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ELECTROTYPING AND STEREOTYPING

A PRIMER OF INFORMATION ABOUT
THE PROCESSES OF ELECTROTYPING
AND STEREOTYPING

PART I
ELECTROTYPING
BY HARRIS B. HATCH

PART II
STEREOTYPING
BY A. A. STEWART



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PART I
ELECTROTYPING

PART I. ELECTROTYPING

INTRODUCTORY

THE outlines on electrotyping given in this text-book are the practices of some of the best electrotypers in this country. There are, however, many variations in practices regarding electrotyping. While these variations are many times small and often not important, the users generally feel that they are in some way essential to the success in the particular shop where they are used. Because of these facts, and because the average printer does not familiarize himself with electrotyping, and as a rule knows but very little about the quality of an electrotype except as demonstrated on the press (and this is not always proof that the electrotype is bad, as the fault may be in the originals) and because but little is known regarding the equipment necessary and the different handlings which electrotypes go through in manufacture, the student is earnestly urged to familiarize himself by observation in the workrooms of electrotyping plants. The more familiar the student is with actual conditions connected with the allied trades the better position is he placed in when running a plant as foreman or superintendent, or operating a plant for himself.

ELECTROTYPING

CHAPTER I

History of Electrotyping Making

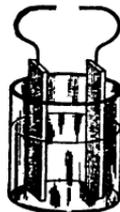
WHEN in 1799 Volta invented the galvanic battery, the foundation for electrotyping was laid. It was more than forty years, however, before any building was done upon this foundation.

Some thirty or more years after Volta's discovery it was discovered, probably more by accident than otherwise, that when copper was deposited upon the side of a Voltaic battery and removed it furnished a replica of the surface on which the copper was deposited. This gave the idea that a replica of a printing surface might be reproduced in copper.

It is a well-known fact that just previous to 1840 Thomas Spencer, of Liverpool, England, J. C. Jordan, of London, England, and Professor Jacobi, of St. Petersburg, Russia, were making experiments along this line.

It is not apparent that the first discoveries, which were wholly of a scientific nature, were taken notice of by the public or deemed of any commercial importance.

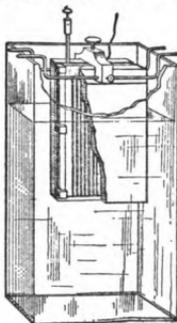
In 1839 Mr. Jos. A. Adams, a wood engraver of New York, connected with Harper & Brothers, experimented along this line with a wood cut and made an electrotype which was used in printing in Mape's Magazine in 1841. Adams was the first person to call the attention of any number of persons to his process. He employed it for making illustrations for Harper's Family Bible, issued between 1842 and 1844. His electrotypes were made by an impression being taken in an alloy of soft metal, bismuth probably being the chief ingredient. Making the impression, however, destroyed the wood cut, so that this method of making an electrotype was not a commercial possibility.



Simple Voltaic
Battery

2 HISTORY OF ELECTROTYPE MAKING

In 1840 Smee invented a battery which made electrotyping possible commercially. At practically the same time,



Smee Battery

a man by the name of Murray, of New York, was the first to use black lead or graphite in coating the surface of a mould made in beeswax for the purpose of depositing copper.

In 1841 Savage's dictionary showed several illustrations from electrotypes.

The first commercial electrotyper was John W. Wilcox, of Boston. Mr. Wilcox had been the foreman for Daniel Davis, a manufacturer of electrical instruments, and Mr. Davis had been doing some experimenting in electrotype making.

Mr. Wilcox was undoubtedly an exceptional man in his line, as it is said of him that a wood carver, by the name of Chandler, told him that if he could repeat what Adams of New York had done he would be certain of a business, and Mr. Chandler offered to lend him wood cuts for experimental purposes. Less than sixty days after this, in 1846, Mr. Wilcox had in use every essential principle known for the next twenty-five years in electrotyping. Mr. Wilcox's plant has passed through different hands and the business is now (1918) in existence in the city of Boston.

Mr. Wilcox's business was evidently a success from the start.

In 1855 Mr. John Gay, of New York, first used tin foil for the purpose of soldering the back of copper shells.

In 1855 a Mr. Adams of Brooklyn, N. Y., invented the dry brush black leading machine.

In 1856 Mr. Filmer, of Boston, invented a method of backing up electrotype shells by holding the shell down by springs.

Another type of dry brush black leader was invented by Henry Lovejoy and Robert Wheeler, of Brooklyn, N. Y., patented September 14, 1858.

In December 1868 Stephen D. Tucker, of New York,

developed and patented the type of dry brush black leader, which is in common use to-day; while in May, 1877 Edward A. Blake, of Chicago, was granted a patent for the first air-blast black-leading machine.

In 1871 Mr. Silas P. Knight, of Harper & Brothers, New York, invented the wet black leading process, and in 1872 took out another patent for an improvement on this process. Mr. Knight's method of wet black leading was evidently in advance of the times, as it was not adopted by the electrotypers and gradually became practically unknown.

Undoubtedly the cause of this was that the method of dry black leading was good enough for type work and wood cut work. The half-tone and zinc plate had not at that time been invented, and it was only after the invention of the half-tone that a better method of black leading became necessary.

Thirty-seven years after Mr. Knight had successfully used his process of wet black leading a patent was granted to Mr. Frank L. Learman, of Buffalo, N. Y., for a wet black leader. Since that time numerous patents have been taken out on different methods of using the wet process and to-day this process is universally recognized as the best method of graphiting the surface of a mould.

But little is known regarding improvements between the period of 1860 and 1870, but it is known that R. Hoe & Company, the printing press manufacturers of New York, became interested in making electrotype machinery and they were probably the first concern to put on the market the different machines used in electrotyping.

In 1870 Jos. A. Adams patented a process for covering the surface of the mould with powdered tin. This was for the purpose of quickening the deposit of copper, and from this undoubtedly came the oxidizing process of coating the surface of moulds, invented by Silas Knight, which has long been and is now in common use.

On April 19, 1870, Mr. Adams took out a patent for a case connection hook to obviate the necessity of coating the back of the case with wax.

4 HISTORY OF ELECTROTYPE MAKING

Perhaps one of the greatest forward steps in connection with electrotyping was made when the plating dynamo was invented. The first adoption of a dynamo, in place of the Smee type of battery, was by Leslie, of New York, in 1872. The firm of Lovejoy & Company, of the same city, put in a plating dynamo in the same year.

With the Smee type of battery from thirty to forty-eight hours were necessary in the depositing of a shell thick enough for commercial use. In addition to this, the fumes given off by the chemicals used in the battery made it necessary for the battery room to be separated from the rest of the plant. Workmen could remain in the room but a short time.

With the invention of the dynamo and its improvements the time of plating has been reduced so that now two hours is the common time that a mould is kept in the battery, and in extra rapid solutions it is possible to deposit a shell in thirty minutes' time. This quickening of the time of depositing copper is an essential feature in the developing of electrotyping.

From the first hand screw presses, which were successfully used for moulding electrotypes, to the modern high-power, motor-driven, hydraulic moulding press for moulding in either wax or lead, is a long step. Quite a long list of presses comes in between.

The invention of the half-tone, together with the invention of the modern two-revolution cylinder press, which brought printing into its present perfection, made necessary radical improvements in the machinery for making electrotypes. These improvements have been steady and at all times looking to the quickening and perfecting of making electrotype plates, although the fundamental points of the process are practically those which have been in use for many years.

The reader is referred to Lockwood's American Dictionary of Printing and Bookmaking and to Ringwalt's Encyclopedia of Printing for many facts regarding the history of electrotyping.

CHAPTER II

The Moulding Compound

AN electrotype is a facsimile, or duplicate, printing plate made from an original. The original may be type, wood-cut, zinc or copper etchings, such as line cuts or half-tones, or any material which will give a printing surface.

We commonly think of electrotypes as printing plates made of copper, but as electrotyping or electroplating is the electro-chemical depositing of metal, any metal that can be electro-chemically deposited may be used. Because of their wearing qualities and economy copper and nickel are the two metals in commercial use in electrotype making.

Briefly, an electrotype is made by taking an impression of the original in a plastic substance, thus forming a mould, or matrix; depositing copper or nickel upon the mould, or matrix; removing the copper or nickel shell from the mould, or matrix; backing up the shell with a semi-hard metal; trimming the metal to printing plate thickness; and beveling or blocking for printing press use.

In practice more than twenty different operations are necessary to make a finished electrotype.

It should be firmly established in the mind that electrotype making from type forms starts in the composing room. The form should be prepared differently for electrotyping than for printing. In printing low spaces and quads and justification are best. In electrotyping high spaces, quads, and justification are highly desirable, although not absolutely necessary.

The mould or impression is made in a plastic substance or wax. Under pressure this wax will flow or slide. For that reason bearers must be put around the form to confine the wax. If low spaces and quads or justification are used, the wax has just that much farther to flow before a mould can be made. The farther the wax can flow the harder

it is to get a good mould, and good moulds are the foundation of good electrotypes.

The type form should be locked in a specially made heavy chase, one that will not spring or allow the type to move. If half-tones are in the form, and more than one electrotype is to be made, these should be mounted on solid metal blocks, as wood will not stand the pressure used in half-tone moulding. No paper, cardboard, or wooden wedges should be used in justifying the type. Engravings of any kind in a type form should be exactly type high. All of these things are the essentials of good electrotypes. Therefore, the work of the composing room is the first and an important part of electrotyping.

The first step in the electrotype plant is to prepare the wax for moulding. Formerly beeswax was used exclusively for moulding. To-day a resinous mineral wax called "ozokerite" is used. Ozokerite is a crude natural mineral wax of the paraffin series. It is a mixture of hydrocarbons in various proportions, the exact nature of which is somewhat in dispute. In the pure state it varies in color from black or dark brown to light yellow, and in some cases it has a dark greenish color. Its chief source of supply is Galicia, in Europe, where it is mined, the ozokerite being reached by levels driven along the strike of the deposit. For the electrotyper's use it is compounded until about the same hardness as beeswax, and shows a fine texture when broken.

In preparing ozokerite for moulding it is first melted and kept in a liquid condition several days to drive off all moisture and oil. There are many formulas for treating ozokerite so as to give it better moulding properties. Practically every foreman moulder has methods of his own for getting a moulding compound which is slightly different from the accepted standard. Because of this only two formulas will be given here, and the student may experiment if he desires to get a harder or softer wax. The first formula is for winter use, as follows:

82 pounds hard green ozokerite, 3 pounds beeswax, or yellow wax, 15 pounds pure white rosin. In making this formula melt the white rosin first, making sure that it is thoroughly melted, then add the beeswax and ozokerite.

Formula for summer use:

80 pounds hard green ozokerite, 5 pounds soft ozokerite and 15 pounds white rosin. In making, melt the white rosin first, making sure that it is thoroughly melted, then add the ozokerite and soft ozokerite. After these are thoroughly melted stir well and keep melted with steam pressure or heat for at least 24 hours. Then pour out in small pans suitable for use as needed.

Either of these formulas is suitable for the general run of jobbing work that daily comes to an electrotype foundry.

After the ozokerite is ready to be used as a moulding compound it must be put into a suitable form for handling at the moulding press. A foundation on which to put the ozokerite must be used. This foundation, together with the ozokerite on the foundation, is called a "case." The foundation of the "case" may be any suitable metal which will withstand the pressure of the moulding press. Electrotype metal is used quite frequently on account of the low cost. Copper is a better material as it is harder and will stand the continued heavy pressure of the moulding press better than electrotype metal.

It should be borne in mind that the case should always present a true foundation for moulding and that when electrotype metal cases are used the moulding of small forms in the center of the cases will in short time make the cases hollow in the center, and make it impossible to get a perfect mould on larger forms.

The case should be kept at a uniform thickness over the entire surface. The thickness of a copper case should be $\frac{1}{8}$ " ; of a lead case $\frac{3}{8}$ ". The surface size varies according to local conditions and the class of work handled—14"x20" is considered a large case.

A suitable table must be provided for flowing the melted ozokerite onto the case. The modern table for this purpose has a steel top with a rim on three sides, and a steel bar is used at the

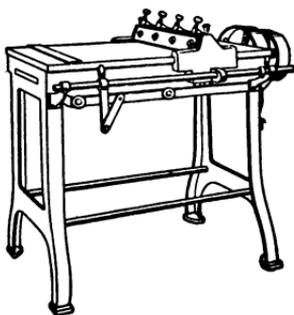


Combination Wax Apparatus

fourth side for confining the ozokerite as it is poured. This table has both a steam jacket and a water jacket; the steam to heat the table so that as the ozokerite is poured it will not chill and flow unevenly, and the water to cool the case quickly after it is filled.

The cases are placed on the surface of the table inside the rims, and the ozokerite is poured over until about $\frac{1}{2}$ " of material is on the cases. Connected to the table at the right hand end are two steam heated kettles which hold the ozokerite. At the right of the first kettle is a steam heated table so made that cases which have been used may be placed on it and the ozokerite melted off and drained into the kettle for use again.

The contents of the first kettle are strained into the second kettle, and from the second kettle the cases are filled. As soon as the cases are filled, and before the ozokerite cools, the surface of the ozokerite is flamed to remove the air bubbles on the surface caused by the pouring. This flaming is done with a lighted gas jet having flexible connections so that the flame may be run back and forth over the surface until the bubbles are all removed. As soon as the ozokerite cools the cases are lifted from the table, the ozokerite breaking where the cases come together.



