THE CONSTRUCTION OF THE TYPE-SETTING MACHINE.

Journalism in its present state of progress, which has been wonderful during the past few years, necessitates diligent study and inquiry into the many improvements being introduced into the mechanical departments of the many large publications, in order that one may understand how his writings may be reproduced into a printed surface. In the university we can promote the foundation of journalism, but in the newspaper office we are required to have a practical knowledge of the general operations necessary to produce a paper. It is possible that a number of those in the journalism class will be called upon to fill the position of managing editor for some large daily, and in this case a thorough knowledge of machine composition will be of great value to them. It is not the writer's aim however to dwell upon journalism as an authority on that subject, but to confine his article to the mechanical progress in the composition of the newspaper.

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Our first knowledge of a practical type-setting machine was given to us by Mr. Ottmar Mergenthaler, a German, who founded the principle of a solid line of type, body and face, which was patented in 1874, and since then his machine has undergone a wonderful amount of improvement. The machine has been recognized by the highest authorities in engineering and mechanics, as one of the wonders of mechanical achievment in this century. The machine cannot be correctly called a type-setting machine, as it is a matrix assembling device. Instead of producing single type of the type foundry class, it delivers type metal bars or slugs, each complete in one piece and having on the upper surface, properly justified, the type characters to print a line. These slugs present the appearance of composed lines of type and serve the same purpose. For this reason they are called "linotypes."

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The linotypes are produced and assembled automatically in a galley, side by side, in proper order, so that they constitute a "form", answering the same purposes and used in the same manner as the ordinary forms consisting of foundry types. After being used, the linotype forms, instead of being distributed at a great expense as is the ordinary type, they are simply thrown into the melting pot and recast into "pigs" or "bricks" to be used in the machine again, the only loss of metal being by evaporation which is very small.

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The machine contains, as its fundamental elements, several hundred single brass matrices. These consist of a flat plate having in one edge a female letter, or matrix proper, and in the upper end a series of small teeth used for selecting and distributing the matrices to the proper places in the different channels of the magazine in which they are contained. A number of these matrices are found in the several channels in fact a complete set of small and capital letters, including punctiuation marks and figures. The machine is so constructed that upon depression of the finger keys, similar to a typewriter, it will assemble the characters according to the finger key depressed, in a line with wedge shaped spaces or justifying bars between the words. This composed line forms a line of female type, adapted to produce a line of raised printing surface on a slug which is cast into or against the matrix characters. After the matrix line is composed as above, it is automatically delivered to the face of a mold of the desired size to be set, the line is then thoroughly justified by the wedge-shaped spaces or justifying bars, molten metal is then forced into the matrix line by a plunger action in a pot directly behind the mold, at a temperature of about 285 degrees Centigrade. This metal immediately solidifies in the mold and forms a line of printing type corresponding to the matrix line.

The matrices having served their purpose are carried back to the magazine and stored in their separate channels to be used over again at the will of the operator.

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The next machine of any importance in the matrix forming machine is called the Lanston Monotype, and is the invention of Talbert Lanston of Washington, D. C. Mr. Lanston received the "Elliott Cresson gold medal" from the Franklin institute in honor of his wonderful machine.

In designing this machine the inventor had an object in view to produce individual types, set in lines of equal length, ready to be formed into columns and locked into chases, for use as a printing surface. Instead of setting previously prepared type, as in the old type-setting machine, he selected a process of casting types in order of their use, and of setting type into justified lines, and the lines into a column, to be subsequently separated into pages by hand.

The greatest difficulty encountered in all type-setting machines, is the problem of justification of the lines. This problem has been solved in this machine, by making the word-spaces types of a variable thickness, after first determining, by an ingenuous plan, the thickness of the word-spaces requisite to make each line of the proper length. This determination must of course, precede the casting of the line, and was presumably the initial reason for dividing the process of type-setting into two operations, each of which is performed on a separate machine.

The first of these machines is in some respects similiar to a type writer, but instead of printing common letters, it is constructed to perforate a ribbon of paper, the locations of the perforations determining, Jacquard-loom fashion, the characters which the operator puts into it. For each character two holes are punched through the ribbon which has previously been provided with two rows of marginal holes that act as racks by means of which the ribbon is advanced with the necessary regularity.

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The keyboard is of rectangular form, the keys being arranged in series of horizontal and verticle lines, and the characters are divided into as many groups as there are verticle lines on the keyboard; those requiring the least spaces being placed in the first group, the next largest ones into the second group, and so on. To the first group is assigned a space of five units, to the second one of six units, and so forth. By the depression of each key, two holes are punched into the paper ribbon, in line with the marginal holes forming the rack. These punched holes record the location of the character on the keyboard, one hole recording the number of vertical and the other that of the horizontal row of keys containing the letter struck. At the same time a mechanism is set into motion by the depression of each key for the object of measuring and indicating the space occupied by the accumulating letters. This mechanism is advanced by the depression of each key, by a number of units of space occupied by the type, and this advance is indicated by an index hand. For each word-space the minimum number of units admissible for this spacing is registered on this mechanism. When the index shows to the operator that the accumulating types would fill a line so far that no additional syllable can be added, it shows precisely how much space is regulated to fill the line. This space is distributed among the word-spaces, the number of which is indicated on a dial, by finding the addendum required to fill the deficiency. The requisite division is accomplished, mechanically, by means of a table attached to the index, and the resulting quotient is recorded at the end of each line on the paper ribbon.

