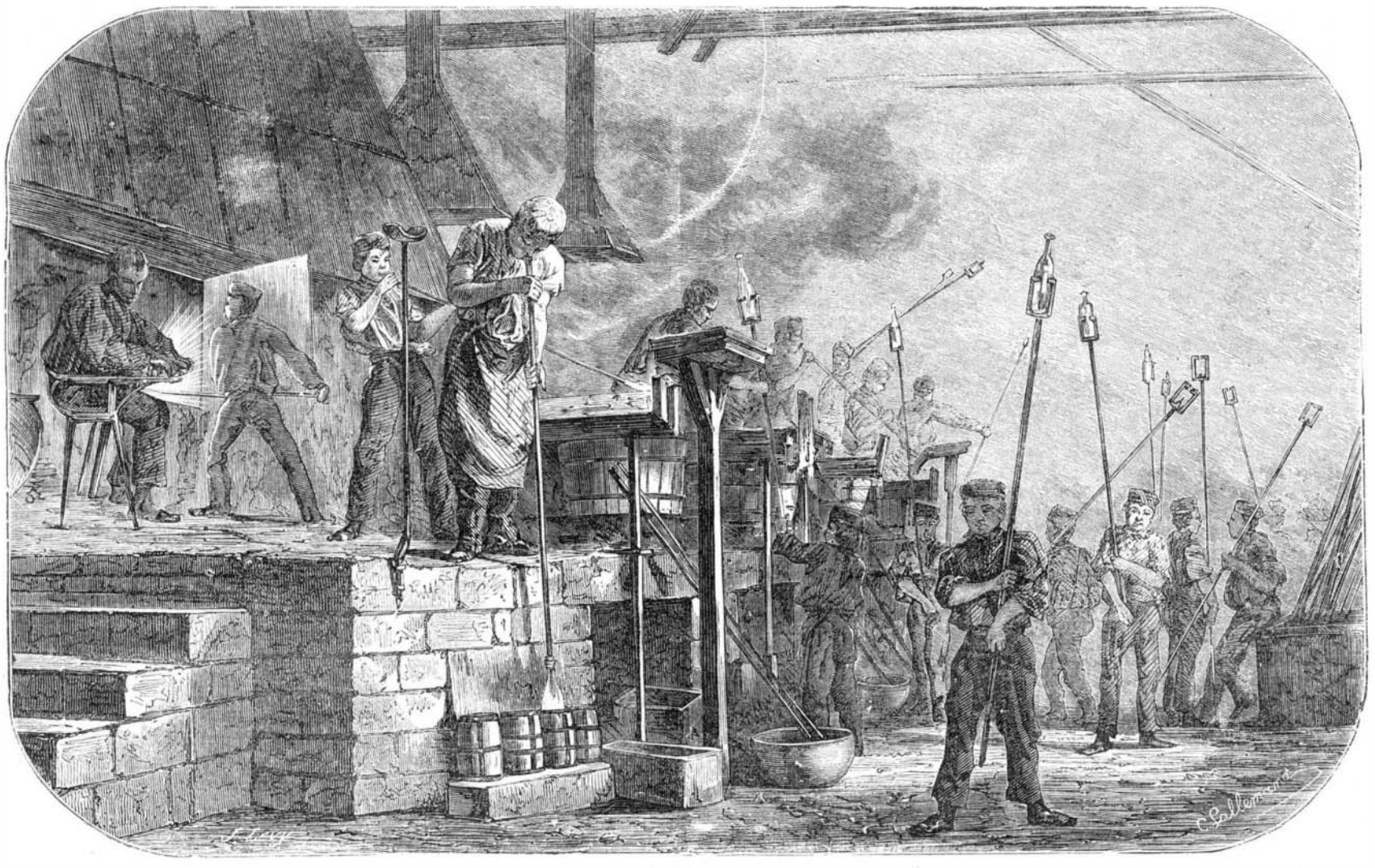
SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXI.---No. 15. NEW SERIES.] NEW YORK, OCTOBER 9, 1869. $3 per Annum [IN ADVANCE.]



MANUFACTURE OF GLASS BOTTLES.

The Glass Works of the Departments of the Loire and the Rhone, France.

For several years the various glass works of the two Departments of the Loire and the Rhone have been united in one company, under the management of Mr. Charles Raabe, who has introduced several improvements in the manufacture. The manufacture may be divided into three classes, viz., first, that of glass bottles; second, colored sheet glass; third, sundry glass ware.

THE MANUFACTURE OF BOTTLES.

This branch can be divided into five departments: the preparation of the crucibles, the setting of the furnaces, the manner of heating, the composition of the charge, and the manufacture proper.

