which are seen at *h* *h,* make their way immediately under the curved ends of the lifting hooks, so as to raise them, or such of them as are not prevented from being taken up, in the manner presently to be described, when the frame is raised. Supposing all the wires to be taken up, the hooks will appear as at fig. 13 ; but that would take up the whole warp.

It should be observed, that the lifting bars are shaped like blunted knife-blades, having the broad part inclined out of the perpendicular, so that in descending their lower edges steer clear of the curved head of the lifting hooks. As however they descend still farther, the flat parts of the bars press against the curved heads and force them against the springs. The lifting bars, still continuing to descend, at length get entirely below the curved head, when the spiral springs cause the horizontal needles, and consequently the lifting hooks, to regain their position ; and when the frame *g,* with its lifting bars, is again raised, the bars must necessarily raise the lifting hooks.

In order to prevent the taking up of the whole warp, it will be obvious that any pressure upon any number of the horizontal needles at *b b* will force in the spiral springs, and thus remove the lifting hooks out of the reach of the lifting bars. In fig. 9, half of the hooks are so pressed in. To produce a figure, therefore, all that is necessary is to have the power of regulating the order in which the needles *b b b b* are pressed forward upon the spiral springs ; and this is effected by means of a square revolving bar, fig. 11, pierced with holes corresponding in number and posi­

tion with the needle points *b b ;* and a number of perforated card boards, fig. 12, which pass over it in endless succession with its revolutions.

The reader will now clearly comprehend the operation of the bar and the cards. If the bar be moved against the frame c c, the needle-ends *b b* will pass into the holes, and all the lifting hooks will remain within the influence of the lifting bars; but if the cards, fig. 12, being partly perfo­rated and partly whole, be placed over the perforated bar, it must be obvious that such of the needles as are prevented from entering the holes of the bar, by the intervention of the unperforated portions of the cards, will be pressed against the springs, and the lifting hooks will be removed from the operation of the lifting bars ; while those needles which pass through the perforated portions of the cards into the corresponding holes of the bar will be unaffected, and the lifting hooks connected with them will be taken up.

As the perforation of the cards is the means by which the harness is raised, the absence of perforation determin­ing what part of the warp shall not be raised, it is ne­cessary to have one card or slip for every shoot of weft, until the whole pattern is described. The whole are loose­ly looped together at the corners, so as to form an endless chain, one whole revolution of which completes the pat­tern.

The cards arc exactly fitted to the bar by means of studs *i i i i* upon the latter, corresponding with larger

perforations *j j j j* in the former. The studs will be seen projecting from the section of the bar in fig. 13, the letter­

ing of the whole of which figure corresponds with the others, so as to enable the reader to trace each part of the machine.

The mode of setting the Jacquard engine in operation is as follows : The bar, fig. 11, marked *k* in the section, the end only being there seen, is suspended in a frame *m m* by its axis *l,* which is swung so as to hang something like the lay or batten of the loom, and to move upon the side of the frame *c*, through which the needle-ends protrude, and to retire therefrom with an equable motion. It will be seen by fig. 11, that the bar has at one end four pillars *n, o, p, g ; n, o,* and *p* only being seen in fig. 11. Each of these pillars is seized in succession by the hook *r,* by which means each revolution is divided into fourths. The equability and pre­cision of this movement is secured by the T-shaped bar, which is pressed uniformly on the uppermost pillars by the action of a spring.

A careful inspection of figs. 9 and 13 will now, we hope, convey to the reader a clear conception of the manner in which the machine works. It will be seen that a roller *u* is attached to the frame *g* by a curved arm. This roller works in a hook-shaped bar *v*, and as the frame *g* is raised, the roller *u* ascends with it, and necessarily moves the frame *m*, to which it is attached, away from the frame c, through which the needle-heads project. In like manner, when the frame *g* is lowered, the roller *u* descending with it, the frame *m,* with the bar *h*, is permitted to approach the needle-heads *b b.* The section, fig. 13, shows the frame and bar in both positions.

The revolution of the perforated bar is provided for by the operation of the catching hook *r* ; for when the bar is in its place against the needle-heads, the hook slips over the furthermost pillar, and there the bar would be firmly locked against the frame *c,* if it did not revolve on its axis ; and it can only yield to the repelling operation of the roller *u*, by making a quarter revolution. It will be readily seen, that the revolution is the only means by which the pillar of the bar is extricated from the hook.

The use of the under hook *y* is to reverse the operation. The hooks *r* and *y* are connected by a cord *w x,* by which the former is thrown out of action, and the latter brought into operation. The movement of the card-slips is of course reversed ; and the weaver is enabled to repair an