purpose that I employ the arm d^6, with its projections e^6, f^6, to act in conjunction with the upright arms g^6, h^6, of the shaft i^6, k^6, before described. The peculiar manner in which said parts of the mechanism on each side of the loom operate in connection with one another, I shall now proceed to explain.

It has been hereinbefore specified that the vibrating shuttle box frames s; t and u, v, are each vibrated or alternately moved first in one direction and next in its opposite. While a shuttle box of one of the front series is in range with the race beam of the lay, another of the back series, at the opposite end of the loom, is also in range with the said race beam.

One of the projections e^6 f^6 of each arm d^6 should be so adjusted upon the arm that when either one of the front series of shuttle boxes receives a shuttle, it (the projection) shall, on the fall of the arm d^6 (which takes place when the roll of the arm a^6 descends into the depression s^6) come directly over and rest upon the top of the arm g^6, belonging to the shaft i^6 of the shuttle box which receives the shuttle. This deposit of the projection on the top of the arm, should take place as soon as the shuttle has fairly and fully entered the shuttle box, and, by so doing, pressed against the shuttle binder m^6 of said shuttle box, and moved the same as before described, and, in consequence thereof, created a slight rearward movement of the arm g^6 of the shaft i^6, as hereinbefore described. By said rearward movement of the arm g^6 or its upper part, it should be brought into a correct position to receive the projection from the arm d^6. And when the said projection so rests upon the top of the said arm, the arm should be long enough to prevent the arm y^5 of the shaft w^5 from pressing against the pin z^5, so as to raise the hook or catch k^5 out of the notch n^5, and thereby cause a stoppage of the loom. The said projection from the arm d^6 should be so adjusted to the top of the arm g^6 with which it operates, that whenever a shuttle, when thrown, fails to enter the shuttle box, and the arm d^6 descends, it (the projection) shall not meet the arm g^6 (which, in this case experiences no movement arising from the action of the shuttle against the binders of the shuttle box) but pass below its top, and, by so doing, permit the arm y^5 to be borne upward against the pin q^5 of the hook or catch k^5, and thus, by pressure against the hook (the said pressure being created by the weight of the arm a^6) cause the elevation of the hook out of the notch n^5, and, of course, the immediate stoppage of the loom.

From the above, it will be seen that, if the shuttle when thrown, does not fully and properly enter the shuttle boxes of the front series, no movement of the arm g^6 takes place, or, in other words, the said arm is not moved into a position necessary to receive upon its top the projection from the arm d^6, when said arm descends, during the time the roll of the arm a^6, passes down the depression of the cam c^6. Each of the other projections upon the two arms d^6 should be similarly adjusted and adapted to operate in connection with the arm h^6 adjacent to it, when either of the rear series of shuttle boxes, immediately adjacent to said projection and said arm h^6 is in range of the race beam, and in the act of receiving a shuttle. That portion of the loom which relates to the arrest of the shuttle, when it has arrived at a certain position in one of the shuttle boxes of one of the series which moves up and down and allows the picker to free itself from the pointed end of the said shuttle, so that the picker may present no impediment to the movement of the series of shuttle boxes either upward or downward, is as follows: Each of the front series of shuttle boxes, has a spring lever x^6, Figs. 1, 3, 4 applied to its vibrating frame and moving upon a pin or fulcrum y^6 projecting therefrom in the position denoted by the drawings. The upper part or arm of the said lever should be made as a spring and at its upper end it should be placed in such a position as to admit of the picker being forced against it, whenever the said picker is struck by a shuttle on entering one of the shuttle boxes. The lower end of the spring lever should be inserted in a vertical groove or elongated passage of a guide cup z^6. A top view of this guide cup is exhibited in Fig. 25, and a vertical, central and longitudinal section of it in Fig. 26. The elongated passage is represented in said figures, at a^7. The said guide cup should be bolted or fastened upon the floor upon which the loom stands, and in such a position that a vertical plane passing through the central part of the passage a^7, and from end to end of it shall make an acute angle with the vertical plane passing through and in line of the axis of the fulcrum or pin upon which the spring lever x^6 moves, the said vertical plane being parallel to either end of the main frame of the loom, the said guide cup being also arranged in such manner that its rear end shall be a distance from the said end of the frame of the loom, greater than that of its front end therefrom. Such an arrangement of the guide cup will,

when the front series of shuttles, to which it is immediately adjacent, retreats, in order to receive a shuttle from the opposite part of the loom, cause the lower end of the spring lever x^6 to be moved in such manner as to carry the upper end of the said spring lever in a direction toward the lay. Consequently, when the shuttle is thrown into the shuttle box, the picker will be forced by it against the upper part of the spring lever, which will constitute a stop, as it were, to arrest the further progress of the shuttle. When the shuttle boxes advance, so as to bring one of the rear series of shuttle boxes into range with the race beam, the passage a^7 of the guide cup z^6 will cause the lower end of the spring lever to advance toward the end of the lay, as the said end passes or moves through the said passage. This will cause a retreat of the upper end of the spring lever, or a movement of it away from the picker, and, in consequence thereof, will allow the spring which causes the picker staff to retreat after each throw of a shuttle, to act upon the picker staff and the picker, in such manner as to move the picker upon its supports or rods, and a short distance away from the end of the shuttle, the said distance being far enough to entirely clear the end of the shuttle (when the series of shuttle boxes are moved upward or downward) from the picker, thereby preventing any rupture of any part of the mechanism which might occur, by reason of the point of the shuttle being in too close contact or proximity with the picker, when the shuttle boxes are moved either upward or downward.