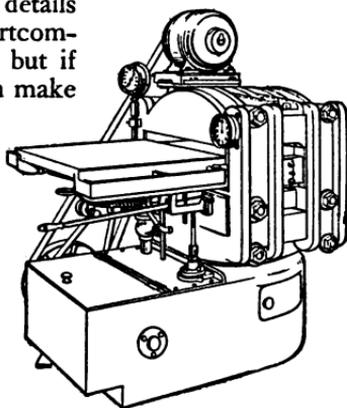
Power Wax Shaving Machine

As soon as the case hardens enough it is taken to a shaving machine with a traveling horizontal knife and about $\frac{1}{8}$ " of the top is shaved off so that a flat, smooth surface is given. The case is then ready for the mould. In some case-shaving machines the knife is heated. Also some moulders flame the surface of the case just before moulding. Neither of these is essential.

CHAPTER III

Moulding and Building

MOULDING is the next, and the foundation, operation of electrotype making. The making of a good electrotype depends more upon the mould than upon any other one operation. Other details may be slighted and the shortcomings in a measure remedied, but if the mould is bad nothing can make the electrotype good. The object, then, is to get a full, clean, sharp mould of sufficient depth for printing. To get a full mould pressure must be used and the wax so confined that it cannot escape. The pressure is obtained from the moulding press. Many types of presses have been used since the invention of electrotyping. The type in common use to-day is the hydraulic with pumps running in oil, although it is easy to find places still using the old style toggle-joint hand power presses.



Automatic Hydraulic Moulding Press

The modern hydraulic press is so constructed that any desired pressure up to the maximum may be obtained by throwing a lever and watching the pressure indicator until the pressure is where wanted. The lever may then be changed to hold the pressure, or the lever may be reversed and the bed of the press dropped to its original position.

Presses are now built that will give a maximum pressure of 2,000 tons on a 22" ram. This enormous pressure is used in lead moulding. High pressures are not required

in wax moulding except on large, compact forms and forms that contain half-tones and large plates which have solid printing surfaces. The amount of pressure needed for the various sizes and conditions of forms and originals is a matter of judgment on the part of the moulder, which can be learned only by experience.

Confining the wax is controlled in the chase. Metal type-high guards are locked in the chase just outside and around the matter to be moulded. This prevents the wax from squeezing out sideways or endways as the pressure is applied. The metal guards or bearers are usually 28 points in thickness. As wax under pressure will travel so long as it can find a place to go, open spaces in the form should be avoided.

Therefore, hollow metal furniture should never be used in making up a form for electrotyping. For this reason high leads, spaces, quads, and other justifying and blanking material are better than low leads, furniture, etc., as with the low material the wax must travel farther before a full mould is made, and, in addition, it is much harder to remove the form from the case after moulding.

It is difficult to get a perfect mould where the wax has the opportunity to travel sideways. In other words the perfect mould is made where the wax can only travel directly away from the pressure and where it cannot travel far before it is completely confined.

The first step by the moulder is to see that the form or original is in condition for moulding. If the form has been carried any distance from the composing room to the foundry, or any condition has arisen that might cause the form to become uneven, the moulder places it on a steel surface slab, loosens the quoins, gently planes the surface so that all the material may be brought squarely on its feet and the surface brought to an even height, then relocks the form. The steel slab used is heated from underneath so that the type is slightly warmed before moulding.

A moulding case is then placed in a warming cabinet and warmed until the wax is at the right temperature for moulding. The proper moulding temperature of the wax

varies according to the particular mixture of wax used, and also according to the atmospheric conditions and temperature of the room, and, to a certain extent, according to the nature of the form; type forms being moulded in wax slightly warmer than that used for moulding half-tones. An average temperature of 95 degrees is right for most wax mixtures.

The case is then coated with graphite. This is done by placing a handful of graphite on the case and brushing the surface with a soft brush. Two kinds of graphite or, as it is commonly called, black lead are used in electrotyping; moulding graphite and polishing graphite. The kind used here is moulding graphite, and it is used as a lubricant to prevent the wax from sticking to the original. Graphite is the best material that has ever been found for this purpose, as in addition to its lubricating qualities the film formed on the case and form is so thin that even the finest dots in the high-lights of a half-tone are not apparently thickened.

The mould is now ready to be made. If, in preparing the wax, proper care has not been used and all moisture and oil extracted, it will show in the moulding, and what is termed a "slide" or "sweat" may result. A "slide" or "sweat" cannot be remedied, and a new mould must replace the defective one. Should the wax be too hot, or the type form too cold, what is known as concaved work will result. Concaved letters can be remedied to a certain extent in the processes that follow, but it is much better to get a full clean mould without any of the letters being concaved, and this can be done by practice and patience.

A sharp mould is obtained by using wax of the proper consistency and at just the right temperature. A clean mould is obtained by care being used in not getting too much moulding graphite on the case and form, especially the half-tones.

After being moulded the case goes to the builder. The builder's work is to trim to an even height all the surplus wax which has been forced into the low parts of the form and thrown up around the bearers, and to build up with wax any non-printing surfaces that are so large that they

would be inked by the printing press rollers were these non-printing surfaces left too near the height of the printing parts.

It must be borne in mind that on the case as it comes from the moulder the printing surface is at the bottom of the mould, and that all the surplus wax above that necessary as a printing depth must be removed or shaved down to a flat surface so that an even foundation is made for the depositing of the copper or nickel shell. This work is done by the builder using a sharp-edged, flat, trowel-shaped tool warmed so as to prevent tearing or bending the wax.



Builders' Knife

To level off a wax case after moulding is a delicate piece of work, requiring both skill and practice. In cutting off the surplus wax a burr is formed around the letters or rules. This is removed by running a gas flame over the surface and melting the burr. Care must be used in this work that the flame does not touch the printing surface.

Building up is just the opposite of cutting down or leveling off the case. Here the object is to remove the non-printing surfaces further from the face or printing surfaces to prevent the paper or rollers of the printing press from touching. This is done by holding a stick of wax against a heated pointed tool and moving the tool as the wax flows from the point over the surface to be raised, care of course being used that none of the melted wax gets into the printing surface.



Builders' Iron

To-day much of the work formerly done by building is done by routing, this being more economical and giving a better appearance in the finished plate. The last thing the builder does to the case is to attach near the top a thin piece of copper. This piece of copper is the point of contact for the electrical current used to deposit the copper or nickel on the case.

CHAPTER IV

Making and Backing the Shell

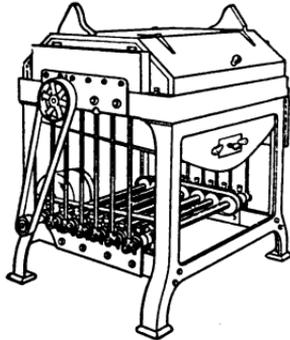
THE case now goes to the black leading or graphiting machine. The purpose of putting graphite on the case is to make it electrically conductive. Wax being a non-conductor, it is impossible to deposit on naked, uncoated or untreated wax.

Polishing graphite is used in coating the moulding case. It is much finer and lighter (bulk for bulk) than moulding graphite.

Two methods of coating cases are in common use, the dry and the wet methods. The dry method has been used since electrotyping was first done. The wet method was used in the early seventies, but it did not come into any extensive use until 1911 and 1912. Now it seems likely to supplant the older method entirely in a short time.

Dry black leading is done in a practically air-tight machine with a traveling reversing bed upon which the case covered with graphite is placed, and over which a series of exceptionally soft, fine, hair brushes oscillate rapidly with a short vertical movement, the brushes being set so that the ends touch the case lightly with each movement. Running a case in this machine for a few minutes gives the surface a thin film of highly polished graphite and the entire surface is then a conductor of electricity.

Wet black leading is done in a variety of machines, the principle of all being the same; namely, to spray under pressure a half-and-half solution of



Black Leading Machine
Dry Method

pure water and polishing graphite against the surface of the case until a film of graphite coats the case. Whether the dry or wet method is used the essential thing in black leading is to see that the entire surface is completely and evenly coated. Failure in this results in holes in the shell, a source of much trouble to the electrotyper.

As the case comes from the black leading machine the entire surface is coated and electrically conductive. The shell is wanted only on the moulded surface. Therefore the next step is to destroy the conductivity of the edges of the case or any portion of the case where no deposit or shell is desired. This work is called "stopping out." It is done by drawing a hot iron tool over the surface of the case outside of the moulded portion, the melting of the wax destroying the conductivity. There is a machine for doing this work mechanically. It should be remembered in doing this that the thin copper connection at the top of the case must be left inside the part stopped out by the hot iron. This work may also be done by scraping away the coated wax with a special tool.

In the black leading, either by the dry or wet process, more or less surplus graphite is left on the case which must be removed before the case goes into the depositing tanks. As the case comes from the wet black leader it is dipped into a small tank for the purpose of removing and saving the major part of this surplus graphite. But this does not remove all the surplus graphite, and the case after stopping out (this applies to the dry case as well) goes to a pumping out tank where every particle of the surplus graphite is washed out by water under pressure, a rotary pump with a sprayer nozzle being used.

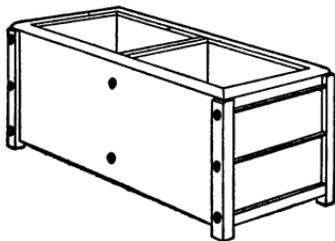
When the case is dry black-leaded a high polish is given the case by the brushes. This high polish must be removed, as otherwise when hung in the depositing tank a film of air on the surface of the high polish would hold the solution from the case and prevent the metal from depositing. Water sprayed under pressure removes this high polish.

The case is now technically ready for the depositing metal. In many foundries it is common to use at this

point of the work a process known as oxidizing the case. Oxidizing is coating the surface of the case with a solution of water and blue vitriol (copper sulphate) and then dusting powdered iron in the form of very fine filings into the solution. A chemical action immediately takes place. The water and blue vitriol form sulphuric acid. This attacks the iron and unites with it, forming hydrogen gas.

Oxygen is liberated from the copper sulphates of the blue vitriol and unites with the hydrogen gas, forming water. The metallic copper of the blue vitriol is no longer held in the solution but is precipitated on the surface of the mould. Chemical copper is thus formed on the case. This hastens by about fifteen minutes the covering of the case with copper-faced electrotypes. It is not used on that class of work where the highest grade of work is wanted.

The case is now ready for the depositing of the shell. The depositing tank may be of any convenient size to accommodate the size of cases used. The usual size permits of two cases side by side, and of a length about twice the width, with a depth sufficient to cover the case, allowing several inches between the bottom of the tank and the lower edge of the case, and room at the top for the electrical connections. 30" x 30" x 72" is a good size for commercial work. Tanks are usually of wood, lead lined, with the seams lead burned, that is to say having the edges fused together solidly leaving nothing for the acid to attack. The sulphuric acid used in the solution is very destructive to wood and all the common metals except lead, as well as to clothing, shoes, and the flesh. Every precaution must, therefore, be used not only in handling but in the condition of the containers which are to hold the solution.



Lead-Lined Depositing Tank

In making the solution the tank is filled to within about six inches of the top with pure water. Sulphuric acid is added until a Beaumé hydrometer stands at two degrees. Extreme care should be used in putting the acid with the water, as any quantity poured suddenly into water causes fumes to generate so fast as to cause an explosion. Pour the acid very slowly and move the container from which the acid is poured along the tank. Add sulphate of copper, commonly called blue-stone or blue vitriol, until the hydrometer stands at 18 degrees. Run this solution for a day to get it thoroughly mixed, and then add acid gradually until the solution is brought to a strength of about 21 degrees. This solution with five volts of energy will deposit six ounces of copper to the square foot in two hours, the thickness of the copper being from six to seven one-thousandths of an inch.

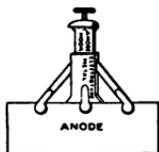
Solutions may be run at either high or low strength, high or low voltage, or a number of combinations of solutions and voltages. The solution given above is a good working solution for copper electrotypes.

For depositing nickel directly upon the mould the tank and general conditions are same as for depositing copper. There are many different formulas for deposition. A good solution is as follows: Pure water; mix single and double nickel salts together in the proportion of one single to five double and add to the water until a Beaumé hydrometer stands at two degrees. Use three to three and a half volts of energy. Nickel salts may be bought of any wholesale chemist. The anode, or piece of metal to be dissolved, should be at least 92% pure nickel. Vanadium and cobalt are frequently used in connection with the nickel.

This solution should be kept neutral—that is neither acid nor alkaline. If alkaline, add single salts; if acid, add a small quantity of liquid ammonia. The test for alkaline or acid condition is made with litmus paper. If the solution is acid the litmus paper will turn red. If alkaline, a deep blue. If neutral, there will be no change in the color.

Both the nickel and copper solutions should be agitated by some method, preferably compressed air pumped through lead pipes at the bottom of the tanks, the pipes having pin-

hole openings every few inches for the escape of the air. This is done because the acid being heavier than water has a tendency to settle at the bottom of the tank, and also because when the electric current is turned on a chemical action takes place on both the anode and the cathode surface which retards the deposition; this chemical action being prevented and the solution kept properly mixed if the solution is agitated. The anode is the surface from which the metal is taken. The cathode is that on which it is deposited.



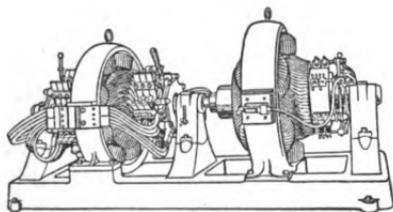
Patent Anode and
Connection Hook



Connection
Clamp

The chemical part of the process being ready, we now turn to the electrical end, the deposition of metals being both a chemical and electrical process. The first requisite is an electrical current. This was formerly obtained from batteries of the wet cell type. To-day in commercial electrotyping the modern depositing dynamo is used. The current required is a large flow with a comparatively small amount of energy. Five or six volts are sufficient, while the amperage may run as high as 1000 to 3000, according to the amount of work in the tanks.

