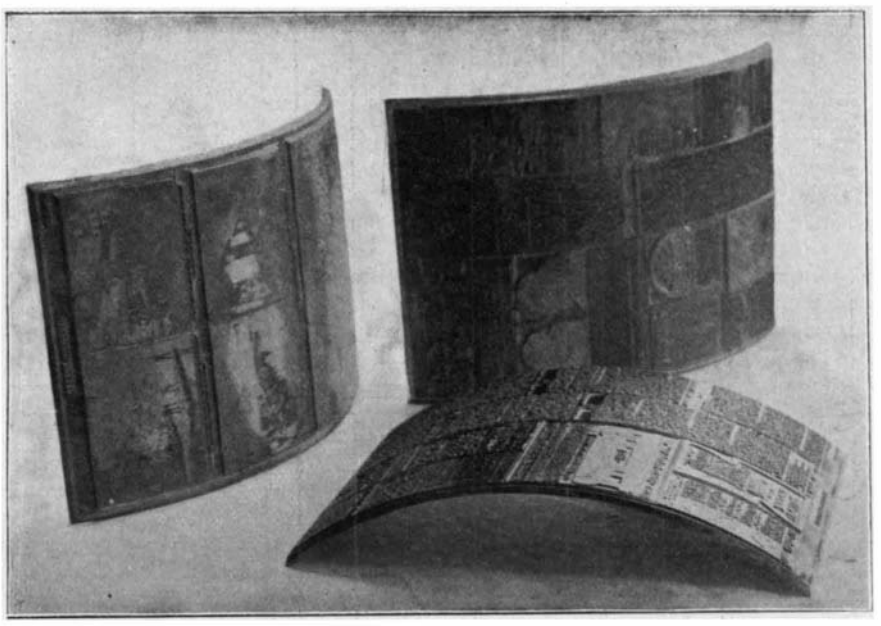


CURVED STEREOTYPE PLATES READY FOR THE PRESS.

THE MANUFACTURE OF PAPER AND PAPER PULP.

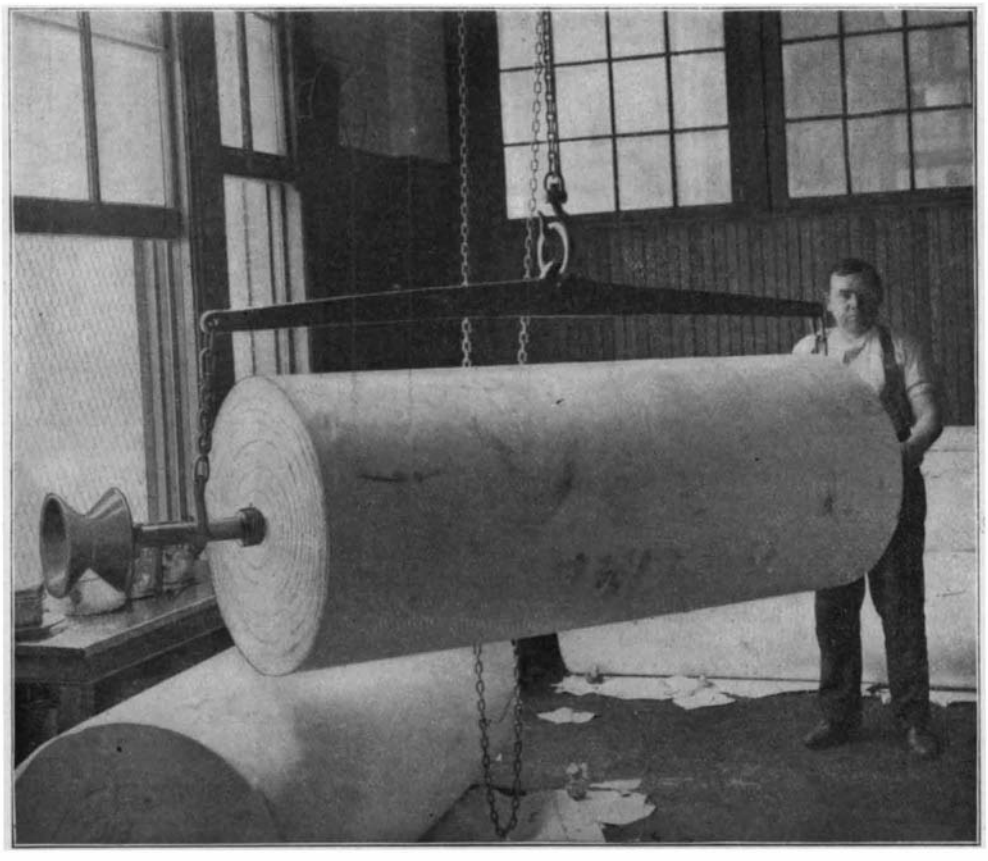
Improved methods in machinery and the great change in the character of materials used has had an important bearing upon the printing art. In the earliest mills established in this country, the raw fiber, after being prepared in the beating machine, was formed into a sheet in a mold or wire sieve which was dipped from the pulp vat by hand, the water drained off and the pulp left in a wet sheet in the mold. The sheets so made were turned out upon a felt press and then dried by exposing to the air in single sheets. Such mills were small and the output was limited. Strictly hand-made paper to-day is a rarity, although it exists. By the aid of the Fourdrinier machine the transformation of the fluid to stock or finished paper is made an automatic operation. The pulp is screened from the vat over an apron to a moving endless wire cloth made of closely woven fine brass wire, and supported by a series of small metal rolls set close together, yet without touching each other. In this way an even surface of the wire cloth is maintained; and by preserving an unvarying flow of the pulp and a constant forward motion of the wire cloth, the thickness of the layer of pulp deposited was kept uniform. By lateral motion of the supporting

