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***TO CROSS (WALKING NEW YORK)*** research document

Compiled by Alisha Wessler, Curatorial Intern, The Drawing Center, fall 2013,
and Project Manager of *To Cross (Walking New York)*

## HISTORY OF THE DRAWING CENTER
## James W. Lyall's Positive Motion Loom Company at 35 Wooster Street

Since its establishment in 1977, The Drawing Center has made its niche in the historic cast-iron district of SoHo, New York City. In 1986 the nonprofit museum moved to 35 Wooster Street where it is still located today.

It is interesting to note that the site of *To Cross (Walking New York)*—the main gallery floor of The Drawing Center—holds strong historical ties to the textile industry. Project Manager Alisha Wessler researched the history of 35 Wooster by visiting archives and libraries throughout New York City. She found that the building, originally known as Lyall House, was built for and named after its original owner James W. Lyall who invented the Positive Motion Loom Company in 1868.

The following texts and images in this section of the document reflect several historical newspaper articles focusing on James Lyall and the Positive Motion Loom Company, which made its headquarters at 35 Wooster Street. It is clear from these documents that the Positive Motion Loom was an important innovation in the field of textiles.

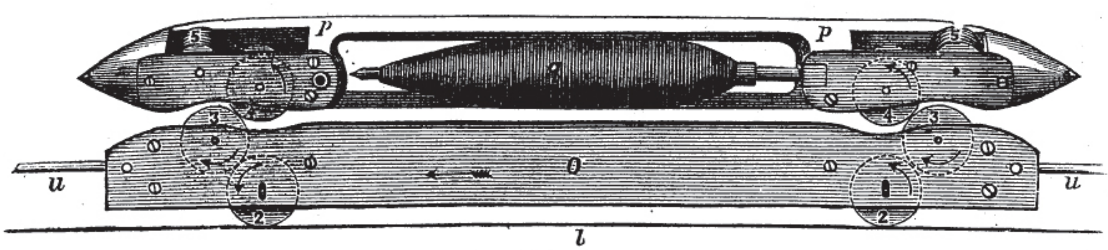
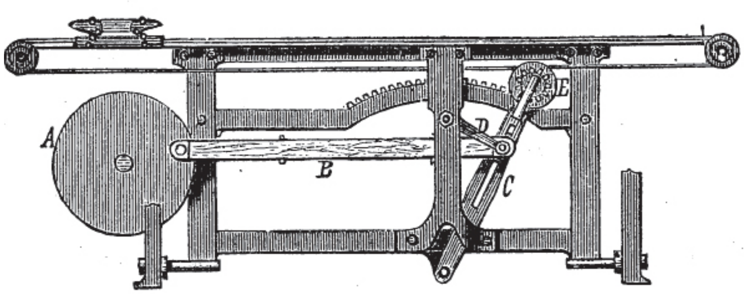



