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SCIENTIFIC AMERICAN SUPPLEMENT

No. 681.

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THE BOOK PUBLISHING TRADES AND INTERNATIONAL COPYRIGHT.

A recent inquiry set afoot by this journal discovered that the sale of cheap books throughout the country is even larger than is generally supposed, and there is not any evidence, at least we could not find any, to sustain the assertion that the taste for these cheap reprints is on the wane. Competition in their production, it is true, is growing closer and closer, and consequently profit in making and vending them has been greatly reduced of late, and is likely to suffer a still further decline. Twenty-five cent editions, once regarded as remarkably cheap, are giving way to equally good editions retailing at fifteen and ten cents, and indeed the same books are now being published in a still cheaper form, though in smaller type, selling for six and three cents, and there are those who believe that editions like those last mentioned will yet be had for one cent the volume.

Examining the objections advanced by those opposed to the conditions now prevailing in the publishing trades, the non-partisan, if familiar with the change that has come through the introduction of "cheap editions," will hardly fail to conclude that self-interest on this as well as on the other side of the water has much to do with the demand for international copyright, and that the objectors to the present condition have not, in their haste, fairly considered the advantages which the general public are now and have long been enjoying because of this condition. Works of the masters of fiction, the faculty of learning, are now distributed at trifling cost among a multitude who could not hope, under the restrictions proposed, to have easy access to them. Does any one doubt that the taste of the public has been improved by this general distribution of good literature? If he does, let him compare the titles of the paper-covered books at the railway news stand and at his stationer's with those of the "dime novels," the "penny dreadfuls," of the years agone, let him inquire into the sales of these cheap editions of the best authors, and compare them with the demand and supply of these same works when they were published only in expensive form.

The supply of cheap literature has begotten the demand, and this has grown apace with what it fed on. What but this and the consequent taste which this has inculcated could have led to the wonderful development of the publishing trades which we see around us? Ought we to do anything to restrict this industry?

The moral point which has been thrust forward so prominently in this debate, and which some allege to be the most important point at issue, may not, because of this assumed importance, be left out in a consideration of the subject. To the average mind it will appear that if we demand no more of the foreigner than he accords to us we cannot be held, even by the severest moralist, to be his debtor or be fairly accused of withholding from him his due. An American book is scarcely any, if at all, more secure in England than an English one is here, for, though it is thought by some that, under British laws, prior publication in England will secure the work of an American author, the fact has by no means been established as yet, and there is a growing opinion that it will not be.

That there is a strong desire in England for a reciprocal copyright law there is no doubt, but are we morally bound to accede to it? If so, it would seem to follow that we ought to accede to the other and similarly expressed desire of reciprocity of trade, and we do not remember that the moralist has made an issue here.

It may be said in closing that the publishers themselves are far from united upon the question of international copyright, and that the solicitude evinced by many of them for the native author seems almost unnecessary upon a review of the evidence recently collected by us from the entire city trade as to authors' sales. Good literary work is in large demand, and those who can furnish it, so we learn, have more orders than they can fill at remunerative prices.

Action of Sea Water upon Cast Iron.

BY CARTER NAPIER DRAPER.

The results of the long continued immersion of cast iron in sea water are well known, and examples may be found in most of the books of reference. The most frequently cited instance is perhaps that related by Berzelius,* of cannon balls which were raised at Carlscrona from a ship sunk for fifty years, and which had become converted through one-third of their mass into "a porous graphitic substance, which became strongly heated when exposed to the air for a quarter of an hour." The chemical change which cast iron undergoes under these circumstances is usually stated to consist in the removal of the greater part of the iron, the residue consisting of graphite and a graphitic substance, FeC_2.