FULL-PAGE PLATE OF A WEEKLY JOURNAL LOCKED UP IN A CHASE.

rolls the fibers are caused to interlace in various directions and give greater transverse strength to the texture. As the pulp is carried along on the wire cloth, much of the water drains through, leaving the fiber on the meshes. This first drying is usually hastened by various devices and the moist web is carried between rolls which are covered with woolen felt and then taken from the wire cloth on endless woolen felts which pass it between rolls and then to driers. These are large metal cylinders heated by steam. The paper has now acquired considerable strength. The water has been evaporated and the heated cylinders complete the drying process. The paper is then given a smooth surface by the calender rolls, which are smooth-faced heavy metal rollers. Finally the finished paper is reeled off in rolls and cut into sheets of the desired size. A large paper mill will make 250 tons of finished paper a day. The most modern machinery turns out a continuous web of finished paper at the rate of 500 feet a minute. The raw material of wood pulp is spruce, poplar, and in smaller quantities various other woods are employed. Wood pulp has to a great extent superseded the use of rags, and entirely so in the manufacture of news paper. The blocks of wood are pressed hydraulically against the edge of a rapidly revolving grindstone, and by attrition reduced to a mushy consistency.

There is also a chemical process of making wood pulp which is largely used. The merchantable shape of the fiber differs somewhat. Ground wood pulp is ordinarily sold in folded sheets only partially dry, and is, therefore, under common conditions, only suitable for use near the locality of its manufacture, its weight being so increased by the water as to preclude the profitable transportation of such a low-priced product. There are 763 paper-making plants in the United States and the total capital is $167,507,713, giving employment to 64,186 persons. The total cost of the materials used was $70,530,236, in 1900. The total value of the products was $127,326,162, and the total power required for running the plants was 764,847 horse power.

It has been estimated that nine novels had a total sale of 1,600,000 copies. This means 2,000,000 pounds of paper. We are assured by a manufacturer of paper that the average spruce tree yields a little less than half a cord of wood, which is equivalent to 500 pounds of paper. In other words, these nine novels swept away 4,000 trees. Is it any wonder that those interested in forestry look with anxiety upon the paper mill?



