

point and called by numerical names: pica became 12-point; long primer, 10-point; brevier, 8-point; nonpareil, 6-point, etc. The present article is set in 8-point leaded.

THE AUTOPLATE.

In the SCIENTIFIC AMERICAN SUPPLEMENT for October 26, 1901, we had occasion to illustrate and describe a machine for making and finishing curved stereotype printing plates for use in printing newspapers, which had been but recently invented by Mr. H. A. Wise Wood, of New York, and first put into use upon the New York Herald.

It will be recalled that this machine—the autoplate—after a flexible papier maché matrix, made from a type page, is inserted therein, proceeds to cast printing plates, weighing about fifty pounds each, at the rate of four a minute, and to dress their edges and inner surfaces and prepare them for attachment to the printing cylinders, and that this is done automatically—all within the compass of one machine.

Previous to the advent of the autoplate such work had been invariably done by hand-worked devices, with which the fastest rate of production attainable was at the rate of slightly less than one plate per minute.

So great a change did this invention make in the work of stereotyping upon the larger newspapers, that not only was the machine generally adopted by the New York Herald, New York World, New York Times, Brooklyn Daily Eagle, Philadelphia Bulletin, Philadelphia Telegraph, Boston Post, Boston Globe, Chicago Tribune, and other papers, but in every case the hand apparatus were entirely dispensed with, and sole dependence placed upon the autoplate.

It will doubtless seem strange that so great a stride in so important an art should have been delayed until the very last year of the old century; but it was nevertheless the case that until Mr. Wood's machine came full-fledged into the stereotype room, not a single automatic device of any kind had been used therein for the production, or even for the finishing, of plates. How much such a device was needed may be realized when it is known that for the larger newspapers the saving in operating expense by means of the autoplate approximates \$500 to \$700 weekly; that its product in clearness of types and in beauty of illustrations far surpasses hand work; and that by reason of its celerity it is not only possible to hold pages open longer, and thus to print later news, but successive presses may be set running so much more quickly as to greatly increase the capacity of any given printing plant. So great is the last-mentioned benefit, that for an issue of a given size from one to two presses less need be run where autoplates are used; and even into the mailing and delivery room has the saving gone, for by reason of its now being possible to finish the printing of an issue earlier than formerly, much more time is left for the all-important work of distribution.

STEREOTYPING AND ELECTROTYPING.

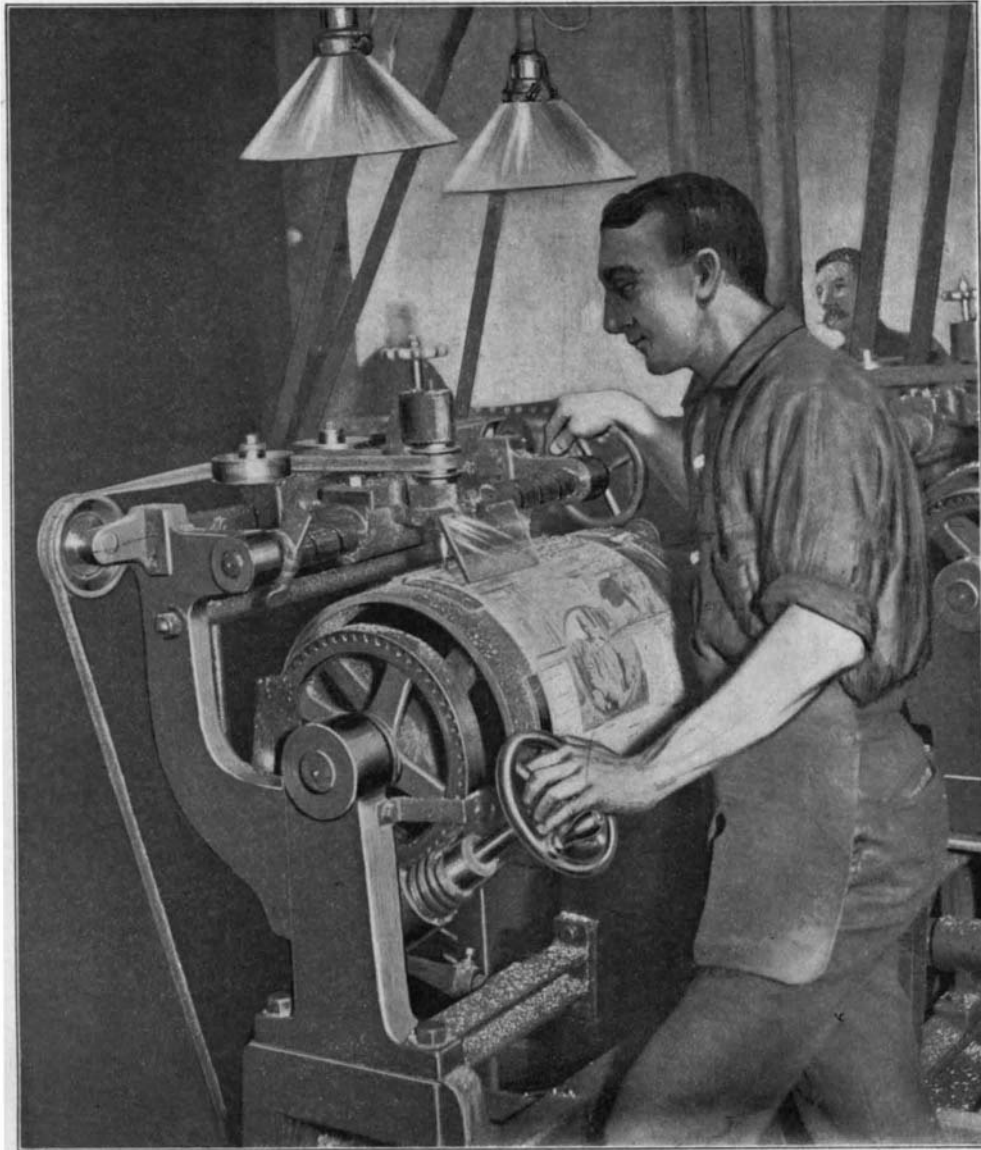
The development of book and newspaper printing has been aided to an extraordinary degree by stereotyping and electrotyping. The stereotype plates or the matrices can be stored for future use at low expense and the type can