It is well known, that, after the picker has been a short time in action, the pointed end of the shuttle creates an indentation in it, and as said pointed end might extend too far within the said indentation, whenever it should be required to move the shuttle boxes upward or downward, it becomes necessary to move the picker far enough away from the point of the shuttle, to admit of the elevation or depression of the shuttle boxes without accident.

In order that the manner in which the spring attached to the picker staff, actuates the picker or forces it away from the shuttle, whenever the shuttle frames advance or come forward, may be understood, I have in Figs. 1 and 23 represented a picker and its mode of connection with the picker staff. In said figures t' denotes the picker which is connected with the picker staff over it by means of a stiff strip of iron c^7 which is jointed or hinged to both picker and picker staff. Consequently, the spring which causes the retreat of the picker staff, can act upon the picker through the connecting strip c^7, and move it upon its rods or supports, whenever the upper part of the spring lever x^6 is moved in a direction away from the picker.

If desirable, each of the four series of shuttle boxes may be provided with a spring lever and guide cup, or other mechanical equivalents, for the purpose above described. In Fig. 2, d^7, d^7, denote springs, fixed to the rails s and v respectively, and in regard to the back shuttle boxes, as seen in the drawings, the said springs being for the purpose of arresting the progress of a shuttle, when thrown into one of the rear shuttle boxes.

The next or succeeding part of my improvements consists in certain turning guide plates, applied to certain parts of the loom frame, in order to prevent accidents from occurring to the loom or a shuttle, whenever the latter projects from a shuttle box. Should the shuttle in its passage into a shuttle box, not fully enter the same, a serious injury to the loom would be likely to occur, when the vibrating frame s, t or u, v by which the shuttle box may be sustained, should move rearward; as that part of the shuttle which would protrude from the box would be carried in contact with one of the vertical plates t^6, u^6 (see Figs. 1, 19) which project above and at the rear part of the plates l^4, m^4. Such contact must either seriously injure the shuttle or some of the mechanism of the loom.

To prevent an accident of this kind from happening, each of the said vertical plates t^6, u^6, should be applied to its plate l^4 or m^4, in such manner as to turn or move horizontally upon a pin or proper mechanical equivalent, projecting upward from the plate l^4 or m^4 in the position as seen at v^6 in Figs. 1, 19. A spring w^6 is placed in rear of each plate t^6, u^6, and is confined to the plate l^4 or m^4, upon which the movable plate t^6 or u^6 may be situated. The said spring should be made to bear against the plate t^6 or u^6, which it may be in rear of and keep it up to its position, proper to guide a shuttle into the shuttle box, the said position being determined by a small projection or screw pin x^7, which extends downward from the outer end of the plate t^6 or u^6, and is made to abut against any suitable part of the plate l^4 or m^4, upon which the plate t^6 or u^6 may be situated. The turning pin upon which the plate moves is placed at that end of the said plate which is most distant from the shuttle boxes immediately adjacent to the plate. The spring w^6 which acts upon the plate t^6 or u^6 should be so made and applied to the plate as to admit the same to retreat far enough to prevent accident, whenever a shuttle projects from a shuttle box, and is borne against the spring plate, by the retreat of the vibrating frame, carrying said shuttle box.

Having thus explained the nature of my

improvements in the aforesaid loom for weaving ingrain carpets, I shall claim therein—

1. The combination or organization of mechanism, applied to each sword of the lay for operating the lay in the manner as above described, and for the purpose of preventing the roller W from wearing to such an extent as to improperly perform its office in the groove of its cam Q, when the lay or reed thereof is required to be kept stationary during the throw of the shuttle, the said combination consisting of the grooved cam Q (fixed upon the cam or lay shaft M) the cam or passage T (made through or upon the sword of the lay) and the respective rollers W and R; the same being arranged and made to operate together substantially as hereinabove specified.

2. I also claim the combination of four sets of shuttle boxes and reciprocating pendulous or vibratory or moving frames (by which they are sustained, and moved from the front toward the rear of the loom and vice versa) as constructed, arranged and operating together and with respect to the lay of a loom and each other, substantially in any of the modes as hereinabove described, the same being for the purpose of weaving two or three ply plain or shot about ingrain carpeting, or other fabrics, as set forth.

3. I also claim, in combination with the shuttle binders of each series of shuttle boxes, and the hook k^5 of the ordinary stop motion of the loom, the mechanism or organization by which I am enabled, in the employment of the several series of vibrating shuttle boxes, to arrest the operations of the loom, whenever a shuttle is thrown and does not properly enter its intended shuttle box; the said mechanism or organization of parts consisting of the cam c^6, arms a^6 and y^5, and shaft from which they project, the arm d^6, with its projections e^6, f^6, the arms and spring of either shaft i^6, k^6, or other equivalents thereto, while the elements or members of the combination are made up of the above parts, and such additional parts as may be simply necessary to their operation, as above described.

4. I also claim, in its application to the plate l^4 or m^4, and the vibrating frame of shuttle boxes, immediately adjacent to it, a spring or movable guide plate t^6 or u^6, arranged and operating in the manner and for the purpose as above specified.

In testimony whereof, I have hereto set my signature, this second day of March A. D. 1846.

E. B. BIGELOW.

Witnesses:
R. H. Eddy,
Robt. Means.