iron founder asserted himself, and it is only since the introduction of the steam engine that any real progress has been made in the foundry business. Now it has reached such a state of perfection that no matter how complicated the article, it can be made.

The introduction of the marine engine has stimulated great ingenuity in the production of heavy and intricate castings. I well remember that when a large cylinder was to be cast it was not uncommon to have it made over the third time before it was accepted; whereas at the present day it is as much as a moulder's reputation and position is worth to save a single blemish upon it. This is the advantage of specializing in the foundry.

Nevertheless it has been truly said that every foundryman should have some knowledge of chemistry; especially that related to his work. It is not so essential to know what an iron contains as it is to know how to utilize the different constituents to the best advantage in the various classes of work required. Theoretical knowledge is of very little value to the foundryman without the practical experience, as great care and watchfulness are required to insure success. The exactness of our art is unlike that of any other. One must follow regular laws, and one small variation will destroy all the work in one minute which may have taken weeks to produce. Very little has been done in the way of machinery for moulding, all the appliances simply being designed to help the skilled moulder whose mind has to be kept continually at work in order to keep up with the requirements.

While the engineer has been making rapid progress with the steam engine for transportation purposes, and has compelled the foundry to be based on science, the founder of specialties has not been behind in his endeavor to produce castings in quantity and of quality, and with the duplication of so many parts the ingenuity of the designer of moulding machines has had splendid results, increasing the output enormously and improving the quality. The moulding machine is now an indispensable factor in the foundry.

Since the introduction of metal into the patternshop there has been a tendency to do away with the regular gated patterns and to substitute aluminum and other metal webs which do away with sand matches and the breakage of gated patterns. The webs are practically indestructable, and when the patterns become obsolete, one has the value of the metal for other patterns.

While the designers of moulding machines have made rapid progress, they have never been satisfied with their work, and in consequence, at every convention, we have been surprised by something new in this line. We have had the indispensable stripping plate machine which produces a most perfect casting, but we must yet dispense with much of the hard work required in ramming moulds. Power rammers of various kinds have been adopted such as those working by steam, eccentric pressure, jolting, etc., which have been applied as a rule to special work. This year we have an innovation in the way of a moulding machine which I predict will extend the machine moulding business as the gravity principle has been applied in a new way. This system has been attracting considerable attention for the past three years in different sections of the country. Mr. Anthes, our vice-president for Canada, has made some valuable experiments along this line which have been very successful. At the same time in the far south and middle west other men, unknown to each other, were experimenting along the same line.

The method is taken from the fact that the most intricate kind of ramming is accomplished by riddling the sand at one side and throwing it into the intricate parts of the mould. For instance, a gear wheel can never be rammed successfully in the teeth with a rammer. This principle is now carried further and applied to every part of the mould in the form of a machine called the gravity moulder. One other good feature of this machine is that one can adopt a special flask the full size of the machine. We have adopted a standard size, 3 feet by 4 feet with a 5-inch cope depth and a similar drag with bars bolted in. One can put any number of sections together to get any required depth. With the stripping plate attachment good and rapid work can be done, the greatest difficulty being the handling of moulds as fast as the machine produces them.

This is the latest development in the art of moulding and is based on the successful application of the force of gravity. Most of the experiments have been based on the theory that the greater the distance the sand has to fall the harder it will pack in the flask. Experience has demonstrated, however, that the reverse is the case, and that the mere dropping of the sand into the flask does not serve to pack it, and the greater the distance it is allowed to fall the less it will pack by reason of the increased tendency to scatter or disintegrate while falling through the air.

The inventors of this machine discovered in their experiments that to successfully utilize the force of gravity, the essential requirements are first in forming separate, unitary bodies of sand of the proper size and shape and degree of firmness, and the discharging of these bodies from an elevation sufficient to cause them to pack together in the flask by the impact of the fall. When these separate bodies of sand are properly formed, it is only necessary to have the fall a comparatively short distance to accomplish the desired results.

It has been found in practice that to make successful the gravity method of moulding it is necessary:—

First—To form the sand into proper size and properly shaped bodies.

Second—To compress these bodies to a considerable degree of firmness before their discharge into the flask.

Third—To discharge a series of these compressed bodies into the flask from an elevation not great enough to cause the sand to disintegrate or scatter, but at the same time of sufficient height to cause the same to pack firmly and uniformly around the pattern.

While the above indicate the first essential requirements in successfully utilizing the force of gravity for machine moulding, at the same time numerous problems of minor importance were met with in perfecting a machine that would perform all the functions necessary to meet these requirements. This has been accomplished in the gravity moulder, which makes use of a simple mechanism for forming, compressing and discharging, from a sufficient elevation, elongated bodies of sand, or compact and separate strips of sand, each body being long enough to extend full width of the flask in one direction, and of such thickness that a series of these bodies falling into the flask side by side are required to form a layer of sand across the flask in the opposite direction.

In other words, by the gravity method the flasks are rammed by a succession of compressed bodies of sand falling and wedging beside each other until a layer is formed across the entire area of the flask, after which additional layers are built up in the same manner until the entire mould is formed in one solid mass of sand of the same degree of firmness throughout.

With this method of ramming it is unnecessary to vent the mould, as there are no hard spots caused by the rammer, and it leaves the sand in a free but solid condition in the mould.

POSSIBILITIES OF THE ELECTRIC FURNACE IN FOUNDRIES.

"We do not want to produce chemical changes in our mixtures if we can help it. We want only to melt quickly, produce very hot iron, and punish the metal as little as we can. Every time we melt the metal under present conditions we hurt it somewhat, the degree of the damage done depending upon a number of conditions, both chemical and physical. We counteract this by additions of steel to reduce the total carbon or select the silicon content in such a way that with the reduction in this element incident to the process, a strong iron results. If, however, we could have a process which in no way changes the composition, we could put into the melt just what we want out of it, and one of the serious difficulties of foundry metallurgy would be solved. Again, if we could regulate the temperature in such a way that the iron is not overheated while melting, but can be heated up very high afterwards, we could obviate the oxidation of the metal during the melt, and in addition remove any existing evil of that kind by the use of ferro-manganese in the melt when it has been brought to practically a steel temperature, at which point the ferro-manganese will do its work.

"The induction furnace, it seems to me, fills these requirements, and I would like to see more work done along this line for the foundry. It would seem to me that scrap of all kinds, properly selected, is all that need be melted, cleaned by some ferro-alloy, and then cast in the usual way. The enormous steel production will always yield scrap enough to supply the demand for small steel castings, once a process of this kind can be made to work commercially.

"Taking the non-ferrous metals. A brass foundry would have abundant use for an electric melting process if run on the line laid out above. The melting loss in the brass foundry in zinc and tin is a great one, and one that runs up into money quickly. A clean wasteless process, as the electrical one should be, would be a boon to the industry. There are many foundries which could melt, with a short periods of time during the day, or night when their plant is not used for its regular purposes. Hence only the electrical apparatus proper might be required, the necessary power being available."—Dr. R. Moldenke in "Electrochemical and Metallurgical Industry."