be distributed and used anew. It was made practical by Earl Stanhope about 1804, and was introduced into New York in 1813. The plaster and clay processes were superseded in 1829 by the papier-maché process, in which a mold is taken on prepared paper, which is baked and which can then be curved, if necessary. Periodicals, other than dailies, and books are usually printed from electrotypes, which

Original half-tone cuts are often soldered or cast in to insure good printing results.

MACHINE COMPOSITION.

The linotype machine, invented by Ottmar Mergenthaler, may safely be said to have revolutionized the publication of newspapers. The linotype does away entirely with the foundry type and goes back to first principles—the block book. It produces a slug the length of a line with the various characters cast upon one edge. These slugs are locked up in forms like ordinary type. The linotype consists of a bank of keys connected with a magazine containing about 1,500 brass matrices, which are smooth plates about an inch high and a half inch wide, and of varying thickness. On one edge is a die from which is cast the letter, and at the upper end a series of nicks or teeth for distributing purposes, every character possessing a different combination. There are also spaces, molds, etc. The magazine containing the matrices is an inclined receptacle 2 feet 6 inches high, the top being 6 feet from the floor. Within this magazine are channels in which the matrices with the different letters are stored and through which they pass. The machine is so adjusted that as the type bar is manipulated, the matrices are selected in the order in which they are to appear in the slug or casting. When the operator depresses a key, the matrix to which it corresponds emerges from its channel, is caught upon an inclined traveling belt, and is then carried to the assembler, which corresponds to the ordinary printer's stick. As each word is completed, a stroke of the space key inserts the wedge-shaped space used between each two words. When the line is completed, the operator can correct errors by extracting matrices or substituting others for those which are in the line. The wedge-shaped spaces are now pushed up through the line, securing instantaneous and complete justification. The completed line is then transferred automatically to

