Accurate Index Wheels and Milling Operations

The Channels in the Cylinders of the Unitype Company's Typesetting Machine Are Correctly Located and Cut with Special Machinery

EDITORIAL CORRESPONDENCE

An accurate index wheel over 3 feet in diameter and having 90 indexing plugs correctly located about its periphery constitutes of itself an important piece of machine work. At the Unitype Company's shop, Brooklyn, N. Y., 10 such wheels are in service on as many special machines employed for cutting longitudinal channels in the surfaces of the cast-iron cylinders forming the bodies of the type-setting machines built by that concern. This row of 10 channels forms a unique battery of machines, several members of which are represented in the half-tone illustration, Fig. 1.

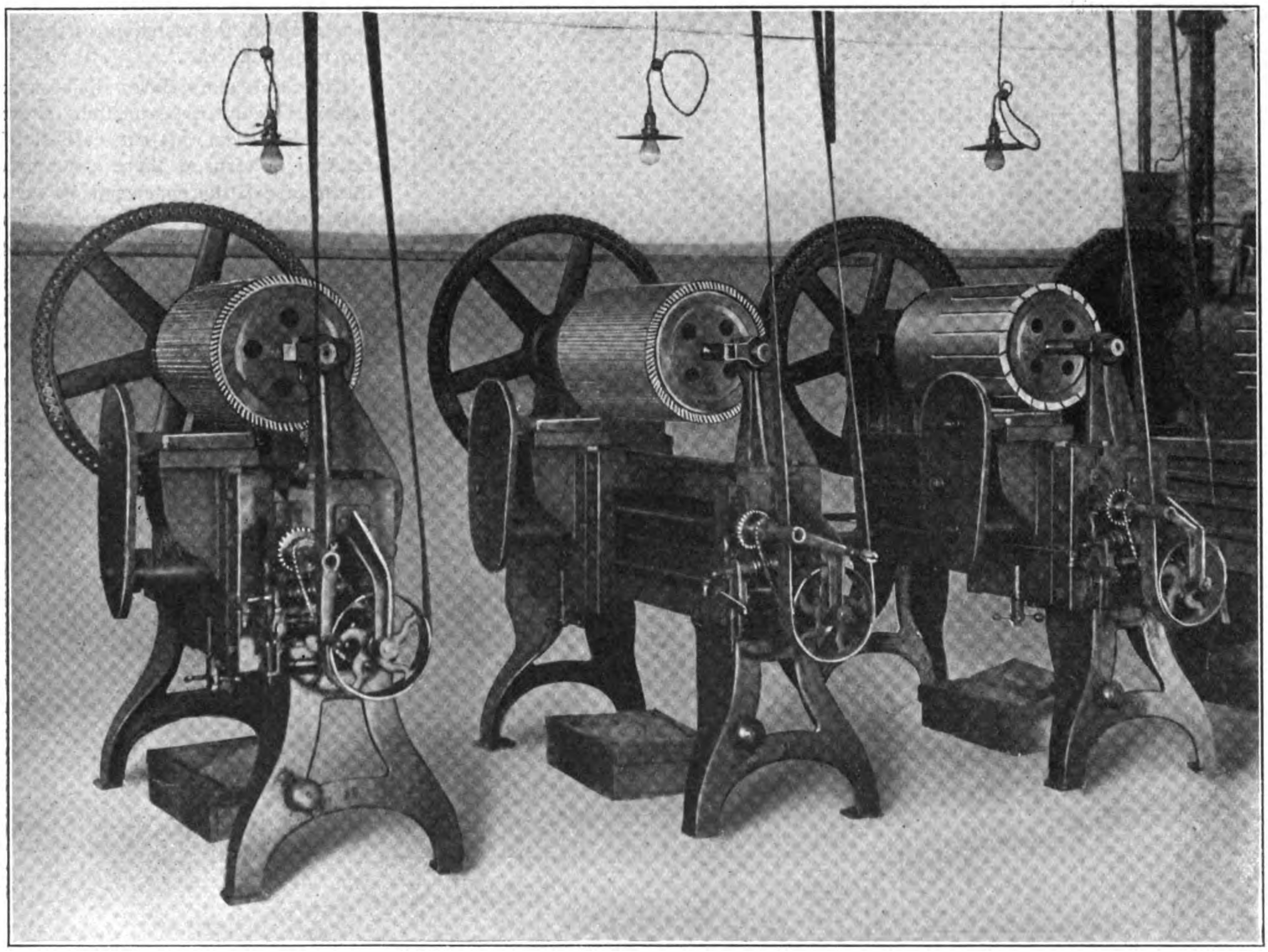

FIG. 1. GROUP OF SPECIAL MACHINES FOR MILLING CHANNELS IN TYPE SETTER CYLINDERS

The Typesetter Cylinders

The Unitype Company's machine has two vertical cylinders placed one above the other, as represented in Fig. 2. In the periphery of each cylinder are 90 longitudinal channels equally spaced about the circumference and cut at an angle, as indicated by the single channel shown in the sketch. The upper cylinder *A* is called the distributor; the lower cylinder B is the magazine. The "dead" type is automatically loaded into the distributor channels in *A* and the latter is rotated step by step by a cam and roller movement bringing each channel in succession over each of the channels in cylinder *B*. The latter channels have a series of steel wards or ribs set into the forward face, as shown at *a*, *a*, in Fig. 3. The ward combination in each channel differs from all the other combinations and corresponds to the combination of notches in the edge of one type character only. Therefore, as the type is carried around by the distributor cylinder the character at the bottom of each line of "dead" type in the distributor can only drop into the proper channel in the magazine. Thus each magazine channel forms a receptacle for a given type character, and from this cylinder the type is reset by ingenious mechanism controlled from a keyboard at the front of the machine.

In order that the type may drop properly into the magazine as the upper cylinder is rotated step by step, the edges of the channels in the two cylinders must match exactly; the cutting of these channels is, therefore, a very important operation.

The Channel Locations

