

# Engraving With the Jacquard Machine\*

Engraving by the Jacquard process represents the idea and efforts of Richard Ruddell, former Jacquard harness builder, now member of the Research Division of Cheney Brothers, Silk Manufacturers of South Manchester, Conn.

A simple method of transferring designs to the copper shell used in textile and other print works has been in demand for years. Such a method is supplied by Mr. Ruddell's machine. His original model has been used by Cheney Brothers on a productive basis for more than a year, and two commercial machines were recently completed at the Cheney Plant.

## The Process

Engraving by this process, the object of the machine is to puncture a thin film of varnish previously spread over and dried upon the surface of a copper shell. This is accomplished by dropping pointed engraving tools from a uniform height in a pre-determined manner under the control of cards in a special Jacquard machine. There is one card for each pick in the design and a multiple of the card pack cycles completes the picks in the circumference of the shell. Each needle in the Jacquard machine is tied in series to a number of engraving tools, the number depending entirely on the length of the traverse repeat of the design.

Since the engraving tools are spaced exactly  $\frac{1}{8}$ " apart and each card is supplied with 12 rows of holes, the machine is equipped with a special automatic control to shift the shell laterally, and the Jacquard position needles vertically after each revolution of the shell. In this manner each  $\frac{1}{96}$  part of the circumference is presented before the points of the engraving tools controllable by a card punching and the varnish is punctured in a way that can be etched to any desired depth to carry color for printing.

## Capacity

The machine is designed to take two stand-

\* By Research Division, Cheney Bros., South Manchester, Conn.

ard copper shells of a maximum 24-inch circumference and 45-inch length. The shells which are to be engraved are mounted on cones, keyed and clamped to rigid mandrels which, when placed in the machine, are definitely located in an endwise relation to the engraving tools by cone pivot screws in the turning member bearings. The shells are placed in the machine with the table at its lowest position to prevent any possibility of scratching the varnished surface after which

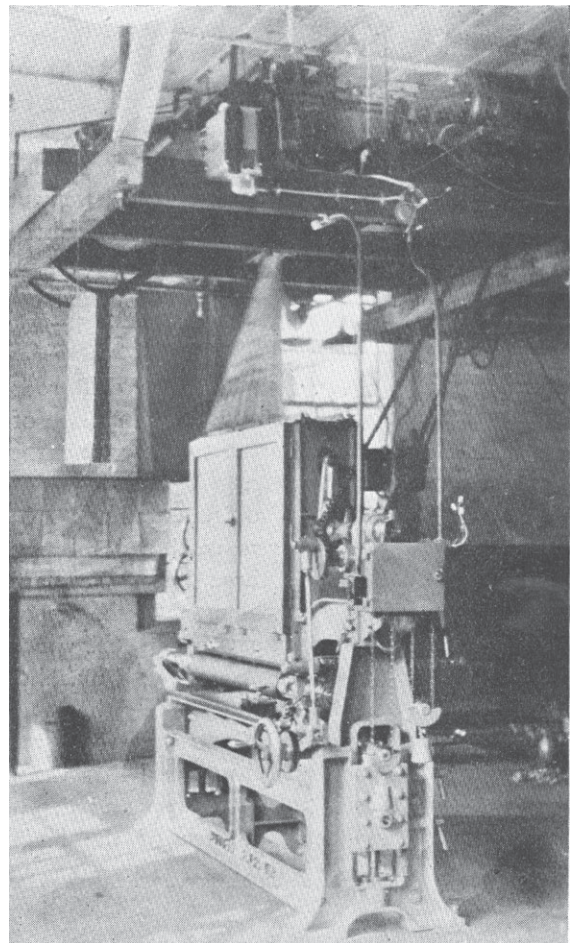


Figure 1  
Ruddell Engraver in Position to Engrave Two 16x45  
Copper Shells

the table is elevated to the engraving position, bringing the surface of the shell approximately  $\frac{1}{16}$ " below the lower guide of the engraving

tools. This insures accuracies of engraving within very close limits.

### Shell Traverse

The circumferential traverse of the shells is operated by a simple crank and ratchet arrangement, this ratchet being changeable. The number of teeth in the ratchet is a multiple of the movements or picks required to complete one revolution. The ratchet drives the shell through a set of worms and gears so designed that even with long service, simple adjustments can be made to eliminate any back-lash, insuring accurate circumferential movement at all times.

