Important Improvements in the Weaving Art.

It was a real treat to us to make a visit to the works of Messrs. J. & W. Lyall, at 540 to 546 West 23d street, New York, where the finest and most improved looms in the world are constructed. This statement is no exaggeration, as proved by the fact that some of these improved looms are exported to England and other countries foremost in the weaving industry.

The main improvement which Mr. James Lyall has effected, and which is really a triumph in the construction of looms and the art of weaving, being as influential and fruitful in its results as any of the improvements made by Whitney or Jacquard, is the positive-motion shuttle. Its motion has only to be watched for a few moments to be convinced of its immense advantages and the extensive range of applications in cases where the ordinary method of moving the shuttle presents innumerable obstacles to accomplish the results aimed at.

As is well known, the common method of moving the shuttle is to throw it through the warp; primitively this was done by hand, and afterward Kay invented the sliding hammers at the ends of the shuttle race, which, by means of cords, were connected with a handle in front of the operator, who in this way could throw the shuttle to the right or left with one hand, while the other hand worked the lay. As soon as steam-power was introduced to operate looms, the same principle was retained, and the hammers, or pickers, as they are commonly called, were moved by mechanism so as to throw the shuttle through the whole width of the warp.

The inherent and insurmountable defects of this system will become evident on a little reflection. First, the shuttle must be moved with a certain velocity, so as to make it reach the end of its course; if it moves too slow, there is danger that it may not pass over the whole length, and if moved too fast, it may throw the shuttle so violently that it may rebound. In both cases the shuttle may be caught between the lay and the fabric; this is technically called a "smash," and results in damaging the dents of the reed, when the loom must be stopped for repairs, which may take several hours. The speed necessary for such looms requires such a nice regulation in order to make the shuttles perform properly, that a retardation of one-twentieth of the velocity is sufficient to cause the accident described. Thus, for instance, if the driving engine is calculated to make 40 revolutions per minute, and by neglect or some other cause, the engineer lets it slow up to 38 revolutions per minute, there is a great chance of several looms becoming at once disabled.

Another objection is that the speed with which the shuttle is thrown must vary with the nature of the material to be woven, whether it be cotton, flax, jute, or silk, and also with the fineness of the thread. This, combined with the variation demanded by the various widths, and it will be seen that the proper adjustment of an ordinary loom is a matter of great difficulty and delicacy.

Finally, as there is a limit to the distance to which the shuttle can be thrown, there is a limit to the width of the goods which can be woven.

All these difficulties have been most ingeniously overcome by the invention of Mr. Lyall, of what he calls the positive-motion shuttle. It differs from the ordinary shuttle in that it is not thrown, and is never out of contact with the power which propels it. How this is accomplished may be understood from the explanation of Fig. 1, where the shuttle is shown resting on its carriage O. Motion is given to the carriage and through it to the shuttle by means of a stout band *u*, which passes over grooved pulleys fixed to the ends of the lay and communicating with a single large pulley underneath the loom, to which, by special mechanism, hereafter to be described, the proper movement is imparted. The wheels 2 of the carriage are pivoted to the ends of short horizontal arms; the wheels 3 are simply journaled in the carriage. The weight of the latter therefore rests on the pivots of wheels 3, and as these rest on the tops of wheels 2, it follows that they must receive a counter motion in the direction of the arrows marked on them, exactly equal to the motion of wheels 2, which is likewise equal to the motion of the carriage along the raceway *l*. Now suppose a sheet of parallel threads to be stretched above this carriage and beneath the shuttle *p*. The only points where these threads will be in contact with carriage and shuttle are obviously between the wheels 3 of the former and wheels 4 of the latter. If we move the carriage so that the wheels 2 revolve to the left, wheels 3 will rotate to the right; and supposing the shuttle removed, it is clear that while the threads are successively raised as wheels 3 pass under them, the rotation of said wheels precludes any lateral movement on their part. It is easy to see that the laying of the shuttle in place above the carriage will in no wise affect this result, because the wheels 3 rotate the wheels 4 at precisely the same speed; so that the successive threads, for the inappreciable instant of time during which they are between shuttle and carriage, sustain no disarrangement from their normal position beyond the very slight elevation, the small fraction of an inch, caused by wheels 3. This clearly imposes no strain, while a moment's consideration of the mechanicism of the device will show that friction on the threads is practically nothing, being applied at the mere line formed at the place of contact of two rolling bodies, and this never twice at the same points considered in horizontal succession from thread to thread, because the sheds are constantly alternating and constantly being moved bodily away as the weaving progresses. The wheels 5 do not engage with the wheels 4, but roll along the under surface of a beveled rail, holding the shuttle down to its work. The shuttle is dovetailed in section, and, when in place with its carriage, can only be removed by drawing it out at the end of the lay.