As will be seen upon inspection of the sketches, Figs. 2, 3 and 4, the outer edge of the channel is cut 4 3/16 inches from the center of the cylinder; that is, it is tangent to a circle of 8⅛ inches diameter. This location off center naturally adds to the difficulty of producing a series of straight, narrow channels of the depth required, which is about 7/8 inch. The width of the slot varies in different cylinders according to the size of type to be handled, but whatever the width, the positive side of the channel is 4 3/16 inches from the center line.

The channeling operation on three different pairs of cylinders is represented in Fig. 1; the sketch, Fig. 4, will make the cutter application a little clearer. In this illustration a few slots or channels are represented as already cut and the cutter is seen in working position. A cutter of the side-milling type is used, the diameter being about 6½ inches. This cutter, although quite thin as compared with its diameter, produces a straight slot, true to size and smoothly finished.

Cutting the Slots

The two cylinders are placed side by side on the arbor in the channeling machine, as in Fig. 5, and the cutter started at the bottom end of the lower or magazine cylinder. The work is indexed five spaces at a time the first time around, every fifth cut thus being made on this round. The next time around an intermediate cut is made between each pair of channels, and so on for the following cuts. In this way errors likely to occur through local heating and distortion of the metal are avoided.

Fig. 5 represents the work in the position it occupies on the slot-cutting machine with the cutter just starting in at the end of the cylinder *B*. In cutting the channels, they are not milled through from end to end at the outset, but instead the cuts are first run up to about ¾ inch of the point where the cylinders abut against one another. It is absolutely essential that the channels in the two members shall match exactly and so the cutting of the portions of the channels across the joint between the cylinders is left until after all the 90 channels have been cut about to point *a*, Fig. 5. Then with a newly sharpened cutter the channels are cut across the joint as at *b*, the work being indexed first for every fifth space as was done in cutting to *a*, and the intermediate channels then being extended across the joint. As before, the work is indexed five steps for each cut, and every precaution is taken to prevent inaccuracy in the matching of the slots of the two cylinders.