The endwise traverse of the table is controlled automatically, the movement being produced by a 12-point cam, the advancement of which is such that the cam roll always rests on a dwell of the cam. As a result of this arrangement, small inaccuracies in movement of actuating mechanisms are not transmitted to the traverse or design.

### Engraving Tools

The engraving tools, which are drill rods with hard and accurately stoned points, are of the correct weight to impart to the copper the desired depth of engraving. These tools, 360 in number on each side, are mounted and held in alignment by tool bars machined to very close tolerances. The three lower bars are rigidly fixed to the machine while the upper bar has a vertical movement of an inch. Since it is impossible to tie up a Jacquard machine so that all the tools will drop exactly the same distance, this upper bar holds all tools released by the head, and drops and lifts them quickly providing a uniform drop and depth of engraving, easing the work of the linen strings.

### Jacquard Machine

The Jacquard head uses the standard fine index card and so far as the cylinder and card control is concerned is a duplicate of the common Jacquard head. The head action differs in that a vertical needle drop is affected when

perforations in the cards allow the horizontal needles to penetrate the cylinder.

Since there are 12 rows of perforations in the card, and since the head is equipped with but a single bank of 80 needles, these needles must be carried in a slide which is elevated to make alignment with the various rows in the cards. This is accomplished by a cam and ratchet mechanism. The shift takes place after each revolution of the shell and is so nicely timed that not a pick is lost.

Since the circumference of the shell to be engraved is a variable and each movement is  $1/96''$ , an automatic variable control is necessary to shift the needle board vertically and the shell laterally on the first pick of each revolution of the shell. The multiplier provides this mechanism.

### Multiplier

The multiplier is controlled through an eccentric, lever and ratchet action which transmits a movement of two links of a common loose link belt for each pick. This chain has two special links which in each revolution cause interferences, setting in motion the mechanism on a second chain. A special link on the second chain closes an electrical circuit through a mercury switch causing two solenoids to act on the pawls which operate on the needle board and lateral shift ratchets. Since a  $16''$  circumference is equivalent to 1,512 picks, these chains contain, respectively, 72 and

$$42 \text{ links, or } 2 \frac{\text{Cir. } \times 96}{\text{No. of links in Chain A}} = \text{No. links in Chain B.}$$

### Drive

The unit is driven from a one-half HP motor through a reduction unit imparting 100 picks per minute to the machine. Normally the machine is operated through a push button control. Should it become necessary to operate the unit within one revolution to obtain a certain position, the hand wheel is used. The machine stops automatically when the complete roll has been engraved. The electrical circuits are so arranged that a single push button controls all the electrical equipment.

### Repeat Tie-up

Each machine is equipped with a series of comber boards so that when it becomes neces-

quard machine needles and the strings from the engraving tools. The tie-up with machine and Jacquard comber boards is then removed

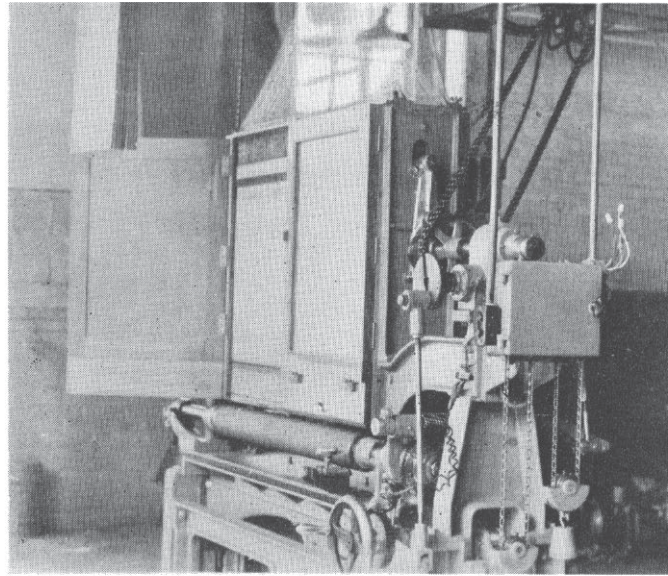


Figure 2  
Drive End View of Ruddell Engraver Showing Reset Indicator  
and Engraving Tools

sary to change the tie-up from a two to a three of five-inch pattern or repeat, all that is necessary is to unhook the neck cords from the Jac-

bodily and the required tie-up is hooked in. The complete time for such a change is approximately thirty minutes and requires no