I have recently been indebted to the kindness of Mr. John P. Griffith, C.E., of the Dublin Port and Docks Board, for a specimen of gray cast iron which was broken from an old rail taken from a graving slip in the port of Dublin, and believed to have been laid in 1833. The rail was at about half tide level, and it may be therefore assumed that it was for twenty-five years immersed in sea water, and for a like period exposed to the action of the atmosphere. The fragment of iron weighed 557·31 grms., and measured 85 by 52 mm., with a depth of 20 mm. On its lateral surfaces it was slightly incrusted with sesquioxide. The upper surface for a depth of 7 mm. had been converted into a brown gray graphitoidal substance, which was without difficulty removed with a knife, leaving the surface of the iron bright and free from any adherent coating. During the operation of removing the easily pulverulent layer, the mass of iron became hot, not hot enough to cause inconvenience in handling, but hot enough to enable it to be very sensibly warm to the touch after the lapse of half an hour.

The quantity of altered cast iron thus removed weighed 67·59 grms., and was examined with the following results: It was wholly attracted by the magnet. Treated with dilute hydrochloric acid it evolved hydrogen, giving a pale green solution of ferrous chloride and a residue of graphite. The carbon was determined by the method of Weyl. The finely powdered substance, with excess of strong hydrochloric acid, was placed in a platinum dish, connected with the positive element of two Smee cells, while a platinum wire terminal from the negative dipped into the liquid. After twenty-four hours the contents of the dish were transferred to a filter, washed, dried, and weighed: 2·66 grms. of substance gave a carbon residue weighing 0·631 grm. = 23·6 per cent of carbon. By the reaction with free iodine abundant evidence of the presence of unoxidized iron (doubtless existing as FeC_2) was obtained.—*Chem. News.*

* Gmelin's Handbook, vol. ccxviii.

Invention of the Power Loom.

In view of the great importance of the power loom, it is perhaps well not to forget the name of its inventor, so that the lapse of time may not obliterate it, and his invention be contended for by a number of claimants, as is the case with so many others.

In the year 1793, a Scotchman, by the name of Andrew Kinloch, who was an instrument maker by profession, with the assistance of an old watchmaker built the first two power looms that were ever constructed in his little shop, in a monastery in Glasgow. The money necessary was furnished by two merchants of the city. The actuation of the looms was effected by a common crank, and after about fifty yards of good fabric had been woven on them, the experiment was considered to be successful. Kinloch at once received an order to build forty others, and the first forty-two looms were afterward operated by water power at Milton, in the vicinity of Dumbarton, Scotland. He was also appointed superintendent of the mill, and taught two pupils to become loom fixers. One of them, Walter M'Lutheon, was for many years afterward superintendent of the Wellington Mill, Hutcheston, near Glasgow, while the other, Archibald Barlay, received a similar position in the Coterine Mills, in Ayrshire. These two men were the first who used a screw wrench for regulating a power loom. The walls of the small old mill at Milton are still standing, overrun with ivy, as a hoary reminiscence of bygone days. The old wheel house still contains the water wheel of thirty-three feet diameter, used for actuating the looms. Two of the old looms had even been preserved, and were to be sent to the London world's exhibition of 1851. It happened, however, that the warehouse in which they were kept was destroyed by fire, and the looms shared the same fate.

After having been in operation for about twenty years, the mill was finally suspended in 1813, because it was not sufficiently remunerative. The beaming and sizing machine had not yet been invented. A firm at Paisley, Scotland, bought the forty looms, and operated them for a number of years with steam power. A short time after their purchase, however, the beaming and sizing machine was introduced in Glasgow, by which power loom weaving became remunerative, and within a few years after thousands of such looms were built and operated both in England and Scotland. In 1842, Walter M'Lutheon was still superintendent of the Wellington Mills in Glasgow, and also old Mr. Kinloch was still alive. He went once on a visit to Glasgow, and the bosses, fixers, and beamers of the already numerous mills in Glasgow celebrated the occasion by tendering him a sumptuous dinner. At the close a collection was taken up for the old man, which resulted in sixty pounds. He spoke of his early trials and mishaps, and said that, in Scotland, the weavers had offered no opposition to his invention. It had been otherwise in England, however, where the hand loom weavers had been of the opinion that they would be reduced to starvation by the introduction of the power loom. The first mill, at Staleybridge, England, which he had fitted up with one hundred looms, had been destroyed and burned during the night. It had been rebuilt shortly afterward, however, and fitted out on a larger scale than before. His life had been threatened repeatedly, for which reason he had lived for some time in America, where he had on all sides been received with open arms, and every facility had been offered him to introduce his loom in the different parts of the country. A few years afterward his looms had been introduced all over the continent of Europe.—*Industrial Record.*

Blow Holes.