After the slots have all been milled across the joint, the remaining short portion indicated at *c* is cut, each slot being finished in turn, as there is no necessity in the case of the upper ends of the channels for taking the extra precautions observed in milling across the matching surfaces of the two cylinders.

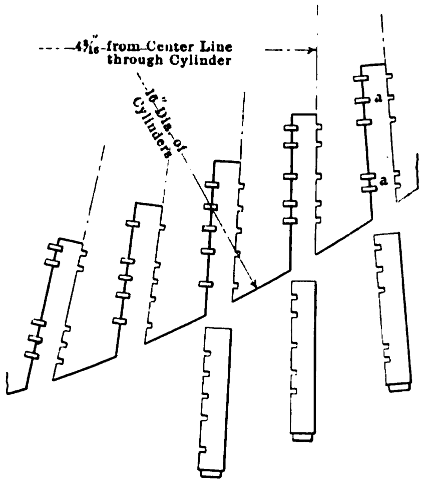

FIG. 3. PLAN OF PORTION OF MAGAZINE CYLINDER

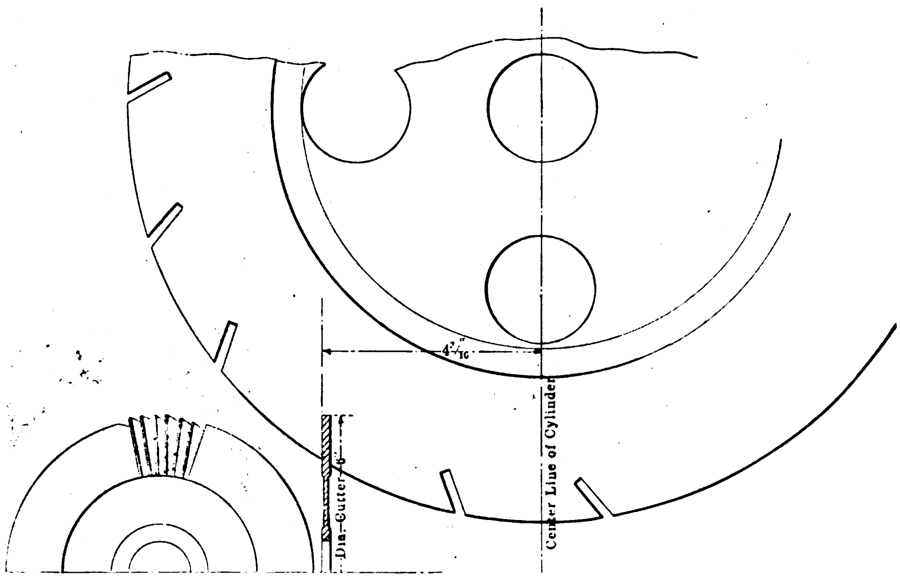

FIG. 4. THE WORK AND THE CUTTER

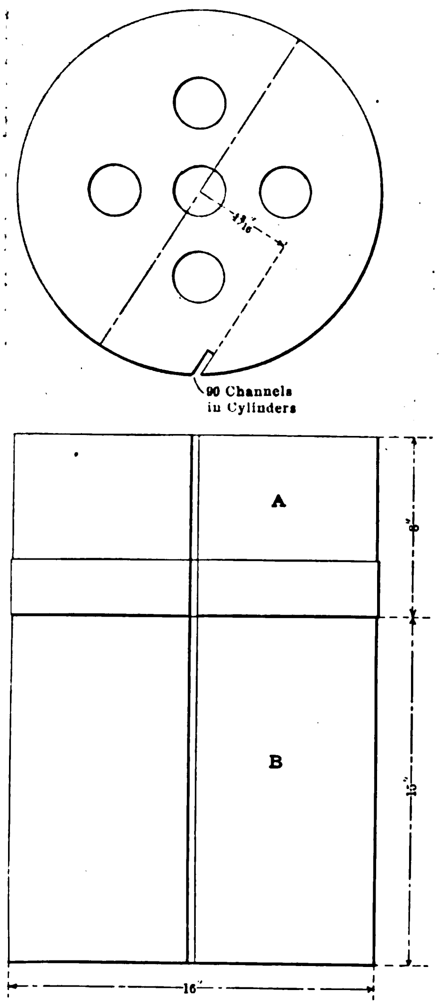

FIG. 2. CYLINDER PROPORTIONS

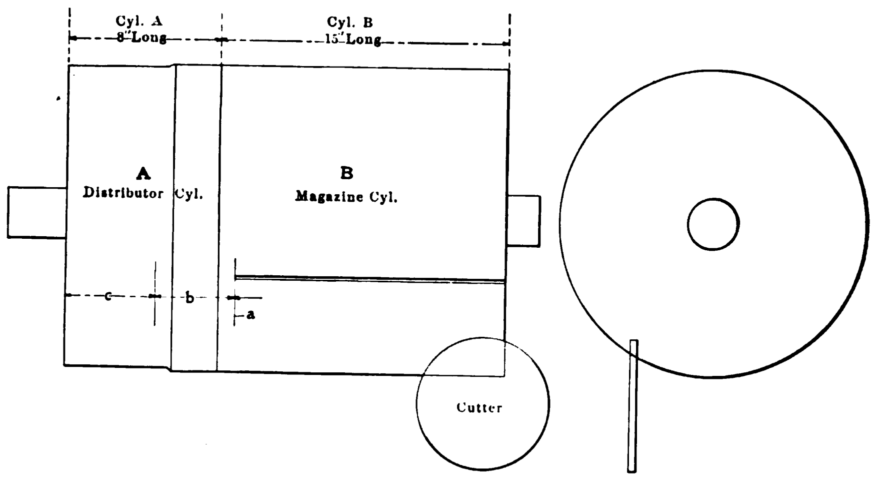

FIG. 5. CUTTING THE CHANNELS

The Index Wheel

Naturally the accuracy of the results obtained in the channel-cutting machines is dependent mainly upon the correctness of the index wheels. As the slots in the cylinders must match exactly in every one of the 90 positions which the upper cylinder assumes upon the lower when in operation, it will be seen that the index wheel must be very accurately constructed. Details of the wheel are given in Fig. 6.

As there represented, the rim of the wheel has 90 holes bored through to receive as many indexing plugs the shanks of which enter very freely in the holes. The plug bodies *A* for any given wheel are ground to exactly the same diameter, and this diameter and the diameter of the wheel surface at *B* are such that with all the 90 plugs in place, they just contact with one another and also with the surface *A*. The series of plugs thus exactly spaced form a ring of about 36 inches diameter. The screws *C* in the rim of the wheel hold the plug bodies against the seat at *B* and nuts like *D* secure them to the wheel rim. As shown by the dimensions given, the plug shanks have 1/32 inch freedom in the holes through the wheel rim, so that they in no way affect the location of the plugs.

Operation of the Wheel

The front ends of the plugs are slightly tapered, and fit a taper hole in a locking pin arranged to slide in a bearing at the right-hand side of the machine. The locking bolt is drawn back by hand after each cut, to release the index wheel and after the latter has been turned ahead the required distance the locking member is pressed back over the corresponding plug and the machine is then ready for the next channeling cut to be taken. After