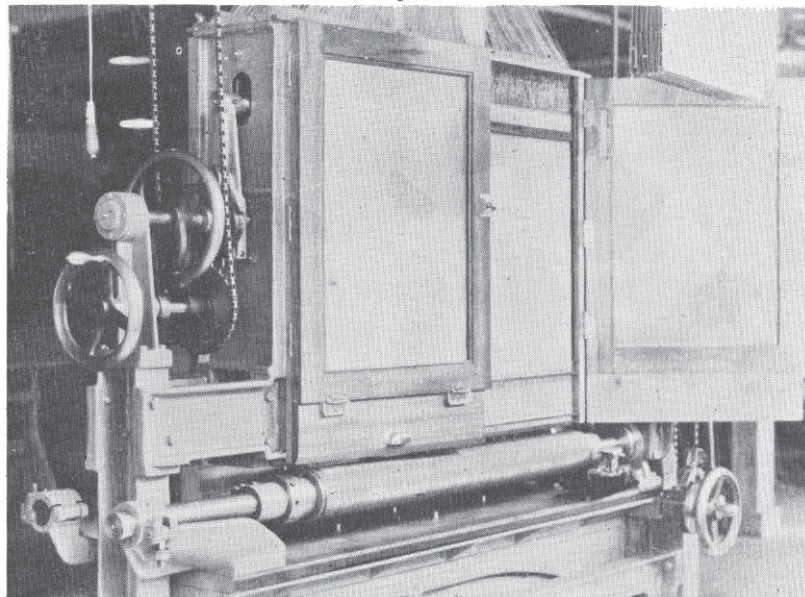


Figure 3  
Rear End View Showing Shell Mounting and Jacquard Controls

particular skill on the part of the operator.

The machine is simple to operate; any person of average talent should be able to master its control after a few weeks of instruction. The machinery is safeguarded throughout and a faulty move on the part of the operator will cause no damage to the machinery, but under the worst conditions may cause a fault in the engraving or scratch the varnish. These faults, however, are ever present in the handling of varnished rolls in any process.

### Re-etch Work

When it becomes necessary to engrave for

### Time Required

In engraving a common shell requiring approximately 1,440 picks for one revolution, the necessary time for finishing a shell is about three hours. Since two shells of the same diameter and repeat can be engraved simultaneously, the complete time required, including setting the rolls and cards and changing the tie-up, is approximately three and a half hours for two rolls. During the three hours of engraving almost no supervision is called for. The time for the engraving is the same whether the design is an elaborate or simple one.

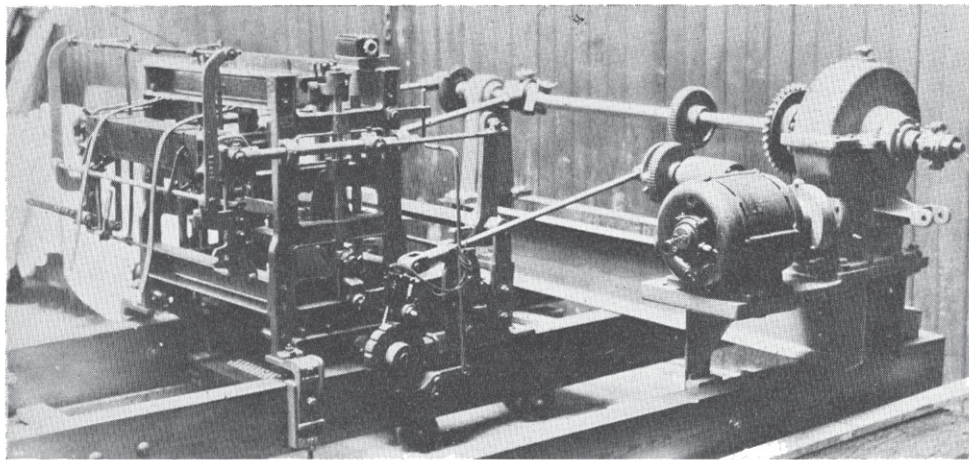


Figure 4  
View of the Jacquard Machine and Drive

re-etch work, the copper shell must be replaced in the machine in such a manner that the design matches exactly; for this work an instrument is attached to the table which insures matching within .001 of an inch.

In certain designs with lines running parallel with the axis of the shell, the design is engraved at a slight helical angle and for this work the machine is provided with a swivel top plate which may be quickly swung to the desired angle.