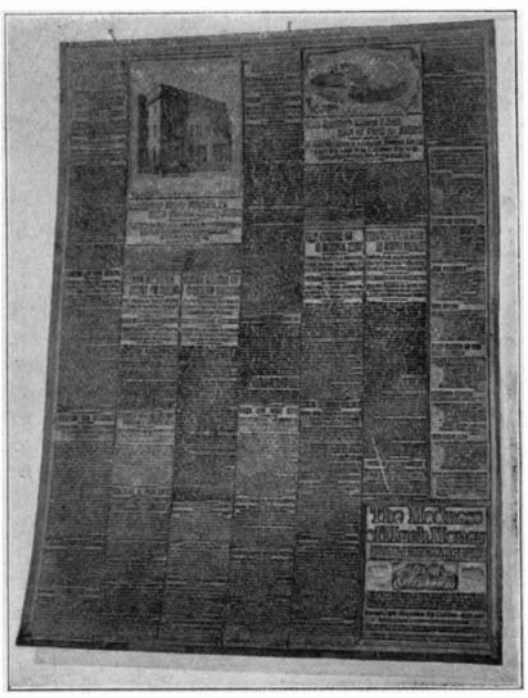
A ROLL OF PAPER 69 INCHES WIDE, READY FOR THE PRESS, OF ALL WEIGHTS FROM 700 TO 900 POUNDS. SUFFICIENT FOR 4,500 COPIES 24-PAGE PERIODICAL.

TYPE FOUNDING.

All early types were cast by hand one at a time, and the result was eminently satisfactory. Very large types are still cast in the same way. In 1822 a type-casting machine was introduced by David Bruce, and the changes in it were not very marked until the introduction of the Barth machine in 1888. A model for the punch cutter consists of a pencil sketch showing the letters 12 inches high. The drawing is reduced by a pantograph in the form of a model letter 3 inches high, with raised outline. An electrotype of this letter is then obtained and is fixed firmly upon the platform or table of the machine, beneath a tracing needle or index. To the head plate of this index are attached the four rods holding the cutting mechanism, which is at the top of the machine, and consists of a rapidly revolving borer, fixed in a stationary position and in a movable framework, in which is set the bar of steel or other metal which is to be cut. The leverage of the machine is capable of various adjustments, so that from the same model letter any body of type, from 2-point to 72-point, can be cut with equal facility and exactness.

The operator moves the index over the model letter on the platform, bearing down upon the lower parts and pressing against the sides of parts in high relief. The direction given to the index, at the will of the operator, upon the outlines of the model letter, is faithfully repeated by the tools cutting the punch. The cutting tools, of which two or three kinds are used in succession, are made with the utmost care. Being very highly tempered and being operated at very high speed, by steam power, they cut into the steel along the lines indicated by the movement of the guide over the model letter. The punches which are produced by this machine are finished in all points, requiring no hand work. Besides being produced more rapidly than those made by hand, these punches are more accurate, the counters are deeper, and the bevels are truer and always of uniform slope. This machine may be arranged to reproduce model letters in either direct or reverse order.

Where the punch is to be employed in making



MATRIX OF A PAGE OF A NEW YORK NEWSPAPER WAITING FOR THE AUTOPLATE TO STEREOTYPE IT.

matrices by the driving process, as is necessary for small characters, hard steel is used. The matrices for the larger characters are made from soft metal by the electrolytic process.

In the Barth type-casting machine, the half of the mold which carries the matrix is fixed immovably by a clamp in an upright position; the other half slides back and forth upon wide friction bearings, setting free the type that has just been cast and presenting again the mold mouthpiece to the nipple before the hot metal is injected for the next type. In order to prevent undue expansion of the mold, to get more accuracy in the type and to chill them quickly, a stream of cold water is carried in pipes through the fixed parts of the mold, and a current of air plays steadily on the matrix to keep it cool. The machine breaks off the gate, plows out the groove in the foot, removes the feather edges from the angles of each side, and delivers the types in serried rows upon sticks ready for the inspector.

At a meeting of the American Type Founders' Association in 1886, a committee was appointed to examine into and report upon the point system. There was some objection to the "pica" as a standard, but the majority of founders finally agreed to accept it as the basis of the point system. The twelfth part of a pica, called a point, was taken as a unit, and all bodies of type were placed on multiples of this

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.