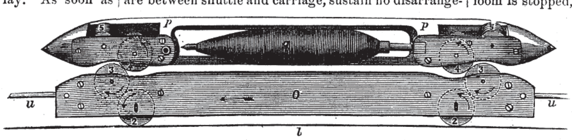
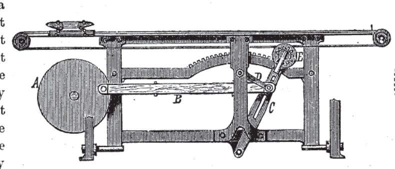


Fig. 1.



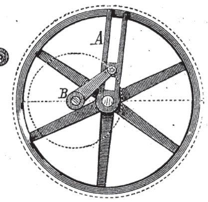


Fig. 2. THE POSITIVE MOTION SHUTTLE. *Fig. 3.*

It will be seen that this shuttle may be moved at various velocities, and even stopped say half way in its course, without doing possibly any damage; that it may be made to move any distance, and therefore may be used to weave any breadth of fabric; and that all the objections to the old shuttles are disposed of, among which we ought to mention that they have sometimes injured the operatives by being forcibly thrown out when the velocity of the driving engine was in the least increased, and even when it was not increased at all.

This shuttle is the main improvement, as stated, but there are others of almost equal importance for producing perfect results; they are, for instance, those represented by Figs. 2 and 3, and intended to produce a period of rest or dwell either in the shuttle or in the lay. Of course the shuttle and lay must stop for each other, the first to allow the lay to be beaten, and the latter to allow the shuttle to accomplish its whole course. Also the motion of the shuttle ought to be swiftest halfway, increasing and decreasing toward the ends, so as to avoid sudden jars and stops. How this is accomplished is shown in Fig. 2, where A is a crank disk, from which motion is imparted by a connecting-rod B to a sliding block in the slotted vibrating arm C; D is a link attached to the sliding block and pivoted to the frame; arm C carries, as shown, the wheel, actuates the shuttle band, and is itself rotated by a rack and pinion device, clearly represented. When the crank disk starts from the position exhibited, (the shuttle being at the end of the race,) the sliding block is at the upper end of the slot in arm C, hence the arm, and consequently the shuttle, is given very slow motion. But as one end of the connecting-rod is carried up the disk, its other end causes the sliding block to descend to the arm, the wheel on the outer extremity of which therefore constantly receives an accelerated motion, which is most rapid when the shuttle is midway in its course, and gradually in the same manner decreases until the pick is made. The shuttle is never returned until the lay is got home, so that no matter what the position of the shuttle is to the race when the loom is stopped, on starting again the first thing done is to draw it out of the way of the lay. The dwell in the lay—an obvious necessity when the shuttle, in weaving wide fabrics, has to travel a very long distance—is obtained by the device shown in Fig. 3; A is a slotted pulley-wheel, in the slot of which is a sliding block, to which is attached the crank of the shaft B, which imparts motion to the lay. The crank wrist is eccentric to the pulley, and as the latter revolves it moves radially in the slot, consequently when nearest the center it imparts an extremely slow or no motion to the shaft B, and a quick movement when it has travelled out toward the circumference.

The looms of Mr. Lyall were on exhibition at the Centennial, and five of them were in a very conspicuous position in Machinery Hall, and are represented in the engraving on the opposite page, in which the largest loom ever made in the world is seen at the left. Formerly wide looms required three men to work them, one at each end to throw the shuttle and one in the middle to move the lay. The loom here represented, weaving in 10 hours fabrics 24 feet wide and 120 feet long, or 2,980 square feet, is attended by a single girl. Notwithstanding the shuttle travels 31 feet every time, it makes 35 such journeys in a minute.

As one of the results accomplished by the labors of Mr. Lyall, we may state that our importation of oil-cloth foundations from Scotland has ceased, as the tedious hand-labor by which it is made in that country cannot of course compete with Mr. Lyall's looms.

Opposite the great loom, our engraving represents the bag loom in the foreground, then the ten-quarter cotton loom, the heavy jute carpet loom, and finally the corset loom in the center. The bag and corset looms are explained in our next article.