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While a copy is thus punched, the ribbon is wound upon a spool, and, when placed in the type-making machine, it will enter that machine with the end of the copy formost, passing into it in a reversed direction.

The matrices of the type-making machine are located on a rectangular plate, in two sets of rows, intersecting each other at right angles, in precisely the same order in which the characters are placer on the keyboard of the first machine. At every stroke of the machine this plate is caused to make a reciprocating movement in both directions, and each of these movements is so regulated that on the return stroke, the movement is so limited that the desired matrix will be placed centrally over the mold in which the type is to be cast. To accomplish this a number of stops is provided in the path of each of the two movements, which are operated by compressed air admitted to the corresponding pistons through channels which are closed by the paper ribbon, except when this ribbon is perforated. The location of the perforations determines which of the stops is to be brought into operation, and thus commands the position in which the plate of matrices is retained immediately before the type is cast. By means of a wedge the movement of the plates regulates the variable width of the type-maker to correspond with the width of the character. The paper ribbon entering the type-maker machine in a reverse direction, the record of the justifying addendum will precede each line. By a pneumatic device the record is caused to adjust a wedge, which regulates the width of the mold for each word-space occuring on the line, by this means the proper length of the line is assured.

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After the matrix plate has been arrested in that position, which will place the required character directly over the type mold, the matrix is more correctly centered than the pneumatic stops are able to do, by means of a taper plug entering into one of the conical centering holes which are located on the reverse side of the matrix plate, one opposite each matrix, and the molten metal is injected into the mold. After congealing the jet is cut off, the mold is opened, and the finished type is transferred, by an ingenuous mechanism to the galley, where it collects in the form of a column, and whence it is taken by hand to be made up into forms.

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The rapidity of the ribbon punching machine depends on the skill of the operator; but since the number of punching machines need not correspond with that of the type-casting machines, the rapidity with which the former machine is used has no direct bearing on that of the machine proper. An expert operator can easily furnish ribbon in excess of the capacity of the type casting machine. It is, indeed, contemplated to have the writers use the punching machine to enable them to turn in copy on paper ribbons, ready for the type-casting machine. The separation of the process of making ribbon copy and casting the type has obviously marked advantages.

The latter machine runs at a speed of about 110 strokes per minute. With the exception of a few strokes at the beginning of each line, each stroke produces type. The capacity of the machine is stated to be between 4,000 and 4,500 ems per hour, and this capacity is self-evidently independent of the skill of the operator, whose function is that of producing the ribbons.

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Matter set up by this machine has the important advantage of admitting of subsequent corrections and alterations, being fully equivalent in this respect to matter set up by hand. This machine casts perfect type in the ordinary sense of the word, which can be used in the finest magazine and book work.

After the matter set up by this machine has been used, it may be remelted, or the type may be distributed and used in the ordinary way for hand work. The waste product of the machine can thus be advantageously utilized.

The monotype is considered the machine of the future for all classes of composition covering news and book publishing. Book publishers are looking forward to adapting the monotype in preference to any other make of machine.

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Besides the matrix forming machines there are several varieties of type-setting machines that set the foundry types direct and do not make their own type. Among them are the Thorne, and the Empire machines which are about the only two up to the present time that are worth mention. The Empire is manufactured by the Empire type-setting Machine company, New York, and consists of a composing machine for composing the lines which come from the machine in long lines and have to be justified by hand, whence they have to be taken to a separate machine for distribution. It usually takes three persons for the operation of the composing and distributing machines, and the cost of labor prevents a very large field for this machine.

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The Thorne is also a direct type-setting machine using foundry types and entailing cost of separate distribution which prevents it from producing the amount of type that the Monotpe or linotpe can. There are many kinds of cheap composing devices which have not demonstrated their practibility up to the present date. It is a battle between the two machines mentioned until some inventive geuious, outwits their constructors and places a more rapid device upon the market.

A. W. COCHRAN.

PICK UPS.

These college men are very slow,
They seem to take their ease,
For even when they graduate,
They do it by degrees.

Jones—How is your boy doing at college? Brown—Splendid! getting high marks; first time he came home he had a pin with '99 on it.

The university luncheon room is growing in popularity everyday. If you have not tried it, do so the first time you are rushed.

A Signal to kick—No Thanksgiving recess—Cornell Widow.

If there is any one who should be "rapped in slumber," it is the man who snores.

Have your tonsorial work done at Westerfield's. You will get the latest style of hair cut there.

"Tommy, who was Joan of Arc?" asked the teacher. "Noah's wife," said Tommy, who is considered great at guessing.

ways on hand at the Smith Premier office, room 30 Bonnell block. Telephone 439.

A young man who once swallowed a drachm
Of poison from eating a ham,
When to him they said,
"It will kill you quite dead,"
He replied, "Well, I don't give a dachm."
—Princeton Tiger.