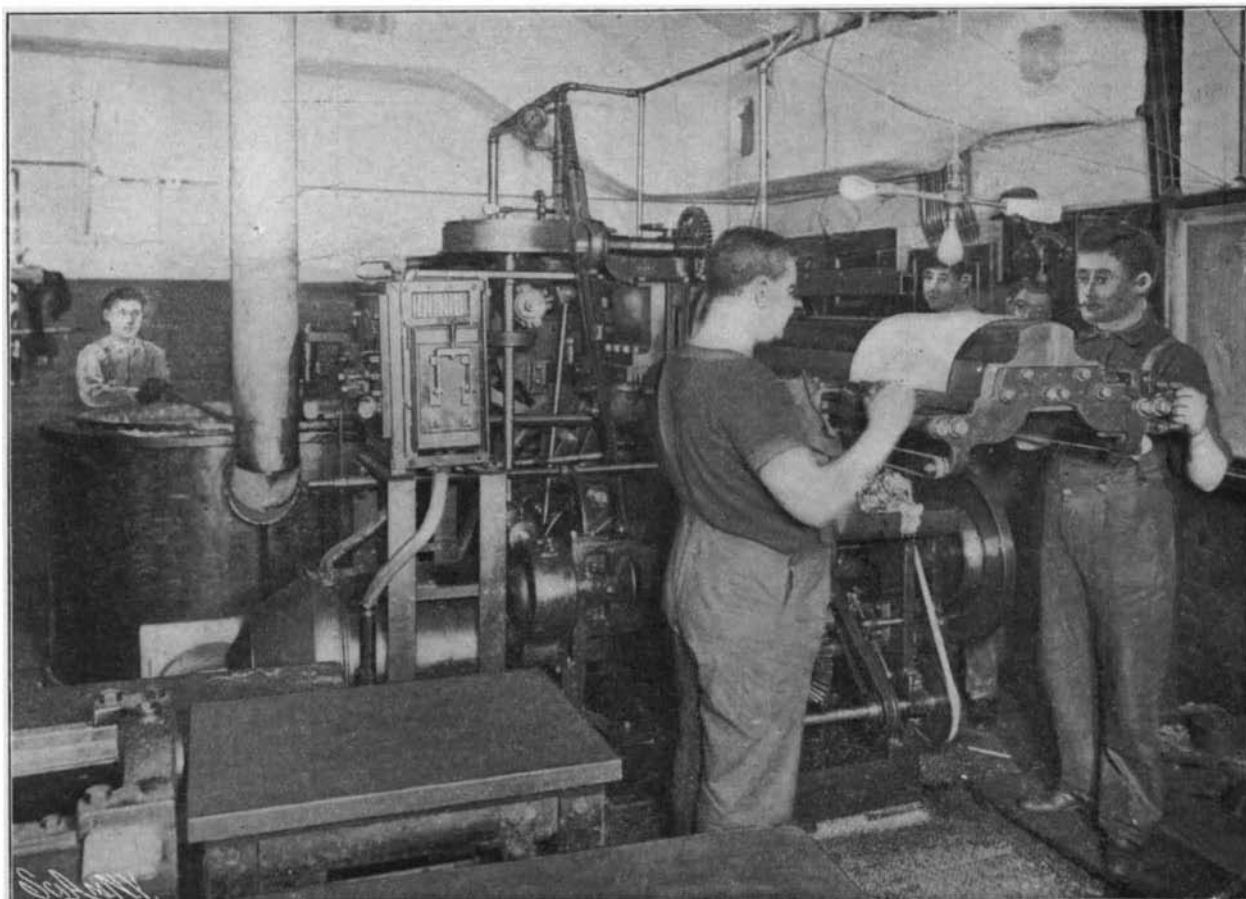


ROUTING CURVED STEREOTYPE PLATES.

process was tried experimentally in New York in 1841 by Prof. Mapes. An impression is taken in specially prepared wax, and the mold is blacklead to insure electrical contact. It is then placed in a plating bath and a shell of copper is deposited. This is stripped from the mold, curved if necessary, the back is tinned, and an alloy resembling type metal is then poured over it, to give it strength. The electrotype is then planed so that it will be type-high when blocked.

the front of a mold. Behind the mold is a melting pot containing a molten alloy resembling type metal. Within the pot is a pump plunger leading to a perforated mouth arranged to close the rear of the mold. When the matrix line is in position, the automatic operation of the plunger forces the metal into the mold and against the line of the matrix letters, where it instantly solidifies in the form of a slug. The mold wheel then makes a partial revolution which brings

the mold in front of a blade which pushes the slug into a receiving galley. The slugs are type high and can be used in connection with ordinary type. The matrices are automatically returned to the magazine to be utilized in making new combinations. A change of face is easily effected by changing the matrices. By the aid of the new double-magazine linotype which we illustrated in the SCIENTIFIC AMERICAN for August 8, 1903, it is possible to set work in two faces of type, so that we can now set body letters, italics and full-face type on the same machine, changes being made instantaneously. Heretofore the type known as pica, or 12-point, has been the largest face of type which could be set on the machine; but it is now possible to make letters twice the size by casting one half of the character on one slug and the other half on a



THE AUTOPLATE CASTS FOUR 50-POUND STEREOTYPES A MINUTE.—SAVES \$500 A WEEK IN OPERATING EXPENSES AND ENABLES PAGES TO BE KEPT OPEN LONGER.