The dynamo may be placed in any convenient place. The nearer the tanks the greater the economy, as large conductors are required to carry the electricity without loss. Electrical engineers advocate putting the dynamo in a good light and where good ventilation may be maintained. While these points may be of advantage



Rapid Depositing Dynamo

they are not absolutely essential. It is essential that all the connections be properly made and the contact points kept clean. The contact points are the hooks used to hang the case in the solution, the case being technically called the

cathode; the hooks used to hold the copper block in the solution, the copper block being technically called the anode; and the rods running across the tank to support the cathode and anode.

The method of making the connection is as follows: From the positive pole of the dynamo run the conductors to a rod running across the tank, the end of the rod opposite the connection being insulated. For depositing copper, hang on the bar wholly submerged in the solution a copper block, the anode, corresponding in area to the case, and about $\frac{1}{2}$ " in thickness. Three inches from the positive rod place a rod connected to the negative pole of dynamo, with the opposite end insulated as in the case of the anode rod. On this rod hang the case with the moulded face to the anode. The case is now the cathode.

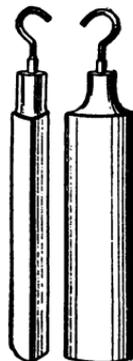
With the current turned on the course of travel is from the positive pole to the anode, through the solution to the cathode, and back to the negative pole of the dynamo. As the electrical current goes through the solution from the anode to the cathode both a chemical and an electrical action take place. The elements holding the copper anode together are detached and decomposed. The copper is released in minute particles, while the action on the cathode is such that it develops an affinity for the copper, and the copper is precipitated or deposited upon its surface.

The length of time required to deposit a shell depends upon the solution, the voltage used, and the thickness of the shell wanted. A workable shell can be deposited in thirty minutes. To do this regularly is too expensive for commercial use and the quality of the copper is not as good as on the slower deposit. Two hours is the average time for depositing copper for the average printing plate, and from six to twelve hours for an embossing or die stamp.

Nickel is deposited in the same general way as copper except that the nickel anode does not have as large an area as the cathode. Nickel anodes are round, rectangular, octagonal, fork shaped, etc. The nickel anode should be at least 92% pure nickel. A nickel deposit is more expensive than copper and is only used because it is harder than

copper and not subject to corrosive action of color inks. It is common usage to deposit only a thin shell of nickel and then transfer the case to the copper bath, adding a copper shell to the back of the nickel face. When this is done care must be used in taking the case from the nickel bath that all of the nickel solution is washed from the case before putting it in the copper solution.

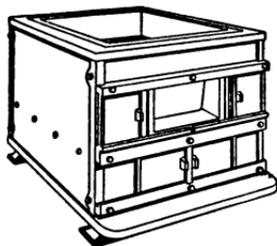
After the desired thickness of shell is deposited the case is taken from the bath. Taking the case from the bath automatically stops the flow of current through the anode opposite the case removed. The shell is taken from the case by pouring on hot water until the wax is softened enough to release the shell. Hot lye is then used to remove the wax that still adheres to the shell.



Nickel Anodes

The wax on the case is now ready to go back to the melting pot and be used over. The shell is trimmed of the surplus copper which has deposited around the edges. It then goes to the backing up department.

Backing up is putting a backing of electrotype metal underneath the shell to be used as the base of the printing plate. Metal will not adhere to copper without a solder being used, so the first thing to do is to coat the back of the shell with solder. The back of the shell is first thoroughly wetted with a soldering fluid or flux. It is then covered with tin foil (solder made into thin sheets). This tin foil is then melted. A common way of melting the tin foil is to place the shell with the foil on the back

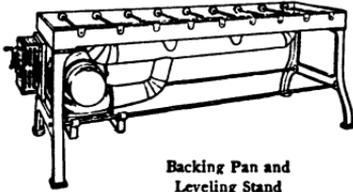


Electrotype Furnace

in a backing up pan and then put the pan into the melting pot, leaving it there until the tin foil is melted. As soon as the tin foil is melted, the pan is removed from the pot and the molten electrotype metal poured into the pan to

a depth of about $\frac{5}{16}$ of an inch. The pan is now allowed to cool. In most foundries the backing-up stand is so arranged that a blast of air can be turned on under the pan for the quick cooling of the metal.

Backing-up is an important part of electrotype making. It is essential that the back of a shell be clean when the tin



Backing Pan and
Leveling Stand

foil is put on, that good foil be used, that the tin foil when melted covers every part of the shell, that the metal be kept at an even temperature, and that the pouring of the molten metal onto the shell be carefully done.

Pure tin foil is made of 50% tin and 50% lead. A good electrotype metal is made of 93% lead, 4% antimony, and 3% tin. The right temperature for pouring the molten metal is 675 degrees Fahrenheit.

The backing-up pan is usually large enough to hold two full size shells.

As soon as the cast cools enough to be handled it is removed from the backing-up pan. Any metal which has flowed under the shell in pouring is removed, the copper surface is cleaned either by hand or by a scrubbing machine built for the purpose, and the pan is ready to go to the finishing room.

CHAPTER V

Finishing

IT is considered that when the electro goes from the foundry department to the finishing department over half the work is done. Accurate cost records, however, show that less than one-half the cost of the finished work has been reached at this point.

The finishing department of an electrotype foundry is an entirely separate branch and practically another trade from the foundry department. Moulding, building, battery work, and backing-up are classed as foundry work. Floor work, finishing, and blocking are classed as finishing, although some foundries run the blocking as a separate department.

The work of the finisher is to take the electrotype as it comes from the foundry and put it in perfect condition for printing and in the proper shape for the press.

The finished electrotype must be perfectly flat; if mounted on either wood or metal it must be type high; if unmounted, the correct thickness for the patent base, usually $15\frac{3}{1000}$ of an inch, beveled on the edges for the particular kind of hook to be used; and if to be used on a rotary press, curved, beveled and trimmed to fit the kind of press.

The pan, as it comes from the backing-up department, may contain one or a number of backed up shells. The first work is to saw apart the different electrotypes in the pan into individual plates, or into pieces containing one or more plates of a convenient size for handling by the finisher. This work is done on a circular saw — the saw being adapted for sawing metal.



Sawing Machine

The finisher now takes the work. On the finisher's bench, directly in front of him, is a steel slab with a perfectly true and polished surface.



Steel Finishing Plate

The work of truing up, making level, and bringing to proper height all low spots in the electrotype is done on this steel slab. A straightedge, a pair of markers, a hammer, a planer, a brush, a rubber, a piece of French chalk, and a few punches are the tools used for this work.

As the work comes to the finisher's bench each electrotype has around its outer edge the copper deposit of the bearers or guard lines placed there for the purpose of confining the wax when moulding. These bearers have also acted as a protection in handling the case and the shell, and have prevented the metal from flowing in under the shell when the molten metal was poured into the backing up pan. They are further to act as a protection in handling until the final trimming up of the electrotype, but being the same height as the face of the plate, and often having a burr or raised edge which would interfere with the finisher using the straightedge and be in the way of the finisher in his work on the printing surface, his first work on the plate is to hammer down or level off with a file these guard lines so that their surface is slightly below the surface of the rest of the plate.



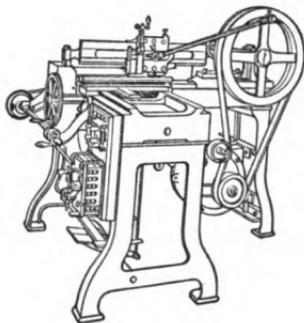
Finishers' Hammer

The face of the plate is carefully brushed to remove any metal sawdust or foreign matter that might injure the face. The surface of the steel slab is also cleaned and the plate laid face down to see if it is level, or if all four corners of the plate rest on the slab. If all the corners do not touch the plate is straightened until they do. This is a simple matter, as the electrotype metal is comparatively soft and easily worked, especially the first few hours after it is poured. Electrotype metal hardens with age.

The plate then goes to a planer or, as it is commonly

called, the rough shaver. Here about one half the surplus metal used in the backing up is rapidly shaved off leaving the back of the plate smooth and true.

The plate now goes back to the finisher for the delicate and exacting work of finishing. While the work of the finisher is to deliver a perfect printing plate it must be borne in mind that type forms as they come from the composing room are seldom perfect. Type that has been used is often in the form with new type; new and old brass rules are used together;



Roughing or Planing Machine

cuts not type high or more than type high are locked in forms with other uneven material. Machine-cast type often shows marked variation in height because of carelessness of the operator or lack of skill and attention in keeping the machine in good condition. Conditions which appear in a majority of all forms cause variations from one to ten one-thousandths of an inch, all of which the finisher is expected to rectify and bring to an even printing surface in finishing the electrotype. Then again in the backing up shrinks may occur which draw the copper shell out of shape. This the finisher must remedy.

As the plate comes from the rough shaver it is laid on the finisher's slab face up and the face of the type and rules is rubbed with a finisher's rubber. This is made of rubber and ground glass, the size being about $1\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{2}$ inches in thickness. Rubbing the face of the plate with this rubber shows where the low type or small low spots are and the straightedge shows the larger low spots and general inequalities of the plate. The larger inequalities may be remedied by being brought up by a hammer and planer, the plate being laid on its face for the work, but the low type and small shrinks and low spots must be hammered up individually, different sized punches being

used according to need. To illustrate: the letter i or l being low between two letters of correct height a very small punch would be needed, while on a small shrink covering an area of half an inch in diameter the round head of the hammer would be used.

For indicating these low letters and spots on the back of the plate where the hammering is to be done a marker is used. This marker is a U shaped tool some ten inches long made of spring steel, the outer ends of the arms being turned toward each other and pointed. The opening



Finishers' Calipers or Markers

of the tool between the points is sufficient to allow one of the pointed ends to be placed over the face of the plate and the other end under the plate. When the pointer over the face of the plate is brought over a low spot or letter, the opposite pointer is pressed against the back of the plate, making a mark which indicates the exact spot to be hammered or punched. The amount of hammering necessary to bring the low spot to the desired height is a matter of judgment on the part of the finisher and this judgment and knowledge come only after months and months of experience and training.

The finishing of a half-tone electrotype is the most delicate part of the work. Here the plate must be made flat and true without thickening the fine dots of the high-lights, and these fine dots are often nothing more than copper or nickel pin points which the least amount of hammering will injure and so change the printing value. On half-tone work the rubber containing ground glass is too abrasive to use. Magnesia in the block form or French chalk is used to show the low spots.

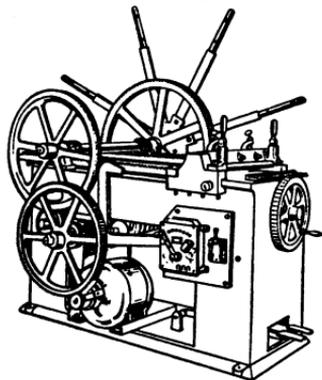
Sheet celluloid is used between the face of the slab and the face of the plate in working on the best grade of half-tone electrotypes.

In addition to the work of leveling up the plates, the work of the finisher is to make corrections in plates, insert type, mortise and insert pieces of electrotyped matter, join rules, etc., some of which requires the most skilled use of

the soldering iron. The finisher is also skilled in the use of all the machines required to trim, shave, bevel, and place the plate in condition for the printing press. Much of this work, however, is done by men who do nothing else, called floor hands.

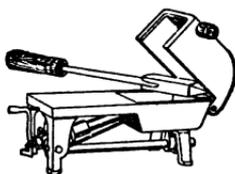
When the finisher has the plate in a satisfactory condition as regards trueness of its surface it goes to the smooth shaver where it is shaved to printing plate thickness.

The smooth shaver is different from the rough shaver in that on the rough shaver the shaving is taken off with a planer tool, a large chip being taken off with each forward movement of the plate, and on the smooth shaver a knife extends across the machine and is run over the entire back of the plate at one movement, making a very thin shaving the size of the plate. This method of shaving gives a polished surface to the back of the plate and leaves the entire plate of a thickness which will not vary $\frac{1}{2}$ of $1/1000$ ".



Power Shaving Machine with Adjustable Bed

If the plate is to be a flat electrotype and there is any routing to be done, that work is done at this time. Routing is cutting down the non-printing surfaces of the plate that are large enough to allow the inking rollers of the printing press to touch as the printing surface is inked and in this way cause a smooch on the paper. The cutting tool revolves at a high speed and is moved by a radial arm in any direction over the surface of the plate, a gauge being used to regulate the depth of the cutting. Considerable skill is required, as the tool is guided wholly by the operator and it is necessary to run it close up to the printing surface.



Improved Soldering Furnace

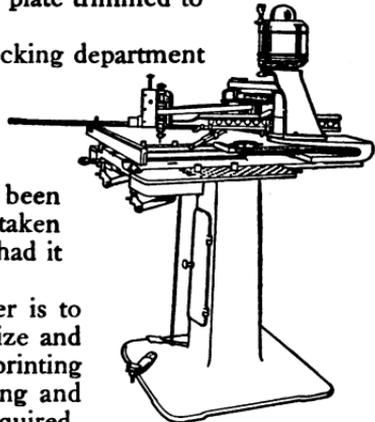
If the plate is to be mounted on a wood block the guard lines are sawed off and the plate trimmed to practically its finished size.

Before going to the blocking department the plates go back to a finisher called a reviser, whose duty it is to go over the plate carefully to see that no imperfections have been overlooked or any damage taken place while the floor hand had it in charge.