The presence of blow holes in steel ingots has been accounted for by many ingenious hypotheses, and it would take several columns to relate all the theories that have been put forth to explain their formation. The latest exposition of the causes at work in producing this defect in steel castings comes from the pen of Mr. W. F. Durfee,* and has the merit of simplicity, while it offers an explanation which appears to fit the facts better than some. It will be remembered that in an ingot of mild steel the blow holes are not uniformly diffused through the mass, but are congregated in a band which, as seen in a cross section of the ingot, runs parallel with the sides at a distance varying from ¾ in. to 2 in. from the edges. Now, whatever may be the nature and origin of the gases which have created the cavities, it is evident that a mechanical cause must be sought to account for their symmetrical arrangement in the mass of the metal. Mr. Durfee finds an analogy to the action which takes place in pouring an ingot in the blowing apparatus called the tromp, used in furnishing the blast for the forges of Catalonia. In this instrument a vertical pipe several feet in height connects two vessels. The upper vessel is kept filled with water, while the lower, which is closed, is connected by a tube with the tuyere of the furnace. At a short distance from the top of the vertical pipe there are a number of air inlets, while the mouth of the pipe is closed by a valve. When this valve is raised the water rushes down, and by its descent it draws in air through the holes provided for it. The air and water descend together into the lower box, which acts as a separator; the air at a moderate pressure rushes through a tuyere into the fire, while the water escapes through an opening which is always kept sealed. A modified form of this device is sold to supply air to the blowpipes of glass workers. This phenomenon of the enlargement of air by a descending column of water may be demonstrated by aid of a tumbler held under an ordinary water tap. When the tumbler is filled, a stream of bubbles will be seen to descend the center of the vessel along with the incoming water, and then to divide and flow up the sides. A part of the air is caught again in the eddy just before it reaches the surface of the liquid, and is again carried down, so that there are always a large number of bubbles in the water arranged in a central column and a peripheral belt. The fluidity of water is so perfect that immediately the stream is stopped the bubbles all escape, but if a quantity of mucilage or gelatine be added to the fluid to render it viscous, then the air is detained, and it is possible to study the arrangement of the bubbles at leisure. By pouring melted gelatine into an ingot-shaped mould, and then cooling it very rapidly, a honey-combed mass may be obtained bearing a very close analogy to an ingot of steel.

It must be confessed that the pouring of an ingot is quite as capable of giving rise to air bubbles as is the running of a stream of melted gelatine. The molten steel falls through the air, and is somewhat viscous, while it rapidly begins to solidify when it meets the surface of the mould. There is, however, a striking difference between the air bubbles in steel and those in gelatine, the former being greatly the larger. This can be accounted for by the great expansion of the air caused by the heat, and by the dissociation of the water carried in the very moist air of the casting pit. Taking the temperature of the molten metal at 3,300 deg. Fahr., the air would suffer a sevenfold expansion, while the volume of the water would be increased from two to three thousand times when converted into gases at ordinary temperature and pressure. Hence a very small bubble of air may well be conceived to produce a blow hole of large size even when compressed under a head of several feet of fluid metal, although the oxygen probably combines immediately with the steel to produce the iridescent lining usually found in the cavities, leaving behind it little besides hydrogen and nitrogen.

The examples used to explain the presence of blow holes in steel suggest the means of getting rid of the cause of them. The air bubbles rise out of a glass of water the moment the stream stops, while in the case of mucilage the rate of clearing is inversely as the viscosity. Now, if the fluidity of steel be largely increased, it is a fair inference that there would be a proportionate decrease in the number of blow holes to be found in an ingot. This extra and hitherto abnormal fluidity can be obtained by adding to the metal in its molten state one-twentieth to one-tenth of aluminum, which at once brings the steel to a condition in which it will run like water, and enter the tiniest crevices of a mould. The reason of this effect is not known, but it is not at variance with characteristics of many alloys which are known to have far lower melting points than any of their constituents. Already aluminum is largely used in the production of iron castings made from melted scrap, and the experience gained with it shows that while it renders iron perfectly fluid at a temperature at which it would otherwise be scarcely more than pasty, it improves the quality, and confers upon the metal an increased tenacity twenty per cent greater than that of the iron from which it has been made.