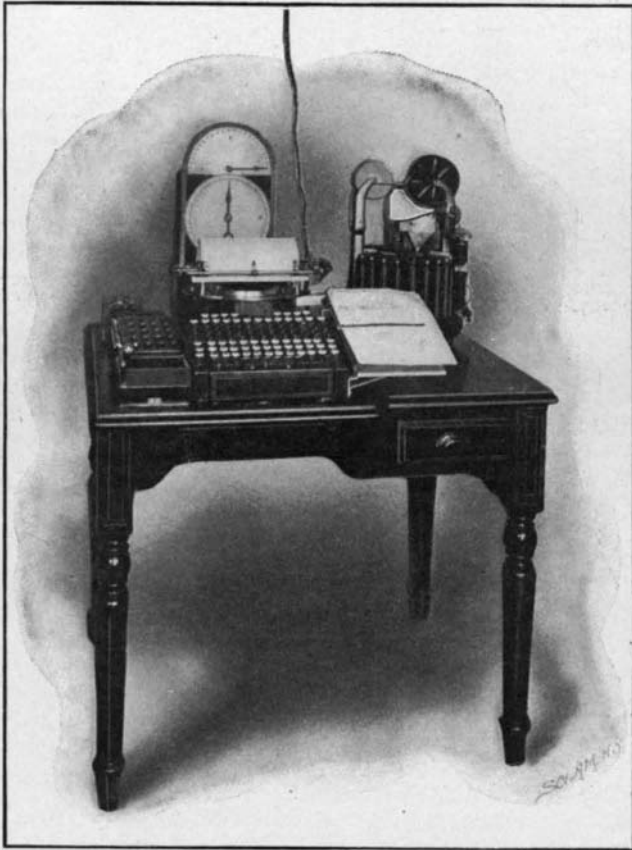
second slug. So accurate is the machine that not even an expert will notice the difference between a proof from the two slugs and from a foundry type.

The average product of a good operator is 4,000 ems per hour, the measurement of type being based on the width of the character "m." Many operators, however, can set from 5,000 to 6,000 ems per hour and a speed of 13,000 is on record. About 1,000 new machines are put in operation each year, and they are in general use in the large newspaper offices in the United States, and are also largely used in Europe. The Lanston monotype machine has already been illustrated in the SUPPLEMENT, No. 1089, and the Dow composing machine in the issue of the SCIENTIFIC AMERICAN No. 3, vol. lxxxv. The Goodson graphotype is described below.

THE GRAPHOTYPE.

The use of electricity in individual type-casting and composing machines originated with the "Graphotype;" and the reader bearing in mind that there is no known power-producing agent that performs its work with such quickness so easily as electricity, can more readily understand why the graphotype can produce its work in such a small space and with such rapidity. Throughout the entire machine, wherever it is possible, instead of using heavy, cumbersome levers, cams, or other means of conveying power, the graphotype uses small wire cables, which give the quickest results. The work is produced in two operations. The first is done on the keyboard or composing machine, which makes perforations in paper tape that represent the characters or spaces struck by the operator; and when run through the second operation or casting machine, produces the type.