The preparation of the crucibles demands the greatest care, and thus far no mechanical method has been able to replace their being manufactured by hand. They are made of fire-clay and the remains of old crucibles, freed from adhering vitreous particles. When properly dried and heated they will last from twenty-five to thirty days. The crucibles must necessarily resist the pressure and the chemical action of the molten mass in the furnace, and must also bear moving and withdrawal. To a certain extent the company owes its success to the careful manufacture of the crucibles.

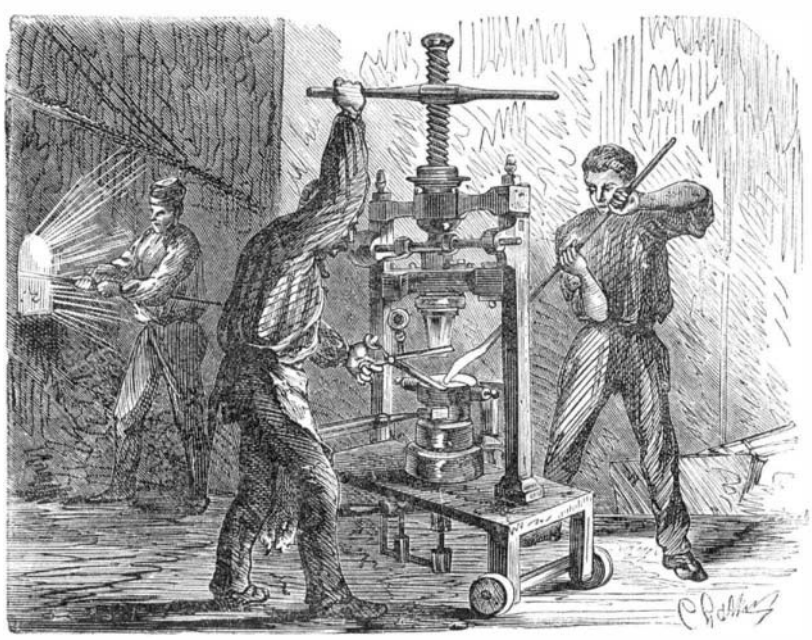
The charges for the production of glass are composed of three principal substances; sand, carbonate of lime, and marine salt. The charges containing iron yield black glass; those that are free from iron yield clear glass. A mixture of the two produces the quality used for the manufacture of champagne bottles.

The manufacture proper is divided into four periods or terms; the charge, the melting, the cooling, and the manipulation.

When the mixture or frit is withdrawn from the vaults of the furnace, it is poured into crucibles, which are filled to the rim. This operation lasts from twenty to twenty-five minutes. The melting occupies from twelve to thirteen hours, during which time the temperature is kept at a red heat. In three hours' time the mixture attains a complete state of fusion. Its volume becomes considerably reduced, and then the charging is finished. Two hours previous to the termination of the melting the crucibles are filled up with calx or refuse glass.

The melting is so well managed in respect to fuel, the men are so well instructed, and the quality of coal so well selected for the furnaces, that every available economy is realized.

The so-called cooling is the time of about one hour and a half that follows the melting, during which the temperature is allowed to fall, the mixture is in a state of repose, and the fused materials arrange themselves according to their order of density, the glass becomes homogeneous, and fines down.



PRESS FOR MOLDING GOBLETS.

GOBLET MAKERS.

The scum is then removed from the surface. The last part of the manufacture is the manipulation, which lasts from eight to ten hours, and during which time the temperature is kept at a red heat, and the glass preserves a suitable consistency. To every crucible there is allowed sufficient room for three men—a blower, a lad, and a boy. The boy dips the glass, the lad finishes it, blows, and prepares the neck; the workman then blows the bottle, by introducing it into a mold (as shown in the large engraving), detaches it from his rod on to a table, and takes hold of the bottom with a pair of tongs. The ring around the top is then formed by presenting the neck of the bottle to the mouth of the furnace and running a string of melted glass round the extremity. The neck of the bottle is then placed a second time within the mouth of the furnace, and finished off by means of a pair of nippers. The finished bottles are handed to boys who carry them on the ends of rods to the baking furnaces, where they remain from twelve to thirteen hours exposed to a temperature of from 200° to 100°. All these operations offer many inconveniences to the workman, who is thereby exposed to a great heat, and is obliged to place the ring on the neck of the bottle while in contact with the flame. In order to ease the workmen of the company, Mr. Raabe, studied a series of improvements for which he took out patents in 1861. These improvements diminish the duration of the work, and avoid its dangers. In principle, the object is to completely suppress the thread of glass around the neck. The neck of the bottle is re-heated at a supplementary opening, then forced into a mold, and, by a slight rotary motion, assumes the form of the ring. Till then this result could not be obtained, owing to the hardness of the bottles. The advantages gained by this improvement are: the eyes are not strained, the ring is necessarily regular and neat, the mouth of the bottle is regular and smooth, and the cork more completely fits the interior cylindrical surface, the operation is more rapid, and yields six hundred and fifty bottles per man per day, instead of six hundred. Mr. Raabe has, therefore, gained rapidity, economy, safety, and the protection of the health of the workmen. Bottles of all the company's molds are disposed throughout the whole of France, at Strasburg, Paris, Nantes, Bordeaux, and Marseilles, large stocks being kept in the two latter cities. The samples exhibited at the London Exhibition, were marvels of production. The chief feature of the bottles manufactured by the company is in the poise of the neck on the body of the bottle, the softness and rotundity of the mouth and in the finish of the rim. Form and solidity are the two results gained. Some experiments made a few years back, by the Society of Encouragement, of Paris, in reference to their power of resistance, gave results that could not be obtained by any other manufactory in France or abroad. Since then progress has been made, and the use of the bottles manufactured by the company, has acquired a considerable development in the south, in the districts of Jura and Bourgoyne, for the sparkling wines made there. Even Champagne, the mother country of all effervescent wines, has commenced to draw her supplies of bottles from this company, which, notwithstanding some disadvantages, enters into competition with the old manufacturers of that locality. The following table of bottles manufactured, will illustrate the success obtained:

1853–4, 17,101,000; 1856–7, 19,583,000; 1858–9, 21,833,000; 1860–1, 23,581,000.

THE MANUFACTURE OF COLORED GLASS.

The great point in the manufacture of colored glass is the composition which here plays the chief part and decides its success. There are two kinds of colored glass—that colored in mass, and lined or covered glass. In the glass colored in bulk, the color must be uniform throughout the whole, imparting the desired hue without destroying the transparency. This, however, is not the most difficult part of the work. When glass is covered, it is necessary that the two surfaces be very perfect and that they coincide thoroughly and adhere solidly. The thickness of the colored layer must be regular, and the two glasses must not be contrary in the sense of contraction. The company had such perfect success in fixing these conditions that it may well be asserted that no covered glass can be compared to their manufacture. The compositions are infinite in their variety, and many are kept secret. The following is the composition of common sheet glass: Fontainebleau sand, 100; sulphate of soda, 36 to 40; carbonate of lime, 40; ground charcoal, 4 to 5; peroxide of manganese, 2 to 3 parts. Red glass is composed of Fontainebleau sand, 100; alkali, 18; oxide of tin, 20; oxide of copper, 15; oxide of iron, 10 parts. Oxides of chrome, cobalt, and manganese are also used for other colors, and lampblack for yellow. The lining of glass with chrome green has not been attained, but recent experiments give hopes of success. The fixing of red glass on yellow has been successfully achieved in the workshops of this company, and forms quite a new feature.

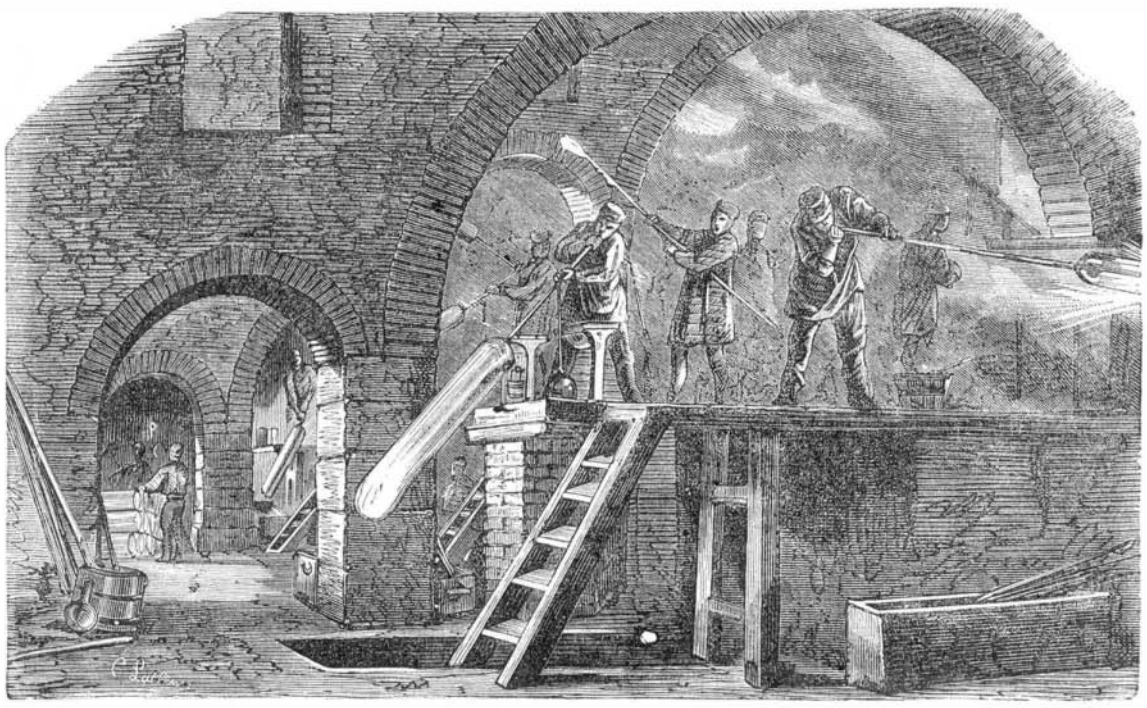
The manufacture of glass cylinders is preceded by a special operation, namely, that of preparing the enamel, which is too well known to require any description. The four periods of manufacture, previously alluded to in that of bottles, is here again brought into practice: the charge, the melting, the cooling, and the manipulation. The melting takes sixteen hours, during which time—the same as for bottle glass—the crucibles are filled up as the contents diminish. For certain colors, such as rose, violet, and yellow, the duration is limited to twelve or thirteen hours.