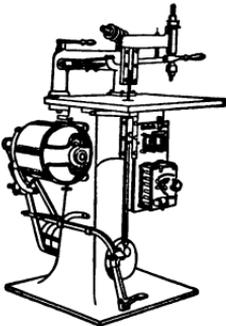
The work of the blocker is to prepare wood the proper size and thickness for mounting the printing plate and to do the mounting and such mortising as may be required. Cherry and a cheap grade of mahogany are most commonly used, although beech and maple are used to some extent. Whatever the wood used it should be close grained and well seasoned to prevent warping and twisting.

Different types of wood planers are used for planing the wood to height, the essential thing being to plane the wood evenly. The plate is fastened to the wood with steel brads, driven through the copper and metal. Where a half-tone electrotype or a tint block electrotype is to be blocked the full size of the plate and trimmed flush without a margin for nailing the plate is anchored on the block by making holes in the block, countersinking the holes on both sides and filling the holes with hard solder, then trimming the metal and wood to height.

Mortising electrotypes is the work of the blocker. Outside mortising

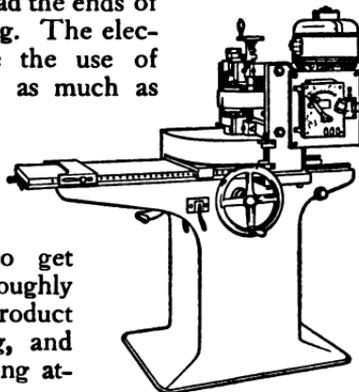


Improved Straight-Line Routing Machine



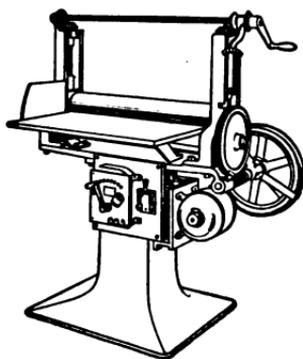
Combination Jig Saw and Drilling Machine

is usually done with a circular saw and inside mortising with a power jig saw. Where extra large plates are wood blocked it is best to crosshead the ends of the block to prevent warping. The electrotyper should discourage the use of wood blocked electrotypes as much as is consistent with good business practice as wood is not only a poor printing foundation for the modern presses but it is also almost impossible to get blocking wood that is thoroughly seasoned, the kiln-dried product warping, twisting, swelling, and shrinking so much in varying atmospheric conditions and temperatures that it is impossible to guarantee that a wood blocked electrotype will stay type high or flat. Cheapness is its only recommendation.



Improved Planer

If the plate is to be used unblocked, commonly called printing plate thickness, $153/1000^{\text{N}}$ for flat bed cylinder presses, and varying thickness up to $210/1000^{\text{N}}$ or even thicker for curved bed or web presses, the plate after leaving the smooth shaver goes to the beveling and trimming machines.



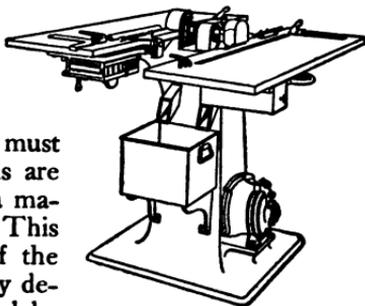
All-Size Power Roller Bending Machine

The degree of bevel varies for different types of hooks used in fastening the plate to the patent blocks used on the press or, in web press, to the cylinder of the press. The variation is from 20 degrees to 45 degrees. There is no good reason for this wide difference except that patent

block and hook makers have not standardized their product. This changing of bevels on different plates causes the electrotyper much annoyance and loss of time.

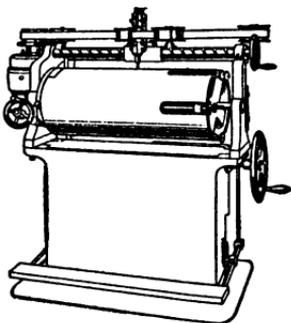
The plate, if to be used on a flat bed press, is, after trimming and beveling to size, turned over to the reviser and if found in good condition is then ready for delivery.

If the plate is to be curved for web press or sheet feed rotary work, it must be curved before the bevels are cut. Curving is done on a machine built for the work. This machine may be either of the three roller type, where any desired curve may be obtained by setting the rollers, or on a single curve type built for curving plates, a fixed curve for a special make of press.



Beveling and Squaring Machine

Plates are curved cold, but the curving must be done before the metal has tempered or hardened to any appreciable extent. Where a plate has become tempered or hardened from age it gives a metallic ring when struck with a hammer entirely different from that of a plate only a few hours old. After a plate has tempered it should be heated before curving.



Improved Rapid Straight-Line Curved Plate Routing Machine

From the curving the plate goes to the trimmer to have the bevel cut, the trimmer having a curved saddle to conform to the shape of the plate. Machines are made which bevel both sides of the plate at one operation.

Routing the curved plate is the next operation. If rout-

ing is necessary it must be done after the plate is curved, as to rout out metal before curving would cause the plate to curve unevenly and possibly to crack or break at the point where the metal was routed out. In fact, on curved work having much open space it is good practice to leave dead metal in the open spaces, making the plate comparatively even in thickness to get uniformity in the curving. The dead metal is then routed out.

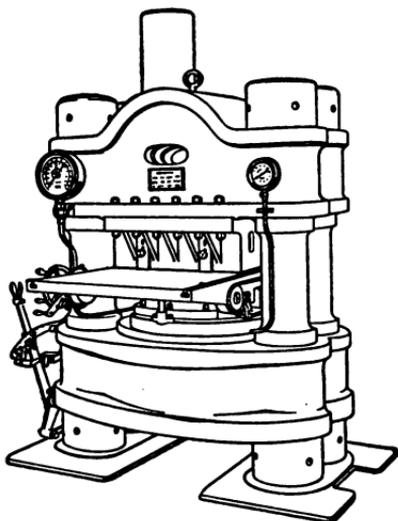
From the router the curving plate goes to the reviser for examination and then to the shipping room to be delivered to the customer.

The receiving and shipping department of an electrotype plant is an important part of the work. An electrotype face is easily damaged; careful and intelligent handling is necessary. Original half-tones, especially for color work, are much more expensive than electrotypes and just as easily damaged. Skillful handling and packing are essential to prevent damage. The receiving and shipping department must interpret all orders, many of which are complicated or call for special instructions. In addition to other duties this department must see that promises are kept and, as fully 75% of commercial electrotyping is wanted in a hurry, and 50% done under pressure, this work requires both efficiency and diplomacy. At this point the manufacturing end of electrotyping is finished; the balance of the work is the part of the office force, which at this time we are not considering.

CHAPTER VI

Moulding in Lead

THERE is, however, one process of electrotpe moulding which has not been described. This is known as "moulding in lead," or the Dr. Albert process. This process uses pure lead as the plastic substance in which to make the



Hydraulic Lead Moulding Press

mould and, because lead is a conductor of electricity, the coating of the mould with graphite is eliminated. Because both type foundry and machine made type are not hard enough to withstand the repeated enormous pressure which lead moulding requires this method of moulding is confined almost wholly to copper originals.

Type can be moulded in lead by using care but after several impressions are taken from the same form a decided wear is apparent. For this reason it is not considered practicable to use type except in special requirements. Copper half-tones are not injured by lead moulding. It is necessary, however, to remove the enamel from the face of the half-tone before moulding. If the half-tone is properly etched there is no objection to doing this.

Hydraulic presses capable of giving a pressure as high

as 2,000 tons on a 22" ram are used, the pressure of course varying according to the size and nature of the original.

Lead as a moulding substance is superior to wax in the following ways:

- 1st. It is a conductor of electricity; therefore, the deposit may be made without the coating of graphite necessary when wax is used.
- 2nd. It is moulded at the temperature of the room; wax must be warmed before moulding. When making electrotypes for color printing register is important. Wax moulds, by reason of being heated and cooled, vary in exact size much more than lead moulds.
- 3rd. It goes direct from the moulding press to the depositing tanks thus avoiding two handlings, the building and the graphiting.
- 4th. Lead being less plastic than wax a cleaner and sharper face is more uniformly obtained.

The demand for lead moulded electrotypes has grown rapidly and quite a number of electrotypers are adopting the process. The student is urged to familiarize himself with this process.

So-called Steel Electrotypes

The student may often see claims made that electrotypes are steel faced, or nickel steel faced.

The word steel in connection with the printing surface of an electrotype is a misnomer. Neither iron nor steel is used for the depositing of metal on electrotypes, both are too corrosive to be of value on the face of a printing plate. Nickel, 92% or more pure, is the metal used for making the so-called steel electrotypes.

The words steel or nickel steel were undoubtedly adopted to differentiate between the nickeltyping method of depositing the nickel upon the mould as explained in the text-book and the old method of nickel plating the copper electrotype after the electrotype was made. The method of depositing directly upon the mould gives a harder deposit than is obtained by nickel plating.

*Recapitulation of Essentials for the Best Results
in Electrotype Making*

See that the form is in good condition for moulding.

The moulding compound must be carefully and thoroughly prepared. If ozokerite is the material used, see that all moisture and excess of oil is cooked out.

The case on which the ozokerite is flowed should be of uniform thickness. Good moulding cannot be done with a case hollow in the middle and thick on the edges.

The moulding press should be in such condition that an even impression may be obtained from the entire bed surface.

Care must be exercised that an excess of moulding graphite is not used on the form before moulding, especially on half-tones.

Uniformly good moulding comes only from experience and a working knowledge of all the conditions and practices necessary.

If the dry black leading system is used the brushes should be kept clean, especially the end of the bristles, and the brushes must be carefully adjusted. With the wet black leading method care should be exercised that the proper proportions of the solution are maintained. The more care given to maintaining the solution at its correct strength and the more cleanliness used the better will be the product of the depositing tanks and the battery department.

In backing up a good solder, clean metal at an even temperature, and the backing up pans kept clean and with a true surface are all essentials.

In the finishing department competent workmen and modern machinery, with the cutting edges of the tools kept sharp, are the combinations that produce good printing plates.

SUGGESTIONS FOR THE PRINTER

It is assumed that most of the students studying this text-book will eventually work in the printing industry. Because of this, special attention is directed to the preparation of the forms for electrotyping.

Much of the trouble caused the electrotypers, and the frequent cause for poor quality in electrotypes, may be traced to the poor condition of the forms sent by the printer to the electrotyper.

Generally the printer is ignorant regarding the proper way to lock up a form for electrotyping. The electrotyper is the best person to give the printer proper information on this point and the electrotyper will ask nothing from the printer but the things which will be to the best interest of the printer. Points for special attention are as follows:

1. Heavy chases made specially for electrotyping.
2. High justifying material used throughout the form.
3. Type-high bearers placed around the form.
4. Do not use worn and new type together if it can be avoided.
5. Be sure that engraved plates are neither high nor low to paper. Type-high is .918 inch.
6. If more than one mould is to be made from wood-blocked original half-tones have the plates mounted on solid metal bodies.
7. Make sure that the type is squarely on its feet, carefully justified, and firmly locked in the chase.
8. Do not use one-point brass rule with a hair line face if it can be avoided. It is very hard to make copper or nickel deposit in such a narrow opening and still harder to make the backing-up metal flow solidly into such a small aperture.
9. In making up forms for half-tone color printing the open places or non-printing surfaces should be filled with type-high blank matter, making an even surface of the entire form. By doing this the moulder can get a better

mould, the backer-up has a flat shell on which to pour the metal, and the finisher has a protection around the half-tone matter. Each of these is a help toward preventing the hard edge so often seen in the printing of half-tone work. If the finished plate is to be curved an added advantage is given, as a plate all the same thickness curves more evenly than one with high and low surfaces. The last work in making an electrotype of this kind is to rout out all the dead or non-printing surface.

QUESTIONS

1. What invention made electrotyping possible?
2. When was the first electrotype made?
3. Who made the first electrotypes in America?
4. How were these made?
5. Why was that method impracticable?
6. What inventions were made about that time which made electrotyping possible commercially?
7. Who was the first commercial electrotyper in America?
8. Name some of the principal inventions between 1840 and 1880 advancing the art of electrotyping.
9. What advance did the introduction of the dynamo make?
10. What is an electrotype?
11. What material is commonly used in electrotype moulding?
12. What is this material?
13. Where is it found?
14. Give the formulas for a winter and a summer moulding compound of this material.
15. What is the case?
16. What is the best case material?
17. Describe the apparatus for melting the moulding compound, and for flowing the cases.
18. Why is the case "flamed" before the compound cools?
19. What is the next step with the case?
20. Tell something about the operation of wax moulding.
21. How is the moulding compound confined while under pressure?
22. What trouble is caused by open spaces in the form?
23. Which justification is better in a form to be electrotyped—high spaces, quads, leads, etc., or low spaces, quads, leads, etc.?
24. Why?
25. Describe a well made and locked up form for electrotyping.

26. Why is the case warmed before moulding?
27. Why is graphite used in wax moulding?
28. What is necessary in order to get a clean, sharp mould?
29. Describe the work of the builder.
30. What is the difference between building and cutting down?
31. For what purpose does the builder attach a thin piece of copper to the top of the case?
32. What is the next step after the builder finishes with the case?
33. Why is a case graphited?
34. How many ways of graphiting are used?
35. Describe each method.
36. What is "stopping out"?
37. Why is it necessary, and how is it done?
38. How is the surplus graphite on the case disposed of?
39. Describe oxidizing.
40. Is this necessary?
41. Why is it done?
42. Describe the depositing tank.
43. Why is it lead lined?
44. Give the formula for a copper depositing solution.
45. Give the formula for a nickel typing solution.
46. Explain how to keep a nickel solution neutral.
47. Explain why both copper and nickel solutions should be agitated, and how it is done.
48. What is the anode?
49. What is the cathode?
50. Describe both the old and modern ways of getting electrical energy.
51. Describe briefly the action which takes place with both anode and cathode in position and the electrical current turned on.
52. How long does it take to deposit a good workable copper shell?
53. Why is a nickel deposit used?
54. How is the deposited shell taken from the case?
55. Describe the complete operation of backing up the shell.