*Fig. 1.*



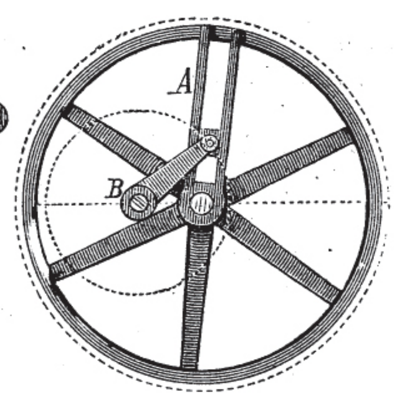



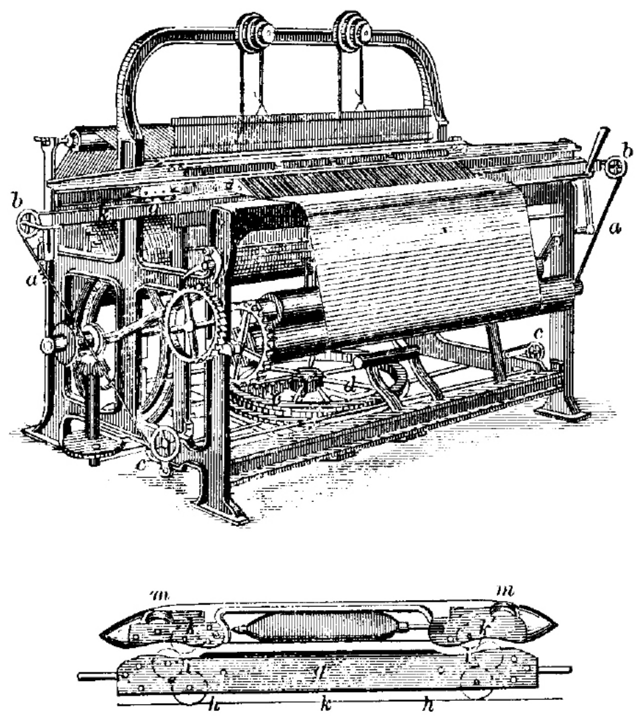

*Fig. 2.* *THE POSITIVE MOTION SHUTTLE.* *Fig. 3.*

Image source: "Important Improvements in the Weaving Art." *Manufacturer and Builder*, (April, 1877), p. 88.

**Pos′i-tive-mo′tion Loom.** A loom in which a definite motion both in velocity and amount is imparted to the shuttle.

In Lyall's, this is effected by means of a cylindrical band *a* (Fig. 3903), which passes over and under the pulleys *b b c c*, motion being imparted by the band-wheel *d* actuated by the reciprocating rack *e* and pinion *f*, and is attached to each end of the carriage *g*. The carriage has two sets of wheels *h h i i*, the lower of which roll upon the upper surface of the raceway *k*; the pivots of these wheels turn in slotted bearings, allow-

Fig. 3903.




*Positive-Motion Loom.*

ing a limited amount of play, and their upper surfaces turn against the lower surfaces of the wheels *i i*, the upper portion of whose peripheries run in contact with the warp-threads. These cause the wheels $k'$ $k'$ in the shuttle to turn at precisely the same speed in an opposite direction, so that no lateral motion is imparted to the warp-threads over which they pass. The wheels *m m* roll on the under surface of a beveled rail, which keeps the shuttle down to its work.

"Considerable attention has been lately attracted, in America, to a new arrangement of power loom, designed by Mr. James Lyall, of New York. The distinguished feature in this loom is that the shuttle, instead of being impelled to and fro by the action of the picker staffs as usual, receives what the inventor terms a 'positive motion,' or, in other words, it is under the complete command of the driving mechanism during the whole of its traverse. The idea of giving a positive motion to a shuttle is, we believe, not in itself new; but the arrangement adopted by Mr. Lyall is not only novel but highly ingenious."

-"Lyall's Positive Motion Loom." *Engineering Weekly*, p. 159

# LYALL'S POSITIVE MOTION LOOM.

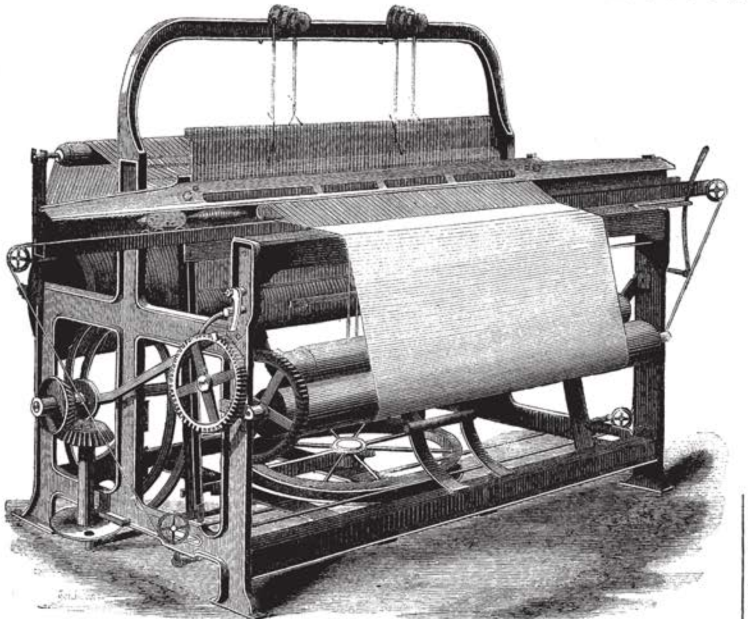


FIG. 3.