FIG. 7. MILLING NARROW WARD SLOTS

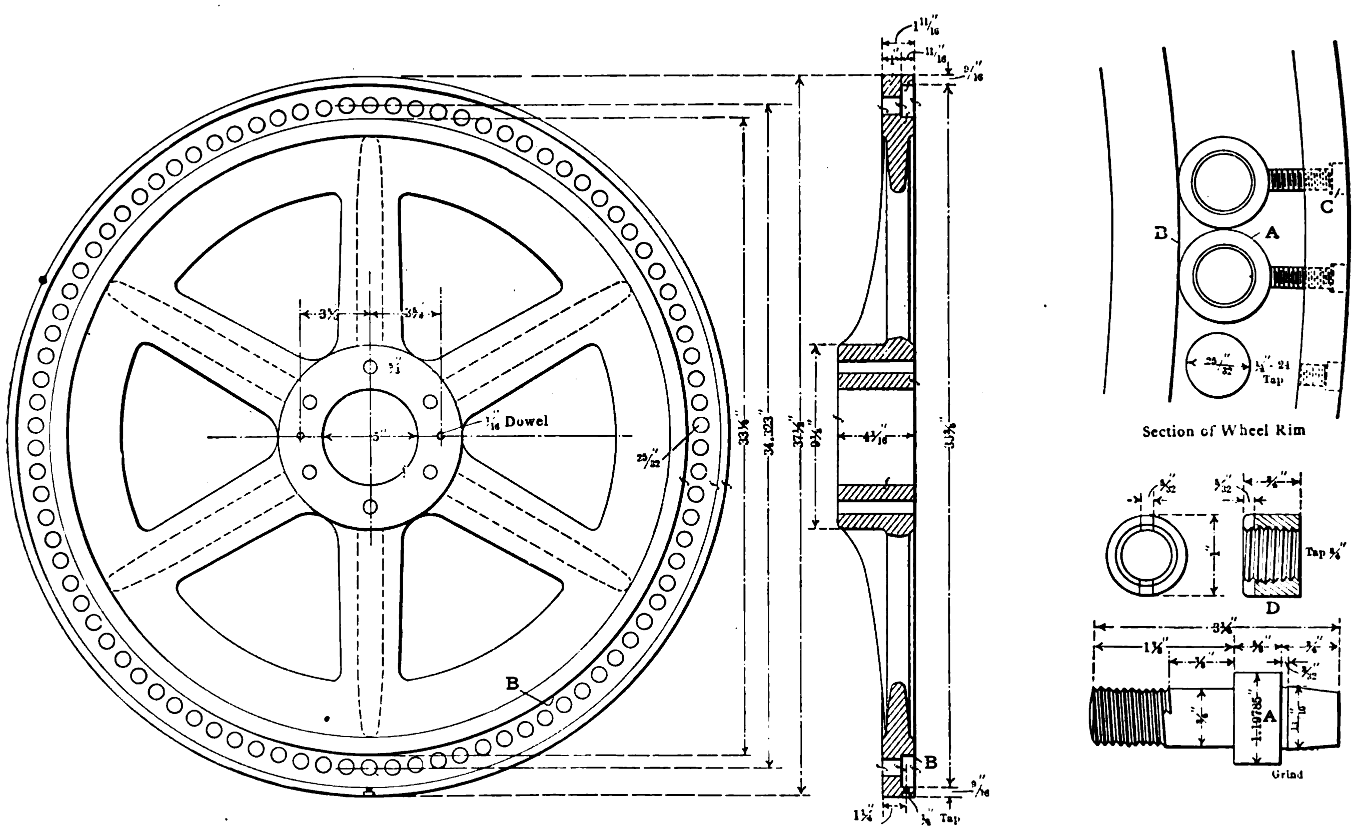

FIG. 6. INDEX WHEEL CONSTRUCTION

the indexing operation the cutter-slide feed is thrown into action and upon completing the forward stroke, it automatically reverses and returns the cutter slide at a rapid rate of speed.

Milling the Ward Slots

Reference has been made to the wards or steel ribs *a a* at the sides of the channels in the magazine cylinder, and in Fig. 3 some of the combinations in different slots are represented. The type sketched at the front of each slot is merely to show the corresponding notches in the edges of the type which permit any given character to drop from the distributor cylinder into its own channel in the magazine and into no other. The shallow notches in the cylinder channels directly opposite the wards, are merely clearance slots which the cutter forms in milling the ward grooves.

The wards themselves are set snugly in their slots and riveted slightly at the top to secure them in place. The method of cutting the slots to receive them is shown in Figs. 7 and 8.