56. Give the formula for electrotype backing metal.
57. What is tin foil?
58. Why is it used?
59. What is the last work in the foundry as the backed up electrotype goes to the finishing department?
60. In a general way describe the purpose and work of finishing an electrotype.
61. Name the tools used by a finisher.
62. What is the work of the rough shaver?
63. On what class of work are French chalk and sheet celluloid used?
64. Why?
65. What is the work of the floor hand?
66. What is the work of the smooth shaver?
67. What is routing?
68. Why is it necessary?
69. What is the work of the reviser?
70. Describe wood mounting.
71. What is a mortise?
72. What are the objections to wood as a printing base?
73. What class of electrotypes have beveled edges, and why?
74. Why are some electrotypes curved?
75. How is curving done?
76. At which part of the work is curved routing done, and why?
77. Why is extreme care always essential in handling electrotypes?
78. What is lead moulding as applied to electrotypes?
79. For what class of work is lead moulding commonly used?
80. Describe its advantages.
81. Tell something about the so-called steel electrotypes.
82. Name the essentials for making good electrotypes.
83. Describe the essentials advisable for the printer to observe in making up a form to be electrotyped.
84. What added precaution should be taken on forms for half-tone color printing?

- AMPERE**—The unit employed in measuring the strength of an electrical current.
- ANCHORED**—Said of an electrotype or other plate which is fastened to its base by means of solder poured through a hole in the base; a method employed for fastening half-tones or flat plates where there is no room to nail the plate to the block.
- ANODE**—The positive pole of a battery. The path by which the electrical current passes through the electrolyte. In electrotyping, the copper slab from which the copper shell is deposited.
- BACKING-UP**—The flowing of metal on the shell for the purpose of making a foundation for printing.
- BACKING-UP PAN**—The receptacle in which the shell is placed for filling with metal.
- BATH**—The solution in which the moulded case is placed for the deposition of the copper or the nickel.
- BATTERY**—The tank, solution, connecting rods, dynamos, etc., comprising that part of the electrotype plant where the deposition of the metal is made.
- BEARERS**—The guards placed around a form to be electrotyped.
- BEVEL**—The sloping edge of an unblocked electrotype.
- BLACKLEADING**—Dusting the wax mould with a fine powdered graphite to prepare it for the moulding process.
- BLOCK**—The wood or metal base upon which electrotypes or other printing plates are mounted. To block a plate is to mount it type-high.
- BUILDING**—Building in the blank spaces in a wax moulded case of a printing form to prevent smooching on the press.
- CASE**—The foundation on which the moulding compound is flowed for the purpose of making a mould.
- CASE CONNECTION**—A thin piece of copper attached to the top of the case for the purpose of making an electrical connection. The electrical connection between the tank rods, the anode, and the cathode.
- CASE MAKING**—Flowing the moulding compound onto the case.
- CASE SHAVING**—Cutting or shaving off the top surface of the flowed and hardened case to give a smooth, even surface for moulding.
- CATHODE**—The negative pole, or the path which receives the electrical energy as it leaves the electrolyte or solution. In electrotyping, the case is the cathode. The case receives the copper or nickel deposit.
- CORRECTIONS**—Inserting type or electrotype pieces to replace defects or make desired changes.
- CURVING**—Bending the electrotype to any desired arc.

- CUTTING DOWN**—Levelling off the moulding compound which has been forced into the interstices of the form while being moulded.
- DRY GRAPHITING**—Making the face of the moulded case electrically conductive by applying graphite in a dry form.
- DYNAMO**—A machine for producing an electric current by means of mechanical power.
- FINISHING**—The work of putting the electrotype into condition for printing after leaving the foundry department.
- FINISHER'S MARKER**—A tool for marking low spots in the electrotype.
- FINISHER'S RUBBER**—An abrasive made of rubber and ground glass.
- FINISHER'S SLAB**—A steel slab with a perfectly true and polished surface upon which the finisher works.
- FLAMING**—Passing a flame over the surface of the melted moulding compound immediately after flowing the case to remove the air bubbles.
- FORM**—A chase of type or other printing surface.
- GRAPHITE**—Carbon in one of its conditions; commonly called black lead.
- HOOK**—The fastener for hooking over the beveled edge of the electrotype and fastening it to the iron base.
- LEAD MOULDING**—The use of pure lead as the plastic moulding compound.
- MOULDING**—In electrotyping; taking the impression of the form or original in the moulding compound.
- NICKEL FACE**—An electrotype nickel plated after the copper face has been deposited.
- NICKELTYPE**—An electrotype having a nickel face deposited directly upon the mould.
- OXIDIZING**—Coating the moulded case with chemical copper.
- OZOKERITE**—A mineral wax used as a moulding compound in electrotyping. Its principal source of supply is Austria.
- REVISING**—The last inspection of the electrotype.
- ROUGH SHAVING**—Removing the surplus metal from the back of the electrotype.
- ROUTING**—Cutting out by machinery the high but non-printing surfaces of the electrotype.
- SHELL**—The term applied to the copper or nickel deposit when taken from the case.

- SMOOTH SHAVER**—The machine for making the finishing shave to bring the electrotype to a proper printing thickness.
- STEEL FACE**—A name given to electrotypes having nickel deposited directly upon the face of the mould.
- STOPPING OUT**—Making the edges of the moulded case non-conductive after the face has been graphited.
- STRAIGHTENING**—The first work of a finisher on an electrotype.
- TANK**—The receptacle holding the bath or solution.
- TIN FOIL**—Soldier in thin sheets.
- UNBLOCKED**—An electrotype that is to be used on an iron or patent base.
- VOLT**—The unit employed in measuring the flow of electricity.
- WAX KETTLE**—The kettle used to heat and hold the moulding compound.
- WET GRAPHITING**—Making the face of the moulded case electrically conductive by applying graphite in a liquid form.
- WOOD BLOCKING**—Attaching the electrotype to a wood base to make it type high.

PART II
STEREOTYPING

PART II. STEREOTYPING

INTRODUCTORY

THE general use of stereotype plates for printing preceded that of electrotypes by nearly a hundred years. Stereotyping was for a long time the chief means of making plates for books and for commercial printing, and it is today the main reliance for producing printing plates for newspaper publishing.

Stereotyping has several advantages. The first, obviously, is the advantage which it shares with several other methods of providing a solid printing plate made by moulding from an original form of type or an engraving. Its peculiar advantage, however, in which no other process approaches it, is that of being the quickest method of producing a duplicate plate from an original moulding form. After the locking up of a type page it can be moulded, the matrix dried, and the plate cast and ready for the press in from five to ten minutes, according to the particular facilities provided. It is in this respect that it is so well adapted for the use of daily newspaper work.

In comparison with the electroplating process, it has two disadvantages. One is that, so far as stereotyping has yet been practiced, it is not adapted for reproducing the finest lines of type faces and engravings. The electroplating methods and material give so much greater clearness and sharpness that its superiority is unquestioned in this respect. The other disadvantage is that the stereotype gives a relatively soft, quickly worn, printing face.*

* Stereotypes have been made more durable to withstand the wearing of printing by the deposition of a film of a harder metal—copper or nickel—on the face of the plate after the cast is made. This is, however, not often satisfactory, as it involves another operation and is suitable only for a limited class of work.

The ordinary method of stereotyping is to make a paper mould from a page of type. This mould is then thoroughly dried and used as a matrix in which to cast type metal or a metal of similar kind. This cast is trimmed and shaved to the required shape and prepared as a printing block. If it is to be used flat the matrix is kept perfectly flat and the metal is cast in that form; if it is to be mounted on the curved surface of a cylinder (which is now the common practice) the modern flexible matrix is placed in a casting box which holds it curved to the required arc and the metal is cast in that shape. Unlike an electrotype, it cannot well be curved, except in the slightest degree, after the cast is made, owing to the brittle character of the metal and the thickness of the plate.

STEREOTYPING

CHAPTER I

History of Stereotyping

THE word stereotype (Greek στερεός, solid; and τύπος, type) was applied to this kind of a printing plate because the first forms were loose types soldered together at the bottom to keep them from falling apart, or "pi-ing."

One of the early uses of the method was to preserve pages of the Bible and other books for which there was constant demand, rendering it desirable to keep the entire set of pages standing in type for reprinting. In the case of books of many pages this accumulation of types meant a great expense and also a great risk in the handling of pages each composed of thousands of separate pieces. Some pieces would become disarranged in spite of the utmost care, and this involved great trouble.

To improve this, Van der Meyer, of Antwerp, about the beginning of the eighteenth century, prepared the pages of a Bible by soldering together the bottom of the type. Several other books were treated in a similar manner. This met one requirement but it still had the disadvantage of holding in comparative idleness a large and costly mass of type useless for any other purpose.

The practice of casting a plate in a mould made from a page of composed type is credited to William Ged, a goldsmith of Edinburgh, about 1730. His moulds were made in plaster-of-paris and he made plates for a Bible for the Cambridge University; but these plates were mutilated by jealous printers and were thrown aside, and the process was abandoned for many years.

In the meantime several other plans were experimented with by different persons. Firmin Didot (1764-1836), the eminent printer of Paris, made type of a hard

alloy and the composed pages were impressed upon a sheet of soft lead, thus forming a mould. Melted metal was then poured into a shallow tray, and just as this was at the point of solidifying, but still soft, the lead mould was pressed on the melted metal.* This process was only partly successful; it could be used only for small pages, and the plates were too often defective. These and other experiments, however, were leading up to the real stereotyping process which developed later.

The Early Plaster Mould

Early in the nineteenth century Earl Stanhope, of England, who is credited with making the first all-iron hand press, re-introduced Ged's stereotype process with many improvements. One or more pages were locked in a chase and the form was covered with a semifluid plaster-of-paris, or gypsum. The surface of the type was oiled to prevent the sticking of the plaster mould, a little fine salt was mixed with the plaster to make it settle solidly; and in order to keep the plaster within bounds a raised metal framework called a flask, about three-quarters of an inch high, was placed around the form. While the plaster was still soft it was carefully pressed down and rolled smooth on top to give a uniform thickness to the mould and to expel any air there might be in the plaster.

When the plaster became solid it formed a perfect mould of the type pages, which was then carefully removed and the mould trimmed with a knife. High spaces

* In France another theory of stereotyping was tried. The form was driven into melted type metal just at the point of solidification. As the page driven in was cold this caused the hardening of the fluid more quickly, and it in turn became a punch for a second impact against melted type metal. This required excellent judgment as to the time when the proper conditions existed, and there must necessarily have been many air bubbles. It was known as polytypage.—*Lockwood's American Dictionary of Printing and Bookmaking.*

and quads were necessary in the composed type, because low spaces formed small holes into which the plaster flowed and the mould could not be removed without spoiling the impression in the plaster.

The moisture in the early plaster moulds was expelled by baking in an oven for three or four hours. A later method of drying the moulds was to suspend them directly in the metal pot or to float them on the surface of the hot metal, as by this means the proper drying could be done in a half hour or so.

In the process of casting, several of these plaster moulds were placed side by side face downward in a special casting pan. The pan was one and three-quarters or two inches deep, and a lid on the pan was screwed down on the back of the moulds. By means of a crane the casting pan with its moulds was then lowered into the pot of melted metal and the metal ran into the pan at the corners and sides. This was allowed to remain ten minutes or so, until it was entirely filled with the metal up against the face of the inverted moulds.

A later method of casting from a plaster mould was to place it in a frame with a smooth, flat plate opposite the face of the mould and to enclose the space at one end and two sides. The casting space thus formed was then turned with the open end up and metal was poured in with a ladle, in a manner similar to the method still employed for cast job-work stereotypes. The distance between the flat plate and the mould was adjusted to make a stereotype plate of the required thickness.

After the removal and cooling of the casting pan the plates were freed from the plaster and the surplus metal cut off. Only one cast could be made, as the mould was usually destroyed in removing the cast. The stereotype was then sent to the finishing department, where the face was cleaned and examined for defective letters, then trimmed on the sides and planed off uniformly on

the back to the desired thickness, in the same manner as an electrotype is treated today. A defective letter could be mortised out of the plate and a good type inserted in its place. In the case of a whole line or other large part being imperfect, another mould was made of as much of the form as was necessary and a new cast inserted and soldered to the plate.

There were many and varied experiments made in the earlier development of this idea of producing a duplicate printing form in a single piece. That such a process was highly desirable was universally recognized, and the conviction that some practicable and economical method was feasible was a continual incentive which gradually led to better results.

Stereotyping in America

Although credit is given to John Watts, an Englishman then working in this country, for making the first stereotype plates here, the real introduction of the process into the United States was by David Bruce, who later became a type founder. This was in 1813. Bruce had learned the printer's trade in Edinburgh and later came to America, where after a few years he was joined by his brother George in establishing the firm of D. & G. Bruce, Printers. Hearing of the new process of stereotyping in England, he went over there to learn about it. He could get very little information about the process there, but came back with some practical ideas which he proceeded to carry out. Bruce and his brother also began typesetting about this time, and abandoned the business of printing; later they gave up the work of stereotyping. The first book stereotyped in the United States was the New Testament, in 1814. Bibles and school books were the first works to be stereotyped, then came other books which were demanded in many editions, such as the works of popular authors.