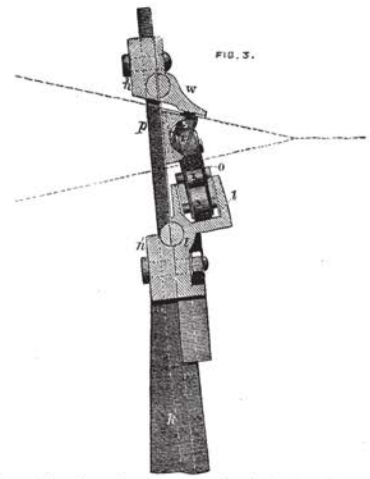
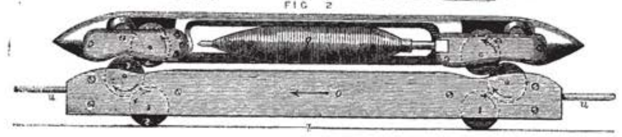


FIG 2



CONSIDERABLE attention has been lately attracted, in America, to a new arrangement of power loom, designed by Mr. James Lyall, of New York. The distinguished feature in this loom is that the shuttle, instead of being impelled to and fro by the action of the picker staffs as usual, receives what the inventor terms a "positive motion," or, in other words, it is under the complete command of the driving mechanism during the whole of its traverse. The idea of giving a positive motion to a shuttle is, we believe, not in itself new; but the arrangement adopted by Mr. Lyall is not only novel but highly ingenious, and even on this account alone it is well worthy of notice. Quite apart from its ingenuity, however, Mr. Lyall's loom appears to possess many decided practical advantages, and it is certainly peculiarly adapted for the manufacture of very wide fabrics; and under these circumstances we abstract from the *Scientific American* the following particulars concerning it. Our contemporary says:

"It is certain that the throwing of the shuttle by hand was practised many centuries ago, and the fact that this method is still retained in the manufacture of many kinds of fine fabrics shows how difficult has been the substitution of any application of power to this motion, which could adequately take the place of the hand, in all kinds of weaving. The introduction of the picker staff, and its adjuncts to actuate the shuttle was an immense stride in the art of weaving. It and the Jacquard attachment constitute perhaps the most remarkable improvements made in the art of weaving up to the date of the present invention.

"Notwithstanding the persistence with which the ancient form and method of actuating the shuttle have held their ground, there have always existed serious difficulties which it was desirable to obviate. Without entering too minutely into details which are perfectly familiar to those acquainted with the art of weaving in all its branches, we will specify a few important defects that the general reader may understand the important advantages the device under consideration is destined to accomplish. First, the distance to which the shuttle can be thrown with certainty, either by the hand or by the use of the picker staff, is limited, and the difficulty of weaving wide goods is consequently so much greater than that of medium or narrow textures of similar materials, that the cost of wide goods per square yard is considerably more than the narrow. This alone would render a shuttle motion, capable of weaving wide goods as cheaply as narrow, a great desideratum. Second, the motion of the shuttle, having no positive relation to the other parts of the loom, the operator has no control over it during the time it is traversing the distance between the shuttle boxes; and the motions of the other parts, if by accident they should take place a little too soon, through the breaking of any of the working parts or from any other cause, are liable to clash with that of the shuttle. Third, the shuttle reaches the shuttle box after its flight in either direction, and comes to rest before the lay makes its beat. An adjustment so perfect that, at this point, the thread of the weft shall be firmly drawn up against the exterior threads of the warp opposite the shuttle, is necessary to make a perfect selvedge. This perfect adjustment is difficult of attainment, so much so that the character of the selvedge on a piece of linen or silk goods is one of the criterions by which the quality of the article is determined.