It is to aluminum that Mr. Durfee looks for the more or less complete abolition of blow holes in ingots. He believes that it is only necessary to render the steel sufficiently fluid for the air globules to be able to disentangle themselves, to do away with this great defect, which in spite of all rolling and forging detracts from the strength of objects made from this metal. No doubt an increased fluidity would improve all classes of steel castings, but if it is the air which is carried down by the falling metal which constitutes the cause of blow holes, surely a mechanical remedy could have been found for it. Moulds can be filled without letting the steel drop through the air like water from a tap, and a very easily tried experiment would show whether Mr. Durfee's hypothesis is correct or not. Whether it be or not, there appears to be great hope in the use of aluminum.—*Engineering.*

* Proceedings of the United States Naval Institute.

PHOTOGRAPHIC NOTES.

Film Negatives.—During the past year, improvements in the production of negatives on thin transparent gelatine and collodion films have been effected, which will eventually do away with the use of glass as a support, and thereby considerably lighten the labor of the amateur. Speaking of these prepared sensitized films, Mr. Pumphrey, in the *Br. Jour. of Photo.*, says:

The sensitive medium is supported on a paper back, but is separated from it by a special non-actinic medium, which secures three points. It prevents the light from the camera passing from one film to the next; it prevents any grain being communicated from the paper; and it holds the film during the stages of exposure, development, fixing, drying, and varnishing, and when the whole is completed and dry the film is *lifted quite clear and clean from the bed* which has carried it.

The film is quite strong enough in the smaller sizes to be used in any dark slide which has a rabbet all round, if a piece of thick card is placed behind it. For sizes larger than 6½ × 4¾ inches a slide with one glass and a back to press against the glass is recommended.

The films are as flat and manageable as plates. They only require to be placed in a dish and the developer poured over. No wetting to start with. Any developer will answer with the film, but I recommend the following:

A.

Warm water	2	ounces.
Sulphite of soda	2	"

When cold, add:

Sulphurous acid	2	ounces.
Pyrogallic acid	½	ounce.

B.

Carbonate of potash	3	ounces.
Sulphite of soda	2	"
Water	7	"
Solution C (bromide of potassium)	1½	drachms.

C.

Bromide of potassium	1	ounce.
Water	2	ounces.

To develop, mix equal parts of A and B, and to every half ounce of mixed solution add from half an ounce to six ounces of water, according to the taste of the operator. The more water, the slower the development and the weaker the negative. The stronger the developer, the stronger the negative.

The proportion of bromide of potassium may be increased if a stronger picture is aimed at, or reduced when softer results are desired. The film when wet is sufficiently transparent to allow of accurate attention being paid to the density if it is held close to the lamp.

Fix in clean hyposulphite of soda, placing the negative face downward, as if the film rises above the surface it may be discolored. Be careful to fully remove the bromide, as it is not quite as easy to determine as with plates; leave long enough. Pass into a saturated solution of alum to harden, and clear, for not less than five nor more than ten minutes. If left much longer than ten minutes the film becomes brittle, but on no account omit the use of the alum. Wash after the alum for not less than four or five hours, as less time will not make a permanent negative.

To Dry.—Take the film and remove the water by draining, or with a cloth or paper, place it face downward and paste the back of the film, put the pasted film on a stout card or millboard at least an inch larger each way than the film. One other precaution is needed, that is, to prevent the edges turning up as it dries. This is secured by pasting a narrow strip of paper over about three-sixteenths of the edge of the film, and the rest on the card. Allow the film to dry, but not in a hot room. The moisture will pass through the card at the back as well as from the surface of the film. It will take ten to twenty hours. The feel of the surface will be a guide to when it is quite dry. A suitable paste is made by mixing one ounce of flour with six ounces of cold water, till all lumps are broken up, and then boiling.