CHAPTER II

The Papier-Maché Matrix

PAPIER-MACHÉ (literally, mashed paper) is a combination of blotting paper, tissue papers, and a special paste, combined in a moist, pulpy, thick sheet, called a flong, in which state it is moulded and later is dried out, becoming a relatively hard cardboard.

A papier-maché matrix was first successfully used for casting stereotypes for book pages in France in 1848, and a few years later (1850) Charles Craske, an engraver of New York, introduced the method into the stereotype trade of the United States. In 1854 Craske stereotyped a page of the *New York Herald* and later made stereotypes for other New York newspapers.

By this mode of making a mould two important advantages were obtained. One was that a number of casts could be made in succession from the same mould or matrix, and the other was that while the form was flat when the matrix was made, the matrix, when dried, was flexible and could be bent into a casting box to make a curved stereotype. A still further advantage of the paper matrix over the old plaster method is that low spaces in the form are no obstacle in securing good matrices, as the wet sheet does not sink deep into small spaces in the form.

The early method of making the papier-maché matrix was to lay the moist flong on the form and beat it into the surface by means of a stiff, flat-faced brush until the type penetrated somewhat below its shoulder into the soft sheet. The beating was done by hand and required patience and some skill to get the impression even all over the form. When this was done, thick blankets or several cloths were laid over it and the form was pushed

under the platen of a screw press and clamped tightly. Heat was applied to dry out the moisture from the matrix while it was kept under pressure. This method may be successfully applied to small forms, and is used for job work in places where a simple stereotyping outfit is installed. The hand method, however, is slow and not adequate for large forms. The modern method of stereotype moulding is described later in these pages.

CHAPTER III

The Casting Box

AN early method of casting stereotypes in plaster moulds has already been described. A different style of casting box was used for the paper matrix. As will be readily understood, the mould could not be immersed in the hot metal pot. The paper matrix will stand considerable heat without burning, but it will not stand the heat of the melted metal for very long, nor will it withstand the metal in a super-heated state without injury. It was found that if the matrix was thoroughly dried out and then warmed up when placed in the casting box, it would safely withstand the heat of the melted metal poured against it quickly and then allowed to cool immediately. The drying of the matrix was important, as any particle of moisture would be instantly changed to steam by the heat of the metal.

The casting box for a paper matrix was near the metal pot, but situated where it could be reached quickly, and the liquid was poured in with a ladle.

There were several forms of these later casting boxes, the essential features being an opening between two flat metal surfaces large enough for the matrix, and a little wider than the thickness of the plate desired. This space was closed on three sides to hold the metal, while the open side was held upward to receive the metal from the ladle.

The thickness of the stereotype depended upon whether it was for book work or for a newspaper page. In the first case it was usually a thin plate to be mounted type high on a wood base; in the latter case (and sometimes for job work also) it was cast type high and used as a solid block.

The use of the paper matrix which could be bent to conform to the interior of a curved casting box was a vital factor in the development of the modern web newspaper printing machines. The curved stereotypes solved the problem of the rotary printing form. It could be clamped quickly and securely to the cylinder of the printing machine and thus enable two cylinders—a plate cylinder and a sheet cylinder—to run together in unison at any rate of speed that the rest of the mechanism was capable of accomplishing.

This advantage offered by the paper matrix was quickly seized by inventors of presses, and the curved casting box instantly became an important accessory of the stereotype rooms.

After the introduction of the paper matrix and the curved casting box, the practice of stereotyping was carried on with only minor improvements here and there, until about 1890, when some automatic machinery was introduced. This was undertaken by Henry A. Wise Wood, of New York, and later was followed by McConnell, of Philadelphia, who patented a stereotype plate-finishing machine which took the place of a number of small machines on the floor of the stereotype foundry. Since then various other firms, notably R. Hoe & Co., Wood Newspaper Machinery Co., F. Wesel Manufacturing Co., and the Goss Printing Press Co., have developed machines and methods to a high degree of efficiency.

These automatic machines were developed especially for the hurried work of newspapers, into which channel the stereotyping process naturally gravitated as it was abandoned for book and commercial printing in favor of the more precise electroplating processes.

CHAPTER IV

Modern Stereotyping

AS practiced in the United States today, there are two general methods of carrying on the process, each of which embodies minor practices not common to the other. These are newspaper stereotyping and "syndicate" stereotyping. These bear the relation to each other of a specialized operation and an all-round process.

The newspaper branch of the trade is the natural field for the highly developed automatic quick-producing machines and it is in these places where the experiments of inventors are adopted and worked to the highest practical advantage. The chief product is a standardized plate for a specific printing cylinder, and specialized methods are carried to a limit set only by the number of plates demanded in a given time and the ability of the management to pay for installing the equipment.

Syndicate stereotyping is the term applied to the work done by a number of large establishments in the larger cities which make a specialty of furnishing matrices or stereotype plates to publishers throughout the country. The work is more of the character of job work on a large scale. There are usually many copies made from one original and the making of the original is often a matter of more attention than is given to the same work on a daily paper.

Some of the methods and details of the process vary from the practice of the newspaper stereotype room. Flat matrices and flat casts are employed, and there is great variety in the sizes of the product.

Newspaper Stereotyping

The arrangement of a modern newspaper stereotyping equipment is planned so that the work will go forward in one direction in the least possible time with the minimum of labor. The moulding press is in or near the composing department, within quick reach of the make-up tables. When the page is locked up it is pushed on to a form conveyor and transferred to the table of the matrix roller press. This conveyor is a steel-topped table large enough to take the newspaper page, mounted on large casters at its four legs, and of the same height as the make-up table. The height of the moulding press table also corresponds with this, so that it is merely the work of a moment to push the page to the conveyor, wheel it over to the moulding press, and slide it off again.

Making the Wet Flong

A stereotype flong consists of several layers of special paper pasted together to form a thick sheet. The base is a sheet of special soft card like a firm blotting. On this is pasted in succession two layers of a thin blotting paper, such as is used between the leaves of small blank books. Three or four sheets of strong, white tissue are next added, each sheet except the last being uniformly covered with the paste. The pasting must be done with great care, to cover the entire surface of each sheet and to press out all air bubbles. The sheets must be pressed smoothly but not squeezed so hard as to force the paste out, and must be kept moist until used.

The paste is a special preparation, made with care from several common materials, according to a variety of formulas. Some of these materials are flour, cornstarch, potato starch, glue, gelatin, acacia gum, alum, gum arabic, carbolic acid, dextrin, kaolin, plaster-of-paris,

china clay, barytes, zinc white, litharge, etc. The following formula is given as a typical one:

Mix together with the hands until all lumps are dissolved: $6\frac{1}{2}$ pounds of Oswego starch and $2\frac{1}{2}$ pounds of wheat flour in 6 gallons of water. Then add 12 ounces of common glue, which has been previously dissolved in 2 quarts of water, and 2 ounces of powdered alum. Cook until the mixture boils thick. Stir continuously while cooking. When cold, take out a quantity sufficient for one day's use and add one-half its bulk of bolted whiting. The whiting should be thoroughly incorporated with the paste and the resultant mass forced through a sieve having about twenty meshes to the inch.

The making of a good flong is considered an important part of the stereotyper's trade. Until recent years it has been exclusively a hand-made product, and it will probably be so to a large extent for some time to come.

The number of these flongs required is, however, a considerable item of labor in some places. On a newspaper of twelve or sixteen pages, for instance, which issues three or four editions in the course of a day and an extra number of pages for the Sunday edition, the total number of flong sheets required each week will run up to several hundreds. The time required to make one hundred flongs is on an average about five hours. In the average newspaper room the expense of these sheets has not been a serious item, in most cases not worth considering, as they are invariably prepared some time ahead of use, and are made by some member of the stereotyping force during waiting time before the rush of work comes on.

A flong-making machine has been invented to meet the needs of the larger stereotype rooms, especially those doing "syndicate" work, where the making of flongs in large numbers is an item of direct expense. This apparatus consists of several sets of brass rolls geared together and arranged to carry the several sheets which comprise the flong. Each set of rolls is connected with a small fountain of paste, supplied from a larger reser-

voir. The paper is supplied from webs which the brass rollers draw together and paste, combining them into a continuous flong sheet which, at the end of the apparatus, is cut into sheets of the required length.

Making the Matrix

On the moulding press a sheet of the moist flong is laid on the form. This is then covered with a moulding blanket of thick felt, and the table is moved in under a powerful roller which squeezes the flong down on the page. Sometimes the page is run through the second time, with an extra sheet on the blanket, to make the impression a little deeper. The roller and the bed are so adjusted that the roller surface and the face of the page will move together at the same speed; otherwise the matrix is apt to wrinkle.

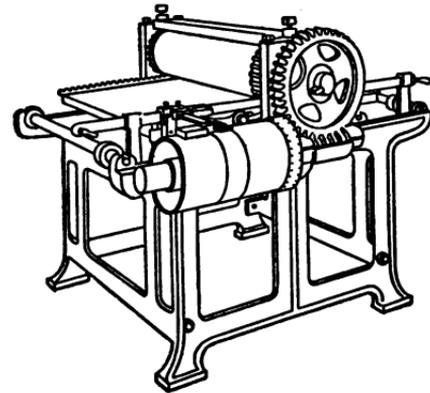


FIG. 1
Matrix-Rolling Machine

The page to be moulded is placed on the table sideways, with the columns running parallel with the impression roller, in order that the strong impression may not push the Linotype slugs or type lines "off their feet" up and down the column. This will be liable to happen if any of the columns are not justified absolutely tight.

With the matrix and blanket still on it, the form is quickly transferred to the matrix-drying press nearby.

Here the blanket is changed for another blanket or two and the form is pushed under a hot platen, where it is again

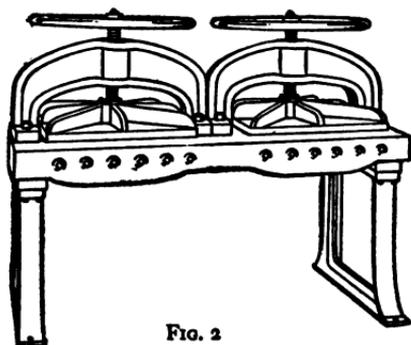


FIG. 2

Double Platen Hand Matrix-Drying Press

squeezed and allowed to remain for a few minutes until the moisture is completely expelled. This drying table is kept at a high temperature, steam heated. Gas or other fuel is used to generate the steam, the equipment for heating depending on the fuel

available. In some moulding rooms the drying table is electrically heated; in such cases requiring very careful, intelligent handling to prevent damage by overheating.

The matrix thus dried out to a sheet of thick, flexible cardboard is trimmed off on the margins and the larger blank spaces in the form are backed with small pieces of thick card pasted so as to support the mould at these spots while the metal is poured on the face.

When thus prepared the dried matrix is then conveyed in the quickest manner (by chute or small carrier) to the casting room. The casting machine and the plate-finishing machines are usually situated near the printing machines.

Casting the Curved Plates

The curved casting box is made especially to mould plates fitting the circumference of the press cylinders. The casting box, like any other mould, is in two parts, so placed together that they may be quickly and easily opened to insert the matrix, then closed tightly to make the cast, and opened again to take out the cast. In the

usual apparatus the part forming the interior of the curved plate is stationary in an upright position and is connected at the top with a pipe through which the melted metal is forced from the metal furnace near at hand. The outer section is balanced to swing up and down on trunnions resting in a frame at its back.

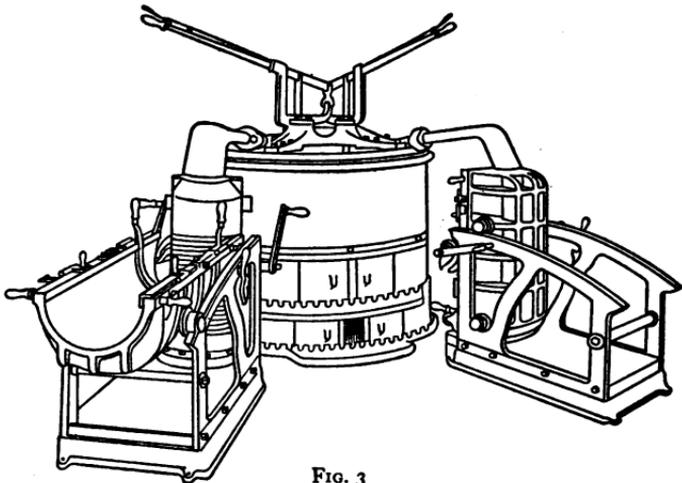


FIG. 3

Stereotype Metal Furnace, with Pumps and Moulds (one open, one closed) for casting curved plates

The metal pot has a round bottom and is situated above a furnace—usually gas, as this kind of heat is easy to regulate. The temperature is kept at about 600 to 625 degrees Fahrenheit. The uniformity of the temperature is an important matter, both in the metal and in the casting box, if good results are to be obtained. If the matrix is absolutely dry and the casting box hot, the metal may be poured at the lower temperature, as there is less liability of scorching the matrix and less shrinkage of the metal in cooling than when the metal is cast very hot.

Just before being placed in the casting box the matrix is laid in a hot oven on a curved surface, to bend it somewhere near the curve of the subsequent cast, and is there roasted until it is bone-dry. It is then dusted over its face with French chalk, a fine, dry, soapstone powder, which helps the cast to come off the matrix readily, especially where several plates are made from one matrix.

The matrix is laid with its face turned inward and its back pressed firmly against the inside of the outer part of the casting box. It is held at the sides by hinged strips of steel which form the straight sides of the mould and of the subsequent cast.

