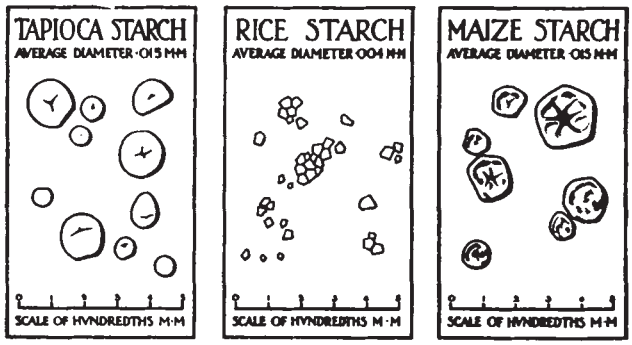
since the rate of the evaporation of the water varies accordingly. It is a noteworthy fact, however, that rice starch does not change its viscosity by continuing the rate of evaporation. On the other hand, the viscosity of wheaten starch increases regularly with the duration of boiling. Potato starch has a maximum viscosity after a boiling of five minutes, then it diminishes rapidly; after ten minutes its viscosity is five times that of wheaten starch, and after thirty minutes it is much below that of wheaten starch boiled for the same period.



Starch from cassava attains its maximum viscosity at the moment the boiling point is reached, then it diminishes uniformly as the boiling is prolonged.

A large number of special finishing preparations are composed mainly of wheaten starch which has been treated with the object of diminishing its viscosity, for instance, by the action of soda, boric acid, or a small amount of borax. A too great proportion of alkali or of borax, however, actually increases the viscosity.

How to Identify Starches.

When starch is boiled with water, or caused to go into solution with the help of an alkali, the granules are ruptured, and it is impossible to state from which particular starch the solution was made.

If the starch granules have not been attacked, they may be recognized under the microscope, and identified by their characteristic appearance and size. The granules of the same starch may differ widely among themselves in size, but in shape and general appearance they are very much alike, as seen from the accompanying two plates of illustrations representing Sago, Potato, Wheat, Tapioca, Rice and Maize starches.

The markings on the granules, which take the form of concentric rings surrounding a central dot or star-shaped crack, called the hilum, are very difficult to see clearly under the microscope by ordinary illumination, hence should be viewed by polarized light.

In order to measure the diameter of the granules, a finely-ruled grating is dropped into the eyepiece of the microscope. The lines on the eyepiece micrometer are visible in the same plane as the object, so that the apparent diameter of the granules can be measured against the spaces between the micrometer lines.

The real value of the eyepiece scale is then found by replacing the starch slide by one ruled in hundredths of a millimetre.

Microscopic Characters of Starches.

Sago Starch: 0.02 to 0.06 mm. diameter of granules, which are obtusely pear-shaped, presenting the following characteristics: Hilum, a spot or crack at narrow end. Rings few and faint.

Potato Starch: 0.05 to 0.1 mm. diameter of granules which are of an irregular ovate shape (the smaller granules being more circular) presenting the following characteristics: Hilum a dot near smaller end. Rings visible on larger granules.

Wheat Starch: 0.002 to 0.052 mm. diameter of granules, which are of a lenticular shape, presenting the following characteristics: Concentric rings very faint. Hilum, eccentric, only occasionally visible in the largest granules. Granules very transparent.

Tapioca Starch: 0.008 to 0.022 mm. diameter of granules, some of which are circular in shape, others suggesting small sago granules. They present the following characteristics: Hilum central, presenting an elongated slit, or being star-shaped.

Rice Starch: 0.005 to 0.008 mm. diameter of granules, which are of an irreguiar polygonal shape, presenting hilum and rings almost invisible.

Maize Starch: 0.007 to 0.2 mm. diameter of granules, which are of polygonal shape, with corners frequently rounded, presenting the following characteristics: Hilum, well defined, star-shaped. Rings very faint. Surface granules, frequently irregular.

THE MANUFACTURE OF RIBBONS, TRIMMINGS, EDGINGS, ETC.

(Continued from August issue.)

2 Systems Warp, 1 System Filling.

Fig. 164 shows us a sketch for a single shuttle ribbon in which the figure is to be produced by means of an extra warp, *i. e.*, 2 systems of warp and 1 system of filling are to be used in the construction of the ribbon. Five repeats of the design are given. The texture of the fabric to be: 25 picks, and 25 ground warp-threads and 25 figure warp-threads per inch, and in the same proportions to fractions of an inch.

Fig. 164

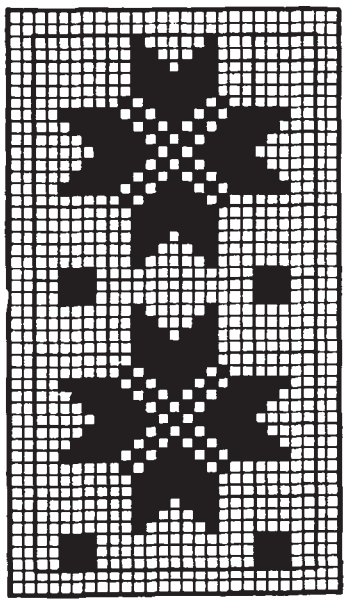


Fig. 165

For this reason, when calculating as to point paper to use, since only the figure warp-threads and the picks come into consideration, the proportion of the texture to be considered is 25 : 25, or point paper 6 : 6, 8 : 8, or 12 : 12 may be used.