"To remedy these defects *in toto*, was a reform so radical in its nature, that a motion radically different was necessitated. It is evident from the nature of the case that no absolute connexion between the shuttle and any appliance working exterior to the sheds of the warp, can be made capable of lateral motion without breaking the threads. The problem may therefore be enunciated as follows:

"Required to produce absolute, positive, and uniform motion in a shuttle, by means of an external appliance moving exteriorly to the sheds of the warp *without absolute and positive connexion between the shuttle and the motor through which it receives its motion*—a problem which the majority of mechanics would have pronounced impossible had not its possibility been demonstrated by this invention. But the problem is further complicated by another condition which is omitted in the general enunciation, namely, no lateral motion must be imparted to the threads of the warp.

"The ingenious method by which these conditions are fulfilled is shown by Fig. 2, which represents the shuttle resting in its carriage, *o*. Motion is imparted to the carriage and through it to the shuttle by means of a stout cylindrical band, *n*, in a manner to be hereafter described.

"Let the reader now imagine a sheet of parallel threads stretched between the shuttle, *p*, and its carriage, *o*, and bear in mind that *l* is the upper surface of a race-way running across the lay beneath the warp, upon which the wheels, numbered 2, roll. Also notice that the pivots of the wheels, 2, play in slotted bearings, so that their upper surfaces roll on the lower surfaces of the wheels, numbered 3. Now suppose the shuttle to be taken off the carriage or driver, *o*, and let this be drawn to the left in the direction of the arrow. It is now evident that the wheels, 2, will revolve in the direction of the arrows drawn upon them, and that their circumferential motion will always be exactly equal to the motion of the carriage, *o*, upon the race-way, *l*, of the lay. But as the slotted bearings of the wheels, 2, allow the weight of the carriage to rest on the pivots of the wheels, 3, and these wheels rest on the tops of the wheels, 2, the wheels, 3, must evidently receive a counter motion in the direction of the arrows marked on them, exactly equal to the motion of the wheels, 2, which is likewise equal to the motion of the carriage along the race-way, *l*. If now the sheet of threads be brought into contact with the wheels, 3, it will be seen that while the wheels, 2, are rolling along the race-way, *l*, the wheels, 3, are rolling along the *under* side of the shed of *warp threads*, causing no more lateral motion in those threads than the wheels, 2, cause in the lay, *l*, which is nothing.

"We have now seen that the carriage itself produces no tendency to lateral motions in the threads of the warp. Now let us lay on the shuttle, holding it to its place by a bevelled rail, a section of which is shown at *w*, Fig. 3; and move the carriage in the same direction as before. The wheels, 2, revolve to the left, and cause wheels, 3, to revolve to the right, and roll along the bottom of the sheet of warp threads. Some of these threads will be successively engaging at each moment between the wheels, 3, in the carriage, and wheels, 4, in the shuttle; and, as these threads may be moved in a vertical direction without conflicting with the object we wish to attain; wheels, 4, also commence rotating to the left and thus roll along the top of the sheet of warp threads, at exactly the same speed as wheels, 3, so that each thread of the warp in succession is passed between the lower surfaces of the wheels, 4, and the upper surfaces of the wheels, 3, without being pulled laterally, their only motion being a slight vertical one, owing to the relative positions of the wheels. The wheels, 5, do not engage with the wheels, 4, but roll along the under surface of the bevelled rail, *w*, Fig. 3, holding the shuttle down to its work.

"The formation of the race-way in which the shuttle carriage rolls is shown in Fig. 3. The back is the reed, *n*. The bevelled rail which holds the shuttle from falling off the carriage in front, is shown at *w*, and another rail, *l*, does the same for the carriage. When the shuttle and carriage are in place they can only be removed by drawing them out at the end of the lay, unless the bevel rail be taken off by unscrewing the bolts which hold it in place. The extreme lightness with which the parts move, is shown by the fact that, in our recent examination, we found we could easily actuate the loom weaving the six yards wide drugget, by a crank screwed on to the main shaft; the labour being scarcely more than that required to turn a grindstone.