The keyboard is the part of the machine consisting of a typewriter electrically connected with perforating device and the counting or adding mechanism, all mounted on a neat table or stand to which is connected an ordinary flexible wire through which is fed a direct current at 110 volts. The typewriter is used to give a written copy as well as act as a keyboard for sending the message to the perforator device and counting mechanism. By actual use it is found that a typewritten copy is of great aid to the operator in case of interruption or tabulated work, as it enables him to see exactly what is done and what key has been struck last without looking at the tape or matrices, as in other machines. The perforator is a group of magnets, each of which is connected with a key or keys on the typewriter and operates small levers, which in turn operate the punches that perforate the paper, which, when taken to the caster after being automatically wound on a spool, produces from the perforations the exact character or space struck by the operator. The counting mechanism is nothing but a simple adjustable adding machine, with two dials one above the other (that can be set for any length of line within the scope of the machine), to notify the operator when the line is full and automatically give the justification, which is determined from the hand on the upper dial, this being set in motion when the line approaches completion. A strong feature in this machine is that, when the operator makes an error in a line, which often occurs on account of poor copy, interruptions, etc., he can, by pressing a certain key, make the casting machine automatically skip that line and begin where he wishes. The keyboard occupies about as much space and weighs about as much as a small typewriter desk, uses an ordinary manila paper about one inch wide, which requires no other preparation than to be cut in rolls of the required width, the feed or spur holes being cut as it passes through the perforator. The table can be moved around and used anywhere that the wires can be reached without being fastened in any way to the

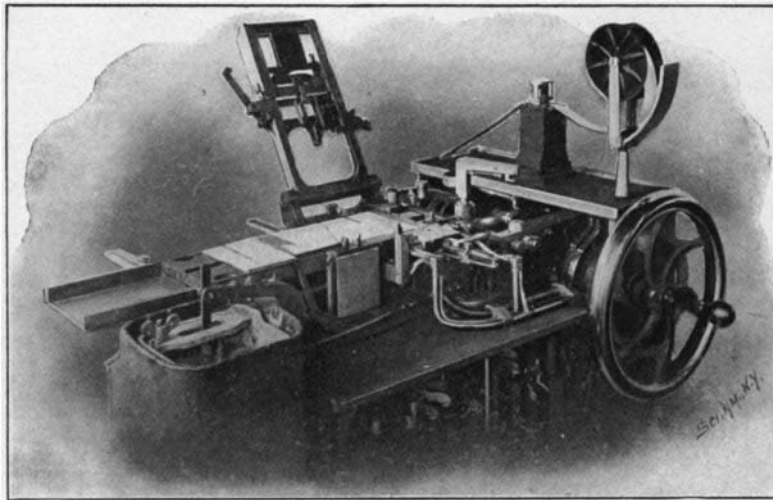


GRAPHOTYPE KEYBOARD.

floor. The illustration shows this machine ready for use. The caster is a small machine composed of the matrix, mold, metal pot, justifier, index head, and a number of magnets and a few cams and levers neatly

mounted on an iron frame and driven by its own 1-6-horsepower motor. The paper tape is taken from the keyboard and passed through the index head, which has a number of index pins, each one of which drops through the proper perforation when it comes to it, making an electrical contact that transmits the cur-

rent over a cable to a magnet or magnets, which operate pins that locate the matrix over the mold in the proper position for casting the character or space required, and at the same time set the mold for the size of the character or space called for. The mold

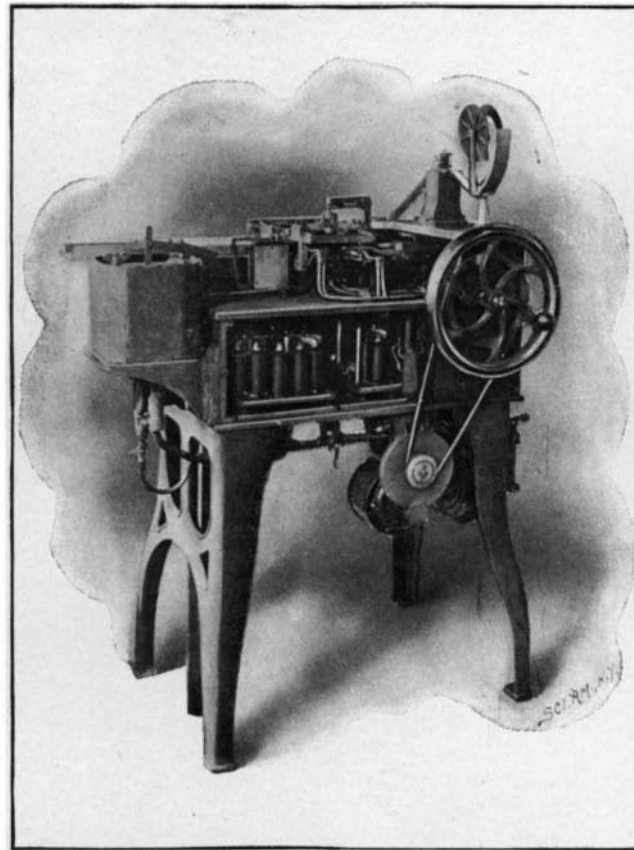


DETAIL VIEW OF CASTER WITH MATRIX UP.