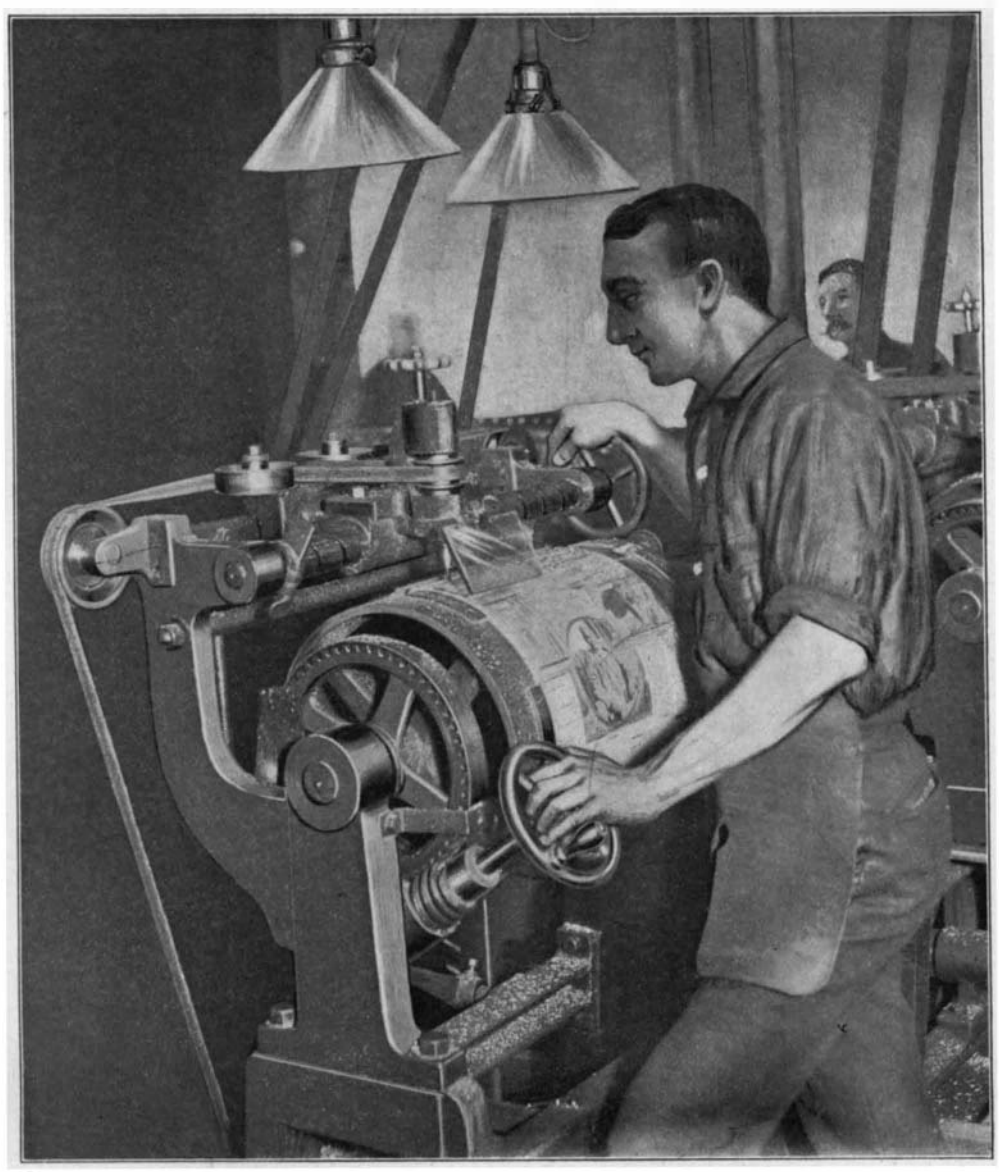
Previous to the advent of the autoplate such work had been invariably done by hand-worked devices, with which the fastest rate of production attainable was at the rate of slightly less than one plate per minute.