"Fig. 1 is a perspective view of a power loom with this shuttle movement attached. In this engraving the band, *n*, which draws the carriage, *o*, may be traced passing over grooved pulleys fixed to the ends of the lay, down over other grooved pulleys attached to the lower parts of the swords, and from thence around a horizontal pulley under and a little back of the cloth beam. Motion is imparted to the horizontal pulley, from the main shaft, by means of a pair of bevelled gears, driving a short vertical shaft, with crank and pitman at its lower end actuating a rack and a pinion attached to the shaft of the horizontal pulley.

"A reversing motion being thus given to the horizontal pulley, the band, *n*, which draws the shuttle carriage, is alternately wound up on one side, and unwound on the other side, and a reciprocating movement imparted to the shuttle carriage and shuttle. It is obvious now that by putting different sized pinions upon the shaft of the horizontal pulley, or by speeding up from the rack, any amount of throw may be obtained for the shuttle, so that the width of the piece to be woven is only limited by other considerations; so far as the shuttle is concerned there would be no difficulty in weaving a piece sixty yards wide, if such a width were required, at precisely the same rate that it travels in narrow goods, and producing a given number of square yards of cloth just as rapidly in one case as in the other. It will be also obvious that any precise rate of speed is not essential, when it is understood that the lay is actuated by a cam motion, and that the cam groove is so cut that the lay must remain stationary until the shuttle has passed entirely through between the sheds, and drawn the shoot of the web perfectly tight. If a loom were stopped with the shuttle midway between the sheds, and then started, the first thing it would do would be to draw the shuttle out of the way. In short, a breakage resulting from failure of any part of the loom to operate, is a contingency so remote that it may be considered practically to be nothing.

"The loom frame, yarn beam, cloth roller, let-off and take-up motions, together with the heddles, and the means for

Image source: "Lyall's Positive Motion Loom." *Engineering Weekly* 3 September 1869, p. 159.

# SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXI.—No. 2. [NEW SERIES.] NEW YORK, JULY 10, 1869. $3 per Annum. [IN ADVANCE.]

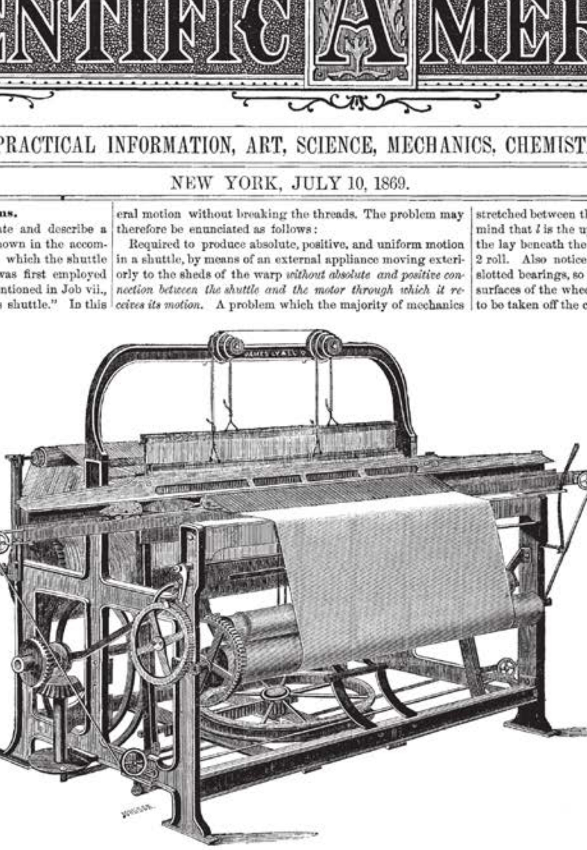

## Improvement in Looms.

We are seldom called upon to illustrate and describe a more important invention than the one shown in the accompanying engravings. The precise date at which the shuttle in the form which it has held so long was first employed in weaving would be hard to fix. It is mentioned in Job vii., 6. "My days are swifter than the weaver's shuttle." In this passage evident allusion is made to the darting motion of the shuttle when thrown by hand, and it is a most beautiful poetic figure by which the brevity of life is illustrated.