After the metal is poured in and allowed to set for a few moments the outer part of the box is turned down to a reclining position and the cast lifted out and placed on a plate-finishing machine. An automatic machine is now used for this purpose in modern equipments. This has a cylinder upon which the curved plate is mounted. The plate is clamped in position and the cylinder set in motion. Revolving beveled knives are situated at the top and bottom of the plate, and these trim off the surplus metal as the plate slowly turns. When the cylinder has turned sufficiently to trim the plate this way, it stops and then starts on a new motion lengthwise without turning. As it moves this way in line with its axis another set of cutters trim off the two sides of the plate. The trimming in this manner leaves the plate with the edges beveled to fit the hooks on the press cylinder.

Usually the back or inside of the curved plate requires to be trimmed to make it the right height or thickness for the printing cylinder. This is done on a machine with a curved bottom corresponding to the face of the cast, into which the plate is laid, and the shaving is done by a long blade turning on a central shaft.

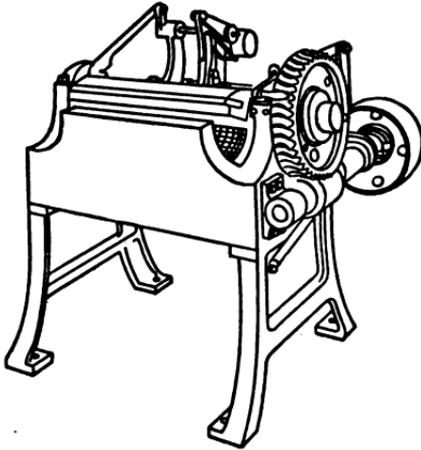


FIG. 4

Machine for Shaving Inside of Stereotype Plates to Uniform Thickness

Where there is a large open space in the page, as in display advertisements, and the paper matrix is not built up to keep this part of the plate deep, to prevent smutting the sheet in printing, it may be necessary to cut away this high place with a chisel. With careful preparation of the matrix, however, this is not often necessary except for very large blank spaces.

Automatic Stereotype Casting Machine

A number of years ago a machine was installed in the stereotype rooms of some of the larger daily newspapers which would automatically cast the curved plate, pass it to the finishing mechanism, cool it, and deliver it ready to go on the printing cylinder. This was known as the Autoplate, invented by Henry A. Wise Wood, of New York.

Later this machine was displaced by a simpler and more efficient mechanism, named the Junior Autoplate, which is in use at present in many large newspaper stereotype foundries. It consists of an upright mould standing near the metal furnace. This mould has an outer shell into which the matrix is fitted. When the matrix is in place this outer shell is closed up against a grooved cylinder, a section of whose surface forms the concaved side of the plate. The metal is forced in from

the furnace pot at the top of the mould. When the cast becomes set, in 14 to 20 seconds, the mould opens and the central cylinder turns slowly, carrying the plate outward with it. As the plate turns it passes a rotating cutter set at the right height in a horizontal position to trim off the tail of the cast, at the top of the mould. When this operation is completed a small arm moves the plate slightly out of its place, so

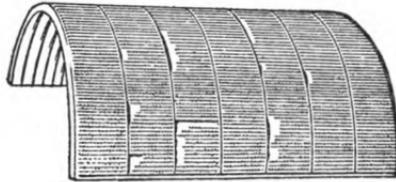


FIG. 5
Curved Stereotype for Newspaper Page

that it can be quickly lifted away. The tail piece is first taken off and goes back into the metal pot for use again.

The bottom and sides of the mould are nicely fitted to cast these three edges of the plate in a finished condition, thus dispensing with several finishing operations required by other methods.

The cast is then placed on the finishing and cooling machine. Here the inside of the curved casting is shaved to make the plate the right thickness and the burs are trimmed by the single turn of a long knife attached to a revolving frame. The plate is then passed automatically over a frame with flowing cold water for further cooling, after which it is dried and is then ready for the press.

The casting box of this apparatus operates at a speed of about three plates a minute, while the finishing and cooling machine will perform its operations at a rate of six or more a minute.

CHAPTER V

The Dry Flong

A RECENT development in the making of stereotype matrices is what is termed the dry flong, or dry "mat." This is a thick, spongy, specially prepared paper which packs together smoothly under pressure.

The advantage of the dry flong is that it dispenses with the drying-out process required by the moist flong, as the matrix can be taken from the form, given a brief toasting to thoroughly dry it, and placed in the casting box immediately. This saving of time is an important advantage in newspaper work, where fractions of a minute are counted important. The dry flong also dispenses with the maintenance of the expensive steam table; and this in turn does away with another source of trouble, that is, the injurious effects upon the page form of the intense steam heat while a wet matrix is drying out.

In the quality of the matrix produced, however, the dry flong appears as yet to give no advantage over the wet flong. Its impression is relatively shallow. Because of the absence of moisture and heat the face of the mould does not come out as smooth as the wet sheet dried under heat and pressure. The impression often appears fuzzy and produces a slightly rough face in the stereotype. There is also a considerable shrinkage in the size of the matrix for large forms. This sacrifice of quality for the benefit of speed is permissible in newspaper work. In many places, however, especially job work and syndicate stereotyping, the preference is still for the older methods which give a deeper and sharper plate.

CHAPTER VI

The Clay Mould

THE plaster mould, made in a special apparatus, is employed in the present-day aluminotype process, referred to on page 65.

A clay moulding process is used in a few stereotype rooms doing "syndicate" work, like the American Press Association, of New York, and the Western Newspaper Union, of Chicago. By this method the original form is moulded in a specially prepared clay and from this a flat stereotype is made. This flat cast is then used as a form upon which to make additional matrices, which are sent to hundreds of patrons throughout the country. The clay mould is deeper than a paper matrix and produces a high relief key-plate especially adapted for this class of work. Because it is a slow method, however, it is not adapted for the rapid work necessary on daily newspapers.

The clay mould is used in Europe more than in this country, and in practice there are many variations in the details, which would hardly be worth while to describe here, as the process is not common enough to warrant more than a general outline.

The clay is a compound, variously combined, of potter's clay, powdered soapstone, plaster-of-paris, kaolin, or similar material, mixed to the consistency of a soft putty. It is spread evenly in a thick layer on an iron plate. The clay-covered plate is then placed on a table where it can be impressed with the form. This is sometimes done by means of a dry press with a swinging head.

In some methods the first impression in the clay is made with a sheet of thin, soft cotton between the form

and the clay, to absorb at the first pressure as much as possible of the moisture from the clay. This gives a shallow impression. The cloth is taken off and subsequent impressions are made deeper to secure the desired depth and compactness.

The mould is transferred to the metal pot and suspended on top of the hot metal until it has become thoroughly dry. A flat casting box is then arranged over the mould and the two parts held together to make the cast.

CHAPTER VII

The Aluminotype Process

THIS is a method of casting plates of aluminum alloyed with copper in plaster moulds. On account of the high temperature required to fuse the metal (1400 to 1800 degrees Fahrenheit) it is not possible to make these casts in papier-maché matrices. Two kinds of alloy are used—one for flat plates, another, softer, for plates which have to be curved when cold.

The advantages claimed for these plates are that they are harder than copper electroplates, that they have a sharper face than stereotypes, and that they weigh about one-third as much as lead. Owing to the toughness of the metal these plates must be cast so that they will require the least amount of trimming. The process requires a special apparatus and is carried out as follows:

The furniture used in locking up a form is of a height equal to the difference between the plate thickness and type high; that is, if the plate is to be .153 inch (11-point) thick, the furniture is .765 inch high. Beveled rules are placed around close to the sides of the form, or if there are several pages, around each page, in order that the plates may be cast with beveled edges. The form is placed on an iron slab and a moulding frame put on top of it, so that the frame will rest evenly on the furniture. Then a composition of clay, asbestos, and other ingredients is poured on the form, and is allowed to set for ten minutes or more. After the composition sets the mould is released from the form and is placed in a hot drying box for about forty-five minutes or until thoroughly dry. The mould in its frame is then covered with another frame and locked in a specially constructed casting machine. The plate is cast by injecting the alu-

minum alloy into the mould under pressure, forcing the metal to flow into all parts of the mould. The cast requires a little scrubbing to release all plaster from the face, and may require more or less trimming (and curving if it is to go onto a cylinder) to make it ready for printing.

It is not claimed that this kind of plate will reproduce fine-screen half-tones or other delicate lines, but for places where a hard wearing plate is desired it gives good service.

CHAPTER VIII

"Cold-Process" Moulds

THERE are several so-called "cold processes" used for making stereotypes. Some of these are patented processes, named after their inventors.

The Dalziel process consists of a privately made composition resembling kaolin, which is spread to a thickness of about 6-point on a sheet of matrix paper. The composition is allowed to set to the condition of putty, when the impression is made on a suitable press, and is then placed on a hot table to dry before the form is removed. The casting is done as for any other stereotype.

The Schreiner process employs a sheet of thick paper, prepared and furnished by the inventor, which is moistened to make it of the necessary softness for taking an impression. This impression is then dried out and the sheet used as a matrix.

It would appear that almost every known plastic substance which would withstand the effect of melted hot metal for casting has been tried for making a stereotype matrix. Inventors without number, in countries where printing is carried on to any extent, have spent time and money working out their conceptions, and many patents have been issued for methods and materials which have been very little used except by the experimenters themselves.

NOTE. Celluloid has been used to make printing plates. In some respects it makes a desirable printing surface, being light in weight and very durable. It is moulded under great pressure while the sheet is in a softened condition and requires a very tough and consequently expensive matrix. Papier-maché and other matrices used for ordinary stereotype casting are not substantial enough to mould celluloid.

CHAPTER IX

The Chalk-Plate Matrix

ANOTHER substance that has been used to some extent as a matrix in its special field is the chalk-covered plate. This is a composition of plaster-of-paris, ground soapstone, chalk, or similar material, with some adhesive ingredient, moistened to the consistency of a fine chalky paste and spread in a thin layer over a polished steel plate. After becoming thoroughly dry it is scraped level to a thickness of about 6-point or less.

This furnishes a ground in which the lines of the design to be printed are cut or scratched with a pointed tool into the chalk, down to the surface of the steel, exposing the polished plate through the chalk covering. It is an engraving operation, not a moulding process, but the result furnishes a mould upon which stereotype metal is cast to produce a relief printing plate.

The process is used only for small work, consisting of sketches, designs, and lettering done by hand, the usual stereotype casting process being employed to make the printing plate.

CHAPTER X

Steam Heat and the Type Form

THE effect of steam heat in the process of drying the matrix on a type form is to cause an expansion of the metal. When newspapers were hand set with foundry type, before the introduction of the Linotype and its more or less porous slug, this repeated heating and cooling of the pages often caused deterioration of the type. A form locked tightly in a strong chase, in which every item was metal, and allowed absolutely no room for side expansion, meant that the expansion occurred in the other direction, causing the type to grow longer. If the form was left to cool while still locked tightly, the type would be higher after the moulding than before, and when it was distributed and again set with other type which had not been subjected to the same treatment, the result in a short time was an assortment of types of varying heights. The effects of the heat on the type were not always the same, and some troublesome results were reported. In some cases it was declared that the type became shorter after cooling than it was originally. These varying results were sometimes attributed to the difference in the quality of the type or in the ingredients of the metal.

Usually the remedy was to loosen the quoins when the form became hot, letting the expansion take place naturally, and to leave it unlocked while cooling. The shrinkage of the metal in cooling would bring

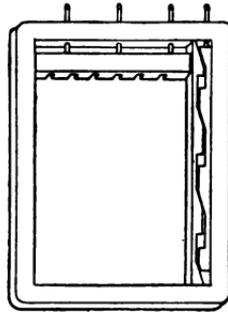


FIG. 6
Newspaper Chase for Holding Page for Stereotype Moulding.

it back to its original condition with slight injury to the type. Another method was to place strips of soft wood reglet, which will easily compress under pressure, around the form inside the chase or next to the quoins.

This kind of trouble has been largely eliminated by the general use of Linotype composition. One reason for this is the great difference in the character of the metal used for line slugs and for foundry-made type. The other is that only a very small portion of a page of Linotype matter is ever used the second time and consequently any effect on the form after the matrix is taken off is of little importance.

Forms for stereotyping do not require to be locked tightly. For the most part they are handled by sliding from one table to another, and need not be so firm as forms that are to be lifted from the make-up surface and carried to another place. Where there is a very solid page and probability that expansion will take place, a loosening of the lock-up will provide for this. This precaution is wise in places where high steam pressure is used to get quick-drying results.

CHAPTER XI

Job Work

IN all newspaper stereotype rooms there is, besides the casting of the regular pages, more or less small work stereotyped. This is occasioned by the need of duplicate headings, engraved blocks, advertisements, etc., and for casts made from matrices furnished by advertisers and by syndicates supplying special features for the publication.

Stereotypes of this kind are cast in small flat moulds, arranged with adjustable side gauges to cast plates of any desired size and thickness. For this work there are several tools required which

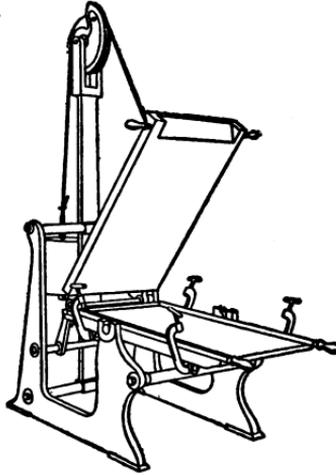


FIG. 7
Mould for Casting Flat Stereotype
(open)

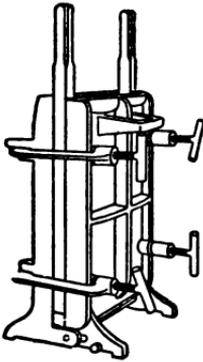


FIG. 8
Bench Mould for Casting
Flat Stereotype (closed)

are not usually needed for work done on the regular page-casting machines. A ladle is used for pouring the hot metal. A shoot-board and planer, or some similar apparatus, is needed for trimming the cast. The saw trimmer and the type-high planer are now the usual machines for such purposes. The manufacturers of the regular newspaper equipments also supply small job casting outfits which include all requisites for the work.

