other mails are also attached. These setts of mail are connected to elastics or springs at the bottom of the loom. The great objection to the last two arrangements is that it is necessary to use a considerable quantity of heald cord, which has the unsatisfactory property of being subject to the changes in the weather. It is needless, probably, to point out that, as this is the case, the loom overlooker may have considerable work in readjusting the selvages of his looms when a moist atmosphere has been replaced by a dry one, or *vice versa*. Recent investigations and experiments have, however, shown that it is possible to make heald cord so that it is almost impervious to the weather, but as the arrangements by which this cord is made are not perfected, it is probably better not to enlarge upon this point. Another method very usually employed to make a bastard plain selvage is what is called the boat system. Between the healds and the yarn rods, two pieces of hard wood, one at each side of the loom, are placed upon a round weight iron bracket affixed to the loom side. These pieces of wood are so fixed that each end can be swayed up and down from the centre of the wood, giving a motion like that of a boat—hence the name. The boats are placed under the warp—the distance being regulated by the length of the wires placed at each end of the boats. These wires are usually made of reed wire bent double and fixed in slits at the ends of the boat. The number of wires is regulated by the number of selvage ends required. Half the selvage ends are drawn through the back, and bent wires are drawn into the healds of the two back staves only, above the eye, and not in the eye, as is usual; and the ends which are drawn through the dents in the front of the boat are drawn through the healds on the front stave, but always above the eye of the heald, and not through the eye. This system is a very inexpensive one to apply. It makes a selvage as follows: Three-shaft drill, one pick in a shed, two picks in a shed; five-shaft sateen, one pick in a shed, three times repeated, two picks in a shed. Where boats are used, very strong selvage ends are necessary, else the selvages will weave very badly, and much time will be lost by the weaver. The healds also are found to wear out very soon at those parts used by the selvage ends. The weaver has also to draw the selvage ends in at the loom. Where sufficient room in the loom exists, the tappit arrangements would seem to be in most respects superior to the boat plan, and, where manufacturers order looms for the weaving of fancy cloths, care should be taken to make such arrangements as will permit of their adoption if required.

PHOTOGRAPHY IN WEAVING.

BY NIC. REISER, DIRECTOR OF THE WEAVING SCHOOL, AASCHEN, GERMANY.

The writer gives in the following the result of his inquiries into an invention which seems likely to cause an entire revolution of the art of designing, the most essential and up to now most difficult part of the textile industry. Since the introduction of the jacquard, about the beginning of this century, no new idea of greater importance and utility has been added to the art of pattern weaving, and already it seems certain that all those branches of the weaving industry which involve designs of any kind will consult their interests by securing and applying the invention.

Designing for weaving by the aid of this process, which has been protected by patents in all countries having textile industries (Jan Szczepanik, of Vienna, being the patentee), is done by means of photography in such a way that any picture or object, of whatever nature, can be produced on an enlarged scale through an optical obstruction (a screen) directly upon sensitive paper. This screen, which is called "Raster," is a photographical negative about 80 x 80 centimeters in size, and is made on a strong glass plate, mounted firmly in a frame. About thirty such rasters or screens are required to make all designs whatever occurring in the whole of the weaving industries. One of them, called the chief screen, is a light gray negative with a strong lineage similar to designing paper, each of the lines consisting of two parallel strokes, one of which is black, the other white. The lineage forms a large number of squares, 800 to 1,000, in the width representing the warp, and an equal number representing the weft ends. The whole surface of the screen thus contains 640,000 to 1,000,000 squares.

The photographic apparatus, which is used for designing, has a focussing screen, which is also covered with a black fine lineage, and conforms in its scale to that of the chief screen, and all the other screens used. A small picture in front of the lens of the photographic apparatus can very easily be projected in the desired scale on to the focussing screen in the following manner: The object, if fixed exactly in the centre of the board, is carried in a stand to the front of the camera; then the apparatus is adjusted so that the image covers the desired number of squares in the width of the focussing screen. The closer the lens is brought to the picture, the larger will be the projected image. At the same time the focussing screen must be removed from the lens until the image appears sharp enough. In order to reduce the picture, the lens is removed from the picture, and the focussing screen is advanced to the lens until the image is quite distinct. The stand and camera are connected by two rods fastened to their side, and containing a scale for mechanically finding the enlargement desired. The board B can be vertically adjusted by means of a crank; another crank works the horizontal adjustment of the board. These motions serve the purpose of easily projecting the picture on to the focussing screen. The focussing screen contains squares representing the warp and weft ends, in the proportion of 1—1. The other proportions—when more warp than weft ends, or more weft than warp ends are in one square—are usually represented on the designing paper by oblongs of different size. These oblongs are so arranged as to divide the design into the desired number of warp and weft ends, in its length and width. With the present arrangement the squares are not altered, but the image projected on the focussing screen is shortened or lengthened by optical means, so that the length also is thrown upon the desired number of squares in the length of the focussing screen, although the width of the image remains unaltered. The width, of