It is certain that the throwing of the shuttle by hand was practiced many centuries ago, and the fact that this method is still retained in the manufacture of many kinds of fine fabrics shows how difficult has been the substitution of any application of power to this motion, which could adequately take the place of the hand, in all kinds of weaving.

The introduction of the picker staff and its adjuncts to actuate the shuttle was an immense stride in the art of weaving. It and the Jacquard attachment constitute perhaps the most remarkable improvements made in the art of weaving up to the date of the present invention.

Notwithstanding the persistence with which the ancient form and method of actuating the shuttle have held their ground, there have always existed serious difficulties, which it was desirable to obviate. Without entering too minutely into details which are perfectly familiar to those acquainted with the art of weaving in all its branches, we will specify a few important defects that the general reader may understand the important advantages the device under consideration is destined to accomplish.



LYALL'S PATENT POSITIVE MOTION LOOM.

First, the distance to which the shuttle can be thrown with certainty, either by the hand, or by the use of the picker staff, is limited, and the difficulty of weaving wide goods is consequently so much greater than that of medium or narrow textures of similar materials, that the cost of wide goods per square yard is considerably more than the narrow. This alone would render a shuttle motion, capable of weaving wide goods as cheaply as narrow, a great desideratum.

Second, the motion of the shuttle, having no positive relation to the other parts of the loom, the operator has no control over it during the time it is traversing the distance between the shuttle boxes; and the motions of the other parts, if by accident they should take place a little too soon, through the breaking of any of the working parts, or from any other cause, are liable to clash with that of the shuttle. To illustrate this, suppose the shuttle, impelled by too feeble a stroke, to pause in its passage between the sheds of the warp. In a power loom of the ordinary construction the lay would then make its beat, and either drive the shuttle through the warps, making an extensive breakage, or it would spring the dents of the reed. Or both these accidents may occur at the same moment.

In a piece of fine goods the bending of the dents is a disaster which cannot be wholly repaired. They cannot be again perfectly straightened without taking the piece out of the loom, and if the piece is woven to the end with such a defect in the reed, a slack woven streak will appear through the entire remainder of the tissue. In order that the shuttle may traverse with certainty, a regular speed must also be maintained, below which it is impossible to work a power loom with success.

Third, the shuttle reaches the shuttle box after its flight in either direction, and comes to rest before the lay makes its beat. An adjustment so perfect that, at this point, the thread of the weft shall be firmly drawn up against the exterior threads of the warp opposite the shuttle, is necessary to make a perfect selvedge. This perfect adjustment is difficult of attainment, so much so that the character of the selvedge on a piece of linen or silk goods is one of the criterions by which the quality of the article is determined.

To remedy these defects *in toto*, was a reform so radical in its nature, that a motion radically different was necessitated. It is evident from the nature of the case that no absolute connection between the shuttle and any appliance working exterior to the sheds of the warp, can be made capable of lateral motion without breaking the threads. The problem may therefore be enunciated as follows:

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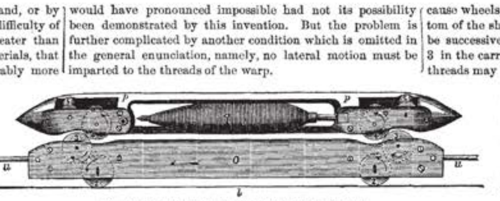

Fig. 2.—Elevation of the Shuttle and Shuttle Carriage.

The ingenious method by which these conditions are fulfilled is shown by Fig. 2, which represents the shuttle resting in its carriage, *o*. Motion is imparted to the carriage and through it to the shuttle by means of a stout cylindrical band, *n*, in a manner to be hereafter described.

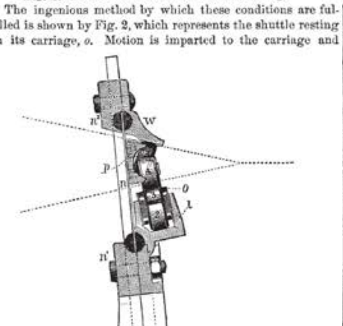

Fig. 3.—Section of Lay and Reed containing Shuttle and Shuttle Carriage.