The design is rigid throughout to eliminate vibration. All sliding surfaces are ample in size and well provided with lubrication facilities. All turning members are housed with ball bearings of sturdy construction, insuring exceedingly low maintenance cost over a long period.

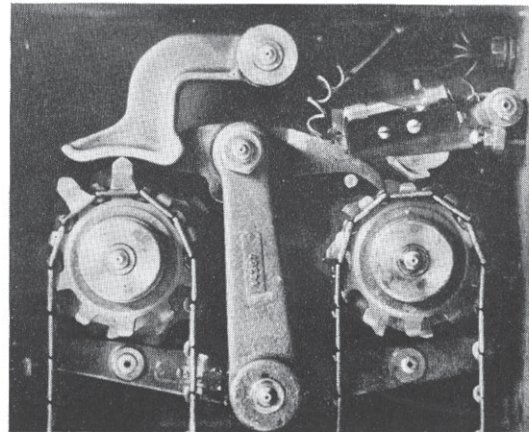
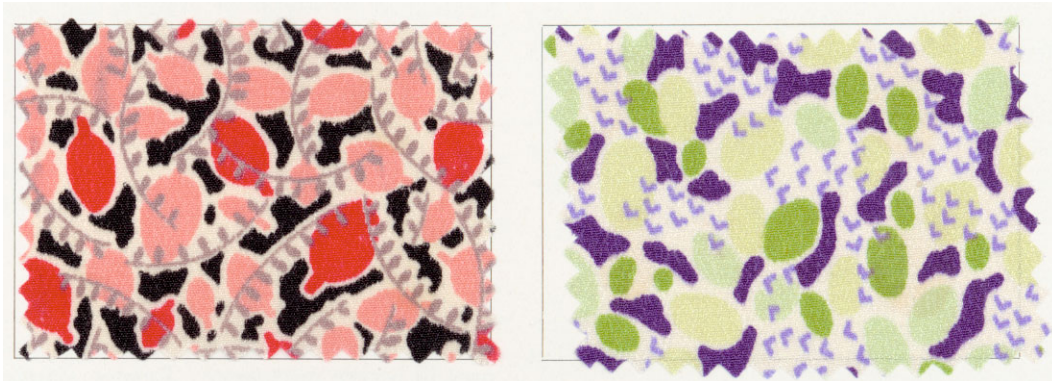


Figure 5  
View of the Multiplier for Controlling the Shell and Jacquard Traverse

## Jacquard Cards

In designing for the production of cards to be used, only one size of plotting paper is necessary. Since each set of cards controls only a single color and no consideration need be

used to prepare designs for weaving is permissible. Another advantage is that, the design is preserved on the cards which may be stored for future use. Thus the copper rolls will be released for other designs instead of



given to weaves, the preparation of the design is a very simple matter compared with the preparation of a design for the loom.

Consideration must be given to the run of color as in blotch and discharge prints, but as this is readily standardized it offers no diffi-

being carried in storage. This will greatly reduce the number of copper rolls carried on inventory.

The accompanying samples show typical print designs produced on the machine and represent an average of 3.4 colors on a 3.2-

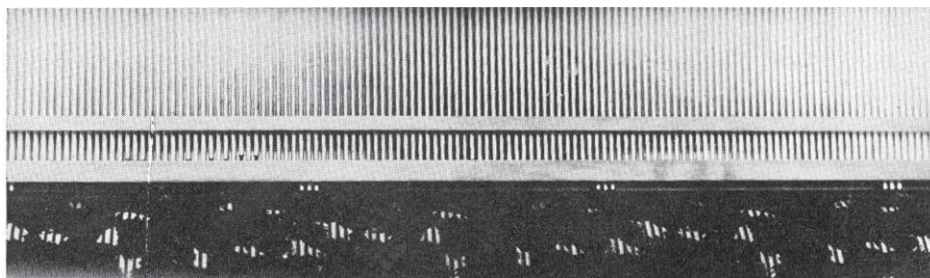


Figure 6  
View Showing the Engraving Tools in the Engraving Position

culty. For the same reason, the card cutting is very simple.

Since the cards pass through the Jacquard machine only 12 to 64 times to complete a shell, a cheaper grade of paper than that now

inch repeat requiring an average of 247 cards per design. A time study for this grade of work shows a 33% saving in time and a 40% reduction in cost over the present method of producing such work.