CHAPTER XII

Stereotype Metal

THE early metal used for stereotypes, from an assay of an old book-page plate, was composed of 91 parts lead, 5 parts antimony, and 4 parts tin. The standard

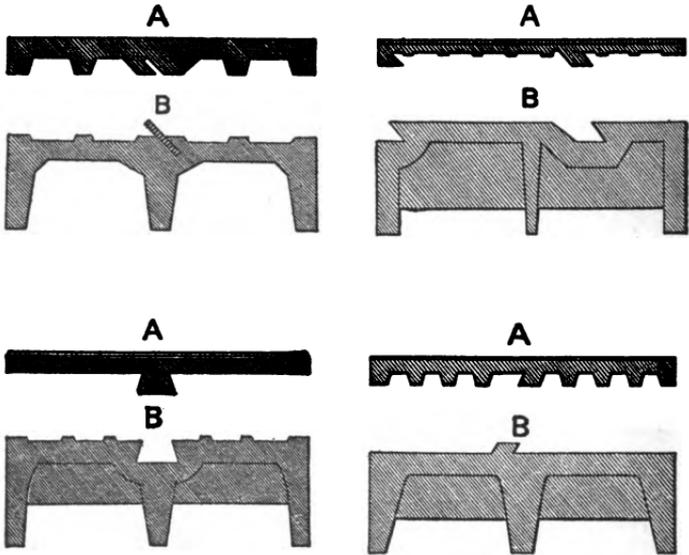


FIG. 9

Above are cross-section views of some typical shapes of stereotype bases used for mounting syndicate stereotypes. The bottoms of the stereotype plates A are shaped to slide into corresponding tongues and channels on bases B which lock the printing plate and base together when used with column rules or other side supports.

metal now used for good plates consists of about 80 parts lead, 6 parts block tin, and 14 parts antimony. In mixing these metals the antimony is melted first, then the lead is added, and the tin last. The cheaper

grades of stereotype metal contain little or no tin. The composition fuses at about 625 degrees Fahrenheit.

For newspaper plates the foregoing formula varies somewhat, sometimes with a little more tin and less antimony. While these are the proportions usually given for good plates, the actual proportions used in different stereotype rooms varies greatly, depending upon the care with which the metal is watched in the re-melting. Every re-melting changes the composition in some slight degree.

Very few stereotypers maintain in their metal any exact percentage of the ingredients, and this variation usually accounts for the wide difference in temperature at which the metal is used. In some places a temperature of 535 to 575 degrees Fahrenheit is sufficient to secure good casting; in others a much higher temperature is maintained. For Autoplate and similar casting machines, a metal temperature of 600 to 625 degrees is recommended.

NOTE. Zinc etchings from the engraving establishments are now common objects around every printing room. The apprentice should be warned not to mix zinc with either type or stereotype metal of any kind. Zinc is a bad thing to get into the combination. A small piece will spoil a kettleful of otherwise good casting metal. There is a method of purifying the metal of the zinc, but it adds to the expense. It is much easier to keep it out than to take it out after it has been mixed.

SUPPLEMENTARY READING

- Electrotyping.** By C. S. Partridge. Published by the Inland Printer Co., Chicago. 212 pp.
- Stereotyping.** By C. S. Partridge. Published by the Inland Printer Co., Chicago.
- Reference Handbook of Electrotyping and Stereotyping.** By C. S. Partridge. The Inland Printer Co., Chicago.
- How to Know Values in Electrotypes.** By H. B. Hatch. Published by Royal Electrotype Co., Philadelphia.
- Principles of Electro-Deposition.** By Samuel Field. An English work on the general subject of electroplating. 383 pp. Published by Longmans, Green & Co., London. 1911.

SUGGESTIONS TO STUDENTS AND INSTRUCTORS

THE following questions, based on the contents of this pamphlet, are intended to serve (1) as a guide to the study of the text, (2) as an aid to the student in putting the information contained into definite statements without actually memorizing the text, (3) as a means of securing from the student a reproduction of the information in his own words.

A careful following of the questions by the reader will insure full acquaintance with every part of the text, avoiding the accidental omission of what might be of value. These primers are so condensed that nothing should be omitted.

In teaching from these books it is very important that these questions, and such others as may occur to the teacher, should be made the basis of frequent written work, and of final examinations.

The importance of written work cannot be overstated. It not only assures knowledge of material but the power to express that knowledge correctly and in good form.

If this written work can be submitted to the teacher in printed form it will be doubly useful.

REVIEW QUESTIONS

1. What are the advantages of stereotyping?
2. What are the disadvantages of the stereotype as compared with the electrotype?
3. What attempt has been made to meet the second disadvantage?
4. Describe in full the ordinary method of stereotyping.
5. What does the word stereotype mean?
6. What was the first form of stereotype?
7. What was the reason for stereotyping?
8. Who was the first to make stereotype pages, and how did he do it?
9. What was the objection to his method?
10. Describe briefly Ged's invention.
11. Describe the Didot method.
12. Describe the method called polytypepage.
13. Describe fully the Stanhope method of stereotyping.
14. Describe a later method of casting from a plaster mold.

15. Who introduced stereotyping into America, and when?
16. What is a papier-maché flong?
17. When and how was the papier-maché matrix introduced to the trade in the United States?
18. What advantages were obtained by this method of making a matrix?
19. What was the old method of making a papier-maché matrix?
20. Describe the casting box for the paper matrix.
21. What is the essential feature of different forms of casting boxes?
22. How thick is a stereotype?
23. What advantage came from the flexibility of the paper matrix?
24. What improvements in stereotyping have taken place since 1890?
25. What is the use of these improved machines?
26. Name and describe two general methods of stereotyping now practiced in the United States.
27. Describe the arrangement of a modern equipment for the first of the above kinds of work.
28. Describe in full the making of the wet flong.
29. Why did a machine for this purpose seem desirable, and for whom?
30. Describe such a machine.
31. Describe in full the making of the matrix.
32. Describe in full the casting of the curved plates.
33. What did the Autoplate do?
34. Describe the Junior Autoplate.
35. What is a dry flong?
36. What are its advantages and disadvantages?

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37. Describe the clay mould process.
 38. Describe the aluminotype processes.
 39. Describe some "cold processes."
 40. How is celluloid used to make printing plates?
 41. Describe the chalk-plate matrix.
 42. What is the effect of steam heat on the type form?
 43. How is the small work handled in newspaper stereotype rooms?
 44. What is the composition of stereotype metal?
 45. What caution should be observed with regard to zinc?

- ALUMINOTYPE**—A printing plate cast in a composition of aluminum metal. See page 65.
- ANTIMONY**—One of the ingredients of stereotype metal. See page 72.
- AUTOPLATE**—An automatic machine for casting and trimming newspaper stereotypes. See page 60.
- BEATING A MATRIX**—The early method of making an impression in a papier-maché flong.
- BLANKET**—The covering of the matrix on the form while it is being dried out on the steam table.
- BUILD UP**—To put small pieces of card or similar substance on the back of the matrix, in places where large blank spaces occur, to keep the matrix up at these points and obtain a deeper cast in the plate.
- BRUSH MATRIX**—A matrix made by beating with a large flat brush.
- CELLULOID PLATE**—Celluloid is sometimes used for printing plates by pressing it into a hard matrix to produce the desired surface. See page 67.
- CHALK-PLATE**—A stereotype matrix made by engraving in a thick film of chalk on a steel surface. See page 68.
- CLAY MOULD**—A stereotype matrix made in a layer of clay. See page 63.
- COLD PROCESS**—A method of producing a stereotype matrix without the use of the usual steam-heating apparatus for drying. There are several methods, mostly patented, but nearly all employ some drying operation to a certain extent.
- DROSS**—The refuse material in a kettle of melted metal; it rises to the top of the mass as a scum.
- FLONG**—The prepared moist sheet, made up of layers of paper and paste, used for making a stereotype matrix.
- MATRIX**—A mould in which a cast of metal or plaster is made. Often abbreviated to "mat."
- PAPIER-MACHÉ**—A strong plastic material made from paper pulp mixed with size, paste, oil, whiting, or other substances, or from sheets of paper glued and pressed together. It is largely used in arts and manufactures, as well as for stereotype matrix.
- PLASTER MOULD**—A matrix made of plaster-of-paris, gypsum, or similar substance. See page 46.
- ROLLER MATRIX**—A matrix made by means of a roller press, in distinction from one made by beating with a brush or by pressure from a platen or flat surface.
- STEREO**—Abbreviation for stereotype.
- STEREOTYPE CHASE**—A strong chase in which forms are locked up for stereotype moulding.

STEREOTYPE METAL—A composition chiefly of lead with small additions of antimony and tin. See page 72.

STEREOTYPE BRUSH—A special kind of strong flat-surfaced brush for beating a moist flong on to the face of a type form to make a matrix for stereotyping.

STEREOTYPE PRESS—A printing machine on which stereotypes are used; a newspaper press. Also a press for making a stereotype matrix.

STEAM TABLE—A specially constructed steel table fitted with steam pipes, for drying out stereotype matrices.

ZINC IN STEREOTYPE METAL—See note on page 73.

TYPOGRAPHIC TECHNICAL SERIES FOR APPRENTICES

THE following list of publications, comprising the **TYPOGRAPHIC TECHNICAL SERIES FOR APPRENTICES**, has been prepared under the supervision of the Committee on Education of the United Typothetae of America for use in trade classes, in courses of printing instruction, and by individuals.

Each publication has been compiled by a competent author or group of authors, and carefully edited, the purpose being to provide the printers of the United States—employers, journeymen, and apprentices—with a comprehensive series of handy and inexpensive compendiums of reliable, up-to-date information upon the various branches and specialties of the printing craft, all arranged in orderly fashion for progressive study.

The publications of the series are of uniform size, 5 x 8 inches. Their general make-up, in typography, illustrations, etc., has been, as far as practicable, kept in harmony throughout. A brief synopsis of the particular contents and other chief features of each volume will be found under each title in the following list.

Each topic is treated in a concise manner, the aim being to embody in each publication as completely as possible all the rudimentary information and essential facts necessary to an understanding of the subject. Care has been taken to make all statements accurate and clear, with the purpose of bringing essential information within the understanding of beginners in the different fields of study. Wherever practicable, simple and well-defined drawings and illustrations have been used to assist in giving additional clearness to the text.

In order that the pamphlets may be of the greatest possible help for use in trade-school classes and for self-instruction, each title is accompanied by a list of Review Questions covering essential items of the subject matter. A short Glossary of technical terms belonging to the subject or department treated is also added to many of the books.

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A primer of information about composing sticks, galleys, leads, brass rules, cutting and mitering machines, etc. 47 pp.; illustrated; 50 review questions; glossary.
3. **Type Cases, Composing Room Furniture** By A. A. Stewart
A primer of information about type cases, work stands, cabinets, case racks, galley racks, standing galleys, etc. 43 pp.; illustrated; 33 review questions; glossary.
4. **Imposing Tables and Lock-up Appliances** By A. A. Stewart
Describing the tools and materials used in locking up forms for the press, including some modern utilities for special purposes. 59 pp.; illustrated; 70 review questions; glossary.
5. **Proof Presses** By A. A. Stewart
A primer of information about the customary methods and machines for taking printers' proofs. 40 pp.; illustrated; 41 review questions; glossary.
6. **Platen Printing Presses** By Daniel Baker
A primer of information regarding the history and mechanical construction of platen printing presses, from the original hand press to the modern job press, to which is added a chapter on automatic presses of small size. 51 pp.; illustrated; 49 review questions; glossary.
7. **Cylinder Printing Presses** By Herbert L. Baker
Being a study of the mechanism and operation of the principal types of cylinder printing machines. 64 pp.; illustrated; 47 review questions; glossary.
8. **Mechanical Feeders and Folders** By William E. Spurrier
The history and operation of modern feeding and folding machines; with hints on their care and adjustments. Illustrated; review questions; glossary.
9. **Power for Machinery in Printing Houses** By Carl F. Scott
A treatise on the methods of applying power to printing presses and allied machinery, with particular reference to electric drive. 53 pp.; illustrated; 69 review questions; glossary.
10. **Paper Cutting Machines** By Niel Gray, Jr.
A primer of information about paper and card trimmers, hand-lever cutters, power cutters, and other automatic machines for cutting paper. 70 pp.; illustrated; 115 review questions; glossary.
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A primer of information about the composition, manufacture, and care of inking rollers. 46 pp.; illustrated; 61 review questions; glossary.
12. **Printing Inks** By Philip Ruxton
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By Harris B. Hatch and A. A. Stewart
A primer of information about the processes of electrotyping and stereotyping. 94 pp.; illustrated; 129 review questions; glossaries.

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Suggestions for the apprentice compositor in setting his first jobs, especially about the important little things which go to make good display in typography. 63 pp.; examples; 55 review questions; glossary.
19. **General Job Composition**
How the job compositor handles business stationery, programs and miscellaneous work. Illustrated; review questions; glossary.
20. **Book Composition** By J. W. Bothwell
Chapters from DeVinne's "Modern Methods of Book Composition," revised and arranged for this series of text-books by J. W. Bothwell of The DeVinne Press, New York. Part I: Composition of pages. Part II: Imposition of pages. 229 pp.; illustrated; 525 review questions; glossary.
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