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.

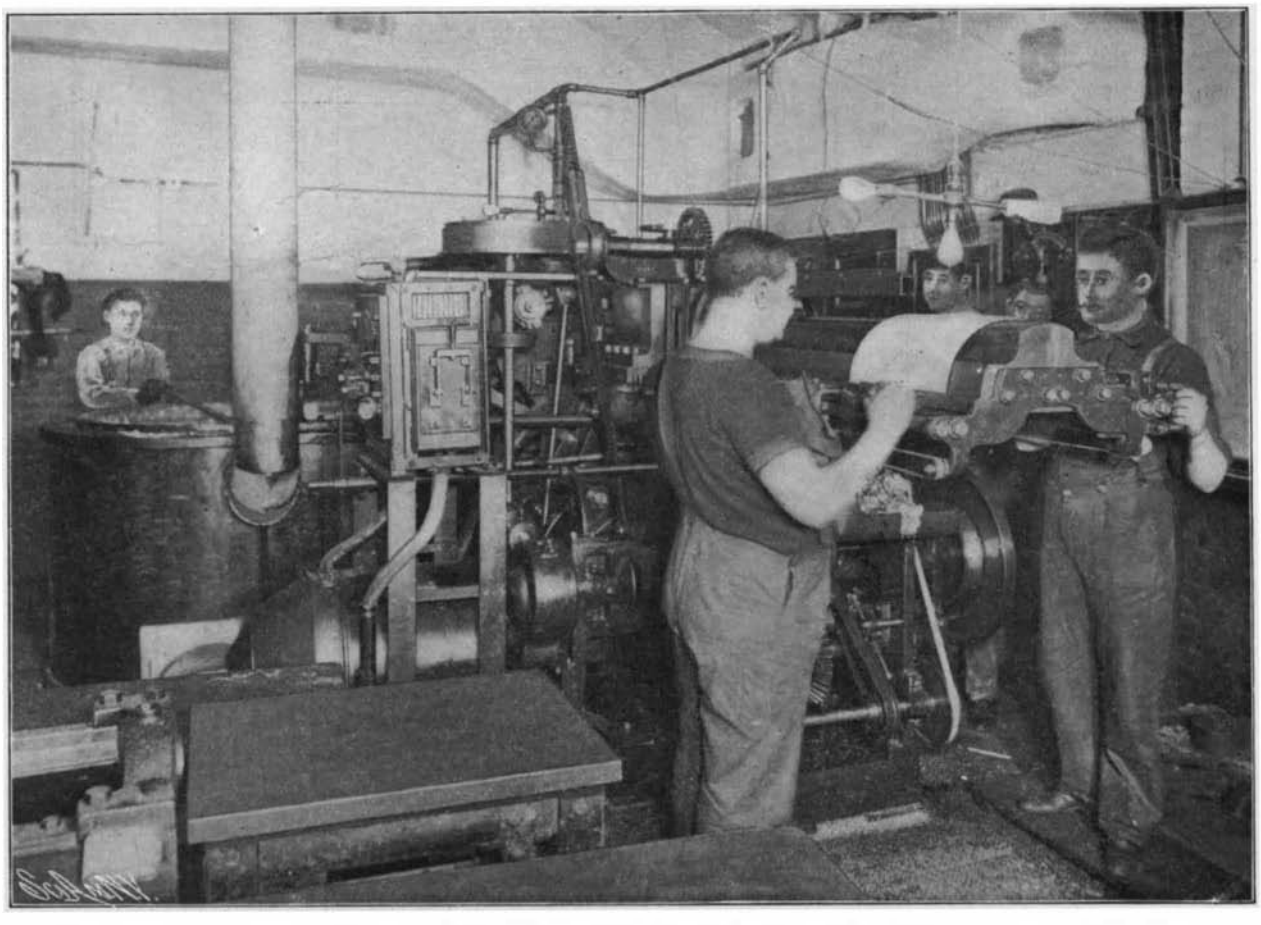
STEREOTYPING AND ELECTROTYPING.

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



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



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

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 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