Let the reader now imagine a sheet of parallel threads stretched between the shuttle, *p*, and its carriage, *o*, and bear in mind that *l* is the upper surface of a race-way running across the lay beneath the warp, upon which the wheels numbered 2 roll. Also notice that the pivots of the wheels, 2, play in slotted bearings, so that their upper surfaces roll on the lower surfaces of the wheels numbered 3. Now suppose the shuttle to be taken off the carriage or driver, *o*, and let this be drawn to the left in the direction of the arrow. It is now evident that the wheels, 2, will revolve in the direction of the arrows drawn upon them, and that their circumferential motion will always be exactly equal to the motion of the carriage, *o*, upon the race-way, *l*, of the lay. But as the slotted bearings of the wheels, 2, allow the weight of the carriage to rest on the pivots of the wheels, 3, and these wheels rest on the tops of the wheels, 2, the wheels, 3, must evidently receive a counter motion in the direction of the arrows marked on them, exactly equal to the motion of the wheels 2, which is likewise equal to the motion of the carriage along the race-way, *l*. If now the sheet of threads be brought into contact with the wheels, 3, it will be seen that while the wheels, 2, are rolling along the race-way, *l*, the wheels, 3, are rolling along the *under* side of the shed of *warp threads*, causing no more lateral motion in those threads than the wheels, 2, cause in the lay, *l*, which is nothing.

We have now seen that the carriage itself produces no tendency to lateral motion in the threads of the warp. Now let us lay on the shuttle, holding it to its place by a beveled rail, a section of which is shown at *w*, Fig. 3; and move the carriage in the same direction as before. The wheels, 2, revolve to the left, and cause wheels, 3, to revolve to the right, and roll along the bottom of the sheet of warp threads. Some of these threads will be successively engaging at each moment between wheels, 3 in the carriage, and wheels, 4, in the shuttle; and, as these threads may be moved in a vertical direction without conflicting with the object we wish to attain, wheels, 4, also commence rotating to the left and thus roll along the top of the sheet of warp threads, at exactly the same speed as wheels, 3, so that each thread of the warp in succession is passed between the lower surfaces of the wheels, 4, and the upper surfaces of the wheels, 3, without being pulled laterally, their only motion being a slight vertical one, owing to the relative positions of the wheels. The wheels, 5, do not engage with the wheels, 4, but roll along the under surface of the beveled rail, *w*, Fig. 3, holding the shuttle down to its work.