Varnishing.—This should not be omitted, as it gives stability to the film and prevents injury in printing. Take the card and film and warm at a fire to a temperature of about 100°; apply the varnish with a brush and again warm at the fire. The film may now be lifted, but first pass a knife all round between the film and the supporting medium. It will then lift with the greatest ease. The cards can be used many times over if the medium be removed by rubbing. The drying of the film causes the card to twist by its slight construction. In pasting a fresh film on the card always put it on the convex side.

Sensation of Warmth Produced by Carbonic Acid Gas.

At a recent meeting of the Physiological Society, Berlin, Dr. Goldschneider spoke on the fact, which has been known for a long time, that when carbonic acid gas is allowed to come in contact with the skin, it produces a greater sensation of warmth than air of the same temperature. He has carried out a prolonged series of experiments to determine the cause of this increased sensation of heat. He examined first the purely physical factors which might have some influence on the observed facts—namely, the moistness, specific heat, and heat absorption by the gases. When he compared the sensation of heat produced by moist air with that produced by dry air, he found that the former always seemed the greater. The difference between the two might be as much as 5° C. to 6° C. when the air was at a higher temperature than that of the skin. Thus, air at 35° C. whose saturation with moisture was 80 produced the same sensation of heat as air at 41° C. whose saturation was only 30. When experimenting with carbonic acid gas, he found that a difference of 40 in the saturation produced a difference in the resulting sensation of heat corresponding to 2° to 3° of temperature. But even when equally moist or dry air and carbonic acid gas were allowed to act on the skin, the sensation of heat produced by the latter was always the greater. It does not seem possible to explain the greater sensation of heat with carbonic acid gas by reference to the extremely small differences of specific heat of air and this gas, still less by reference to their somewhat greater coefficients of heat absorption. He also investigated the effect of the more ready absorption of carbonic acid gas by fluids, by removing the epidermis with a blister on a circumscribed portion of the skin and allowing the gas to act upon this place. The carbonic acid gas was speedily absorbed by the lymph, but it still produced a sensation of greater heat even when all moisture was removed from the surface exposed by the blister. He hence considers that the purely physical properties of the gas will not suffice to explain its remarkable influence on the sensory nerves for heat. Dr. Goldschneider next investigated the physiological factors which might suffice to explain the observed phenomenon. He proved that there is no recognizable objective rise of temperature under the influence of the carbonic acid gas. It is true that he observed now and again a distinct dilatation of the blood vessels, but this was by no means constant, and not sufficient to account for the increased sensation of heat. He proved, however, as has been observed by many physiologists, that the carbonic acid gas has a direct effect upon the sensory nerves; but in contrast to the results of others, who attribute an anæsthetic action to this gas, he observed that at first it produces a hyperæsthesia of those nerves specially connected with the production of heat sensations, and then this makes way for an anæsthesia. The nerves connected with heat sensations were more strongly stimulated than those connected with sensations of cold. The speaker summed up the results of his extremely numerous experiments by urging that in addition to the greater absorption of heat by the carbonic acid gas and its power of producing hyperæmia of the skin, its action is to be explained chiefly by its direct chemical action on the endings of the nerves concerned in the production of sensations of heat. This, therefore, is to be regarded as the cause of the observed phenomenon, that when carbonic acid gas is brought into contact with the skin, it produces a greater sensation of heat than does the contact of equally warm and equally dry air.

THE *Age of Steel* cautions its readers against filling a box with Babbitt metal without first washing the box with alcohol and dusting over the surface with sal ammoniac. Wherever a tinned surface is formed, cover the remaining surface of the box with clay wash to protect it against the attack of the fused metal. To solder a joint that is to be carefully united, the surfaces must be nicely fitted with a file and then cleaned thoroughly before bringing the parts together. A piece of tin foil will occupy a small space, and cover the whole surface, and when the work is heated slowly in a fire, the parts can be united so nicely that the joint will be almost invisible.