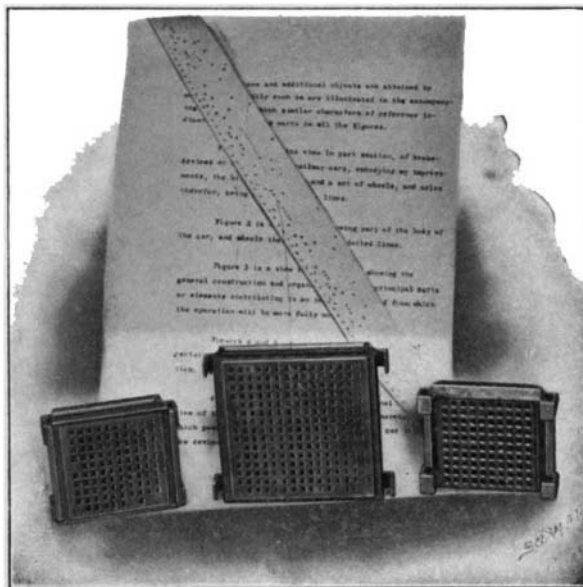
and the matrix are then brought together, and a pump, which rests in the melting pot, is set in motion, forcing the metal through a small tube over a foot long into the mold, filling out the character or space in the matrix. The type being instantly chilled, the mold and matrix then separate, and the type is ejected into a slot. This operation is repeated until the line becomes the proper length, then this is moved forward into a galley; after this operation the type is handled in the ordinary way. The machine will set any size from 5½ to and including 12 point. In the caster there are many things that differ from all other machines. The tube through which the metal is conveyed from the melting pot to the mold is electrically heated, which enables the operator to regulate, by a rheostat, the temperature of the metal as it is delivered into the mold. It makes no difference what the condition of the metal in the pot is, as long as it is molten, the proper temperature is imparted to it as it passes through this tube. It obviates all trouble arising from the irregularities in gas pressure and change in temperature, caused by putting fresh pigs or type in the pot. The mold is water-jacketed in such a way as to insure the cooling of the largest type instantly.

The matrix, which is practically indestructible, is made by a new process, which enables the company to make them at a phenomenally low price. It is as hard as steel, and at the same time not brittle enough to break. There are no knives or cutting edges in the mold to get dull, as the type is cast in such a peculiar way as to leave no gate or tail on the type. This feature alone makes the caster a very clean machine. The metal pot being such a long distance from the working parts, keeps the machine cool, and the fumes of the molten metal away from the operator. The justifier is a very simple electrical switch, which sends the current to a mold-size regulating pin to give the proper size space called for in the tape. This machine occupies 2 x 3 feet floor space, and weighs about 650 pounds. The illustration shows the machine in running order. There are no pulleys or belts to connect with it, as all the power is brought through the conduit, which is fastened on the back legs of the machine. This machine is so adjusted as to auto-

matically stop on a line that is either a hair's space too long or short at the end of a tape, or an improper supply of metal. In fact, the machine is an automaton, that will cast, compose, and justify type. The detail engraving shows the matrix up, giving a view of the mold, type, and in fact nearly all the mechanical motions on the machine. The type has a very deep-cut face with deep counters or cups, which aid greatly in making plates and stereotypes and also keep the type from filling up when used directly on the press, and can be made either hard or soft by changing the properties of the metal. This deep-cut, sharp face is only obtained by using the new matrix process. As the type is made on the unit system and each type or space is a multiple of a certain part of a pica em, and only six different sizes are used, the corrections are easily made, as the compositor can readily determine the size of the space by sight, which nearly always does away with the changing of all spaces in the line whenever the rejustification is required; neither does he have to put it in a stick, and type used for corrections is made on the machine. This machine is owned and manufactured by the United States Graphotype Company, who have their main offices at 13-21 Park Row, New York. They also have an exhibit in New York, where a battery of eight machines has been running for over a year on commercial, book, magazine, and general work with very satisfactory results. This plan was adopted to give



GRAPHOTYPE CASTER.



TYPEWRITTEN SHEET, PERFORATED TAPE AND LARGE AND SMALL MATRICES.