The lower portion of the sketch Fig. 164 is shown ruled-off, by means of dotted lines, corresponding to the heavy ruled squares on the point paper—design

Fig. 165. The latter shows two repeats painted on 6 by 6 point paper to more clearly illustrate subject. One repeat of it is all that is required to be made; by

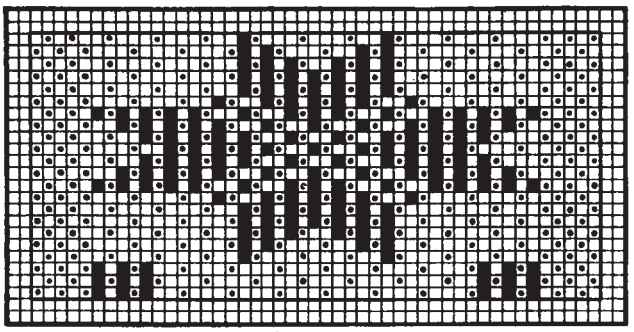


Fig.166

the designer for practical work; drawing in draft and harness chain are made out in the usual way.

Fig. 166 is given to illustrate the analysis of figure and ground warp, as they interlace with the filling in the fabric structure. The ground warp is shown by *dot* type, the figure warp by *full* type.

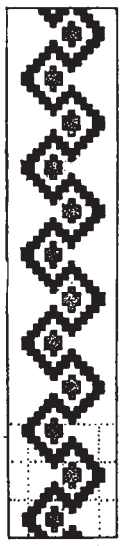


Fig.167

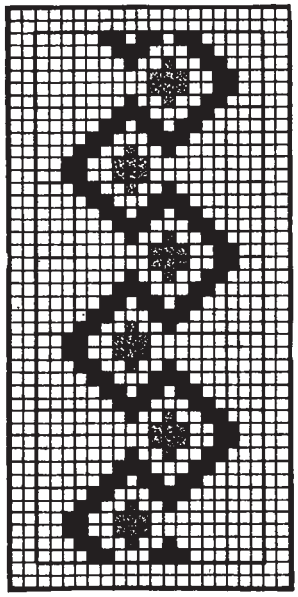


Fig.168

The arrangement of the warp is thus:

4 ends ground
1 end ground } 19 times
1 " figure }
4 ends ground

46 ends, repeat.

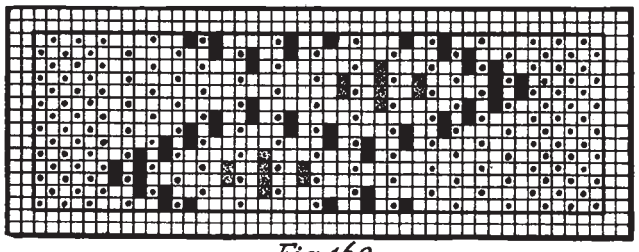


Fig.169

It is immaterial what kind of point paper we use for illustrating the interlacing of both systems warp with the filling in diagram Fig. 166, having used for this reason plain point paper, *i. e.*, such as is not over-ruled with heavy squares.

Producing Figures in Smooth Ribbons.

3 Systems Warp: 1 System Filling.

Fig. 167 shows us a sketch for a ribbon calling for two systems figure warp and one system ground warp used in connection with one system filling. One system of figure warp is shown in *black* and that of the other in *gray*. Six repeats of the design are given.

The lower portion of sketch Fig. 167 is shown ruled-off, by means of dotted lines, to correspond to the heavy ruled squares on the point paper design Fig. 168, which shows three repeats in length of pattern. The ground warp-threads are not shown on point paper design Fig. 168; the two figure warp-threads are represented on the same row of squares in a vertical direction, one system in one color (see *full* type) and the other system in another color (see *gray* type). The point paper used is 6 by 6, which means that figure warp-threads (considering the two systems where they appear on one line as one thread) equal in texture the picks.

Fig. 169 shows the interlacing (one repeat) of all the warp-threads with its filling for design Fig. 168. The ground warp-threads are shown by means of *dot* type, the two figure warp-threads by means of *full* and *gray* type, respectively.

REVERSIBLES.

HARNESS AND JACQUARD WORK.

(Continued from August issue.)

Jacquard Work.

The principle of designing these double cloth reversibles as previously explained in connection with

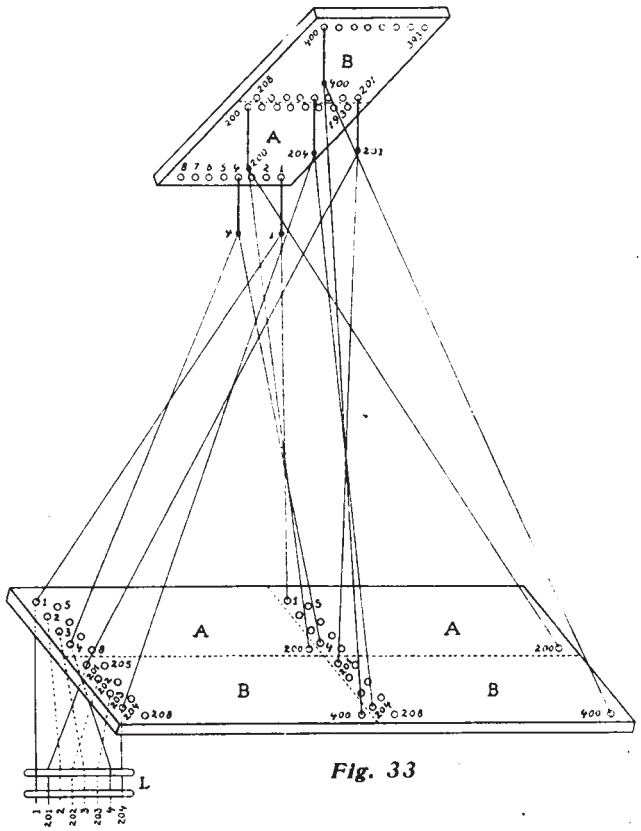


Fig. 33

harness work, also finds extensive use with Jacquard work.