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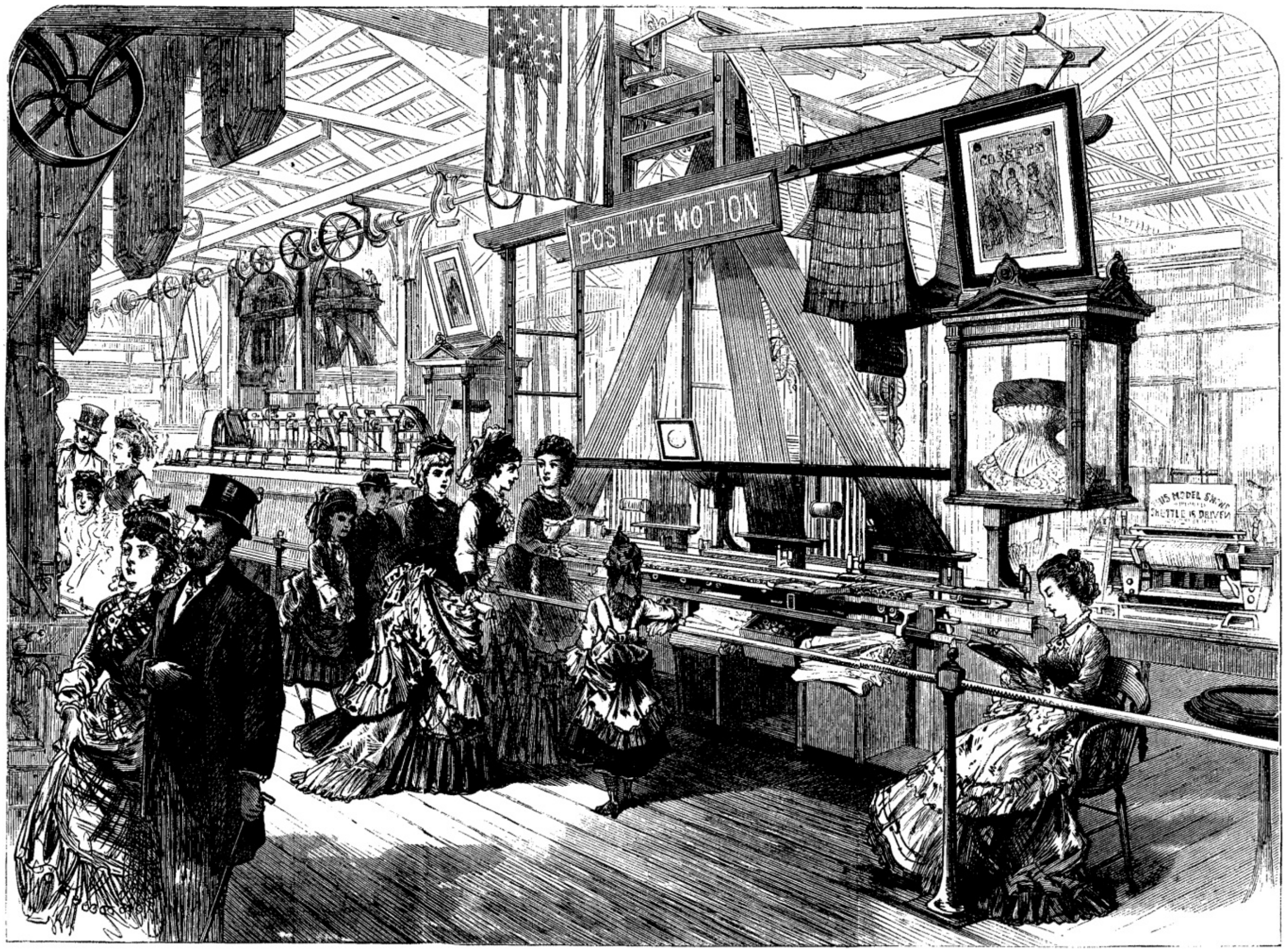
“The inventor of the “positive motion” loom is Mr. James Lyall, of the firm of J. & W. Lyall of New York city. Not content with his achievement as here described, Mr. Lyall is constantly seeking new applications of its principle. By combining the Jacquard apparatus with the positive motion shuttle, he has produced a wonderful machine, which weaves corsets with every gore, every gusset, and every welt much nearer perfect than if the articles were made by hand. Five corsets a day was formerly the labor of one workman…It may fairly be considered as representing the greatest advance in weaving that has been accomplished since the days of Cartwright and Jacquard.”

-“The Lyall Positive Motion Loom.” Harper's Weekly, p. 1012


THE LYALL LOOMS IN OPERATION.

Image source: “Corset and Bag Weaving.” *Manufacturer and Builder*, (April, 1877), p. 89.




THE LYALL POSITIVE MOTION LOOM.
THE CENTENNIAL—IMPROVEMENTS IN WEAVING.—[PHOTOGRAPHED BY THE CENTENNIAL PHOTOGRAPHIC COMPANY.]

Image source: “The Lyall Positive Motion Loom.” Harper's Weekly, December 16, 1876, p. 1013.

“In this loom the shuttle is carried through the warp by a positive motion upon a carrier very ingeniously arranged to throw no strain or friction upon the warp threads; Its advantages are that it enables cloth of any width to be woven as readily as narrow goods. It produces a superior selvage, because of the even manner in which the weft is deposited, and that a strain is kept upon the weft thread until the reed beats it home. It enables the finest silks to be woven by power at a high speed, and it removes all liability to serious "smashes" common to the ordinary flying shuttle. We consider this a very important improvement, and one worthy the highest award.”

- Documents of the Assembly of the State, “Report on Looms” 1869-70

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**The Manufacturer and Builder was "a practical journal of industrial progress" published monthly in the 19th century by Western and Company.