The cylinder is mounted on a vertical spindle carrying two adjustable horizontal arms connected at the outer end by a vertical bar on which is a sliding-cutter head, the spindle of which is driven by a small, round belt. The cutter head has a flat steel guide which fits nicely in the channels milled in the cylinder and which forms a bearing for the body of the delicate T-slot cutter used for milling the ward slots. This cutter is just visible at the inner side of the guide in Fig. 8, and is more plainly seen in the sketch, Fig. 9. The diameter of the mill and its position in the guide are such that it will cut the ward slots to the required depth. The location of the cutter endwise to form the different slots in their right positions in the cylinder channel is determined by gage blocks which are placed between the supporting bearing on the cylinder spindle and a fixed block on the adjustable frame carrying the cutter head. The operator has a table giving the spacing for every series of notches in the cylinder and gages to give the corresponding settings, so that he readily adjusts the cutter-carrying frame in and out as required for the various combinations.

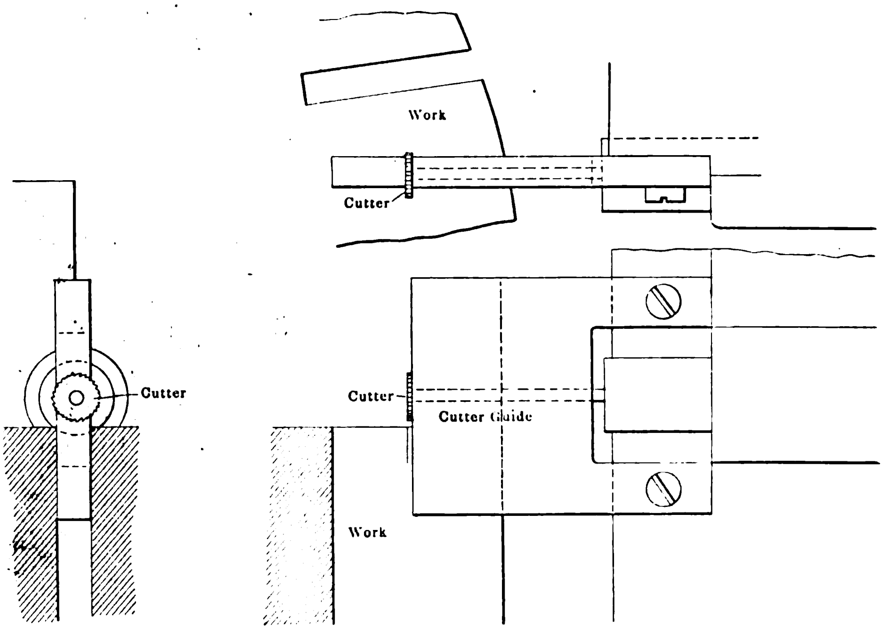

FIG. 9. ARRANGEMENT OF CUTTER AND GUIDE FOR MILLING WARD SLOTS

FIG. 8. MILLING NARROW WARD SLOTS

The cutter is about 3/16 inch diameter by 0.040 inch thick. The slot is cut approximately 1/16 inch deep. The cutter is driven at high speed and is easily fed down by hand during the delicate slot-milling operation.

F. A. S.

In a report recently submitted to the San Francisco Chamber of Commerce it is interesting to note that since the discovery of gold in Eldorado county by James Marshall in the year 1848 the State has produced gold value of $1,452,785,767. The record single year's production was in 1852 when the output reached the figure of $81,294,700. The years from 1850 to 1862 were the largest yielding ones during which period an average output of $55,000,000 was maintained annually.

The best all-round rock-drill steel (W. E. Kimber, *Journ.* Transvaal Inst. Mech. Eng., May, 1908) contains, according to the manufacturer's rating, 0.50 to 0.60 per cent. carbon, for this combines maximum toughness with a hard cutting edge. Milder and cheaper steel should be used for the shanks since it is cheaper, welds up to the cruciform easier, and is less liable to crystallize and break.