The cooling takes two hours, and after the skimming has been effected, the manipulation commences, which lasts from fifteen to sixteen hours, the temperature being a clear red heat. That work, represented in one of the small engravings, requires but one man, but one of the most adept. An assistant dips one dipper full of colored glass and places it on the end of the blowing rod, and passes it to the blower, who puts on three dips of white glass, blowing the muff in the same manner as for window or sheet glass. The enamel being well prepared, spreads with the white glass during the blowing and the stretching of the muff, and forms a uniform covering on the inside. After the longitudinal extension of the cylinders comes the stretching. The stretching of colored glass has only the peculiar feature that the workman uses the wooden polisher to stretch the sheet on the iron table, instead of the iron one, which would spot the colors. When the stretching is finished the sheets are left to cool for seven or eight hours. The sheets are about 32 inches by 24 inches, but much larger can be made. Since the exhibition of 1855, America and England have taken large quantities of colored glass. Glass, either covered or colored in bulk, is used for painting, etching, railroad signals, lighthouses, general ornaments, etc., but lined glass is especially used for etching or engraving.

In white sheet glass the south cannot well compete with the north of France, in respect to whiteness, owing to the primary materials. The manufacture is conducted in the same manner as in colored glass.

The manufacture of goblets or glasses is of excellent quality, and varied among the products of the glass works of the Loire and the Rhone. Here, however, and especially for chemical use, the color is faulty, notwithstanding numerous experiments to render the crystal pure and white. It was finally resolved to construct furnaces on the Belgian system, that is, of a circular shape, with a large grating in the center, charged from two openings in the furnaces. Two flues, placed between two consecutive crucibles, draw the air into the vertical flues which run along the top into the large chimney which stands some twelve feet higher than the roof. In this manner, with stronger draft and a more intense heat, the pots can be left uncovered, thereby avoiding the fumes, and yielding a very white glass, from Fontainebleau sand and lime from the Rhone.

The appreciation of the Jury of the great Exhibition of London, was based more upon the qualities adapted to general consumption and the low prices, than otherwise, and these conditions were amply fulfilled by the company. The number of furnaces in use is thirty, twenty of which are at Rive-de-Gier, nine at Givors, and one at Vienne. Twenty-two are used for the manufacture of bottles, three for white sheet glass, two for colored sheet glass, two for the manufacture of drinking glasses, and one for common glassware. The company holds the first place among the manufactories of France, and employs in all some two thousand men, women, and children.



MANUFACTURE OF COLORED SHEET GLASS.

What English Workingmen Think of Free Trade.

We learn from the *Ironmonger*, that a well attended meeting, convened by "the Trades of Great Britain Defense Association"—a body which, it was stated, was inaugurated by the masters and journeymen lathrenders of London at a meeting in May last—was recently held at the Shoreditch Town Hall, "to take into consideration the present critical state of the country, the depression of trade, and the general want of employment, consequent on the importation of foreign manufactured goods, and to petition Parliament for a commission of inquiry as to the working of our commercial policy." The following resolution was moved by Mr. S. Bartlett: "That the principle of free trade should be based upon an equality of international exchanges; but, other nations not having adopted the principle, it has become injurious to England, and is the cause of the present depression of trade, the want of employment and the increase of pauperism. This meeting, therefore, considers it their duty to the Government to institute an immediate inquiry into the working of our commercial policy, with the view of ascertaining how far this unreciprocated free trade contributes towards producing this depression, want of employment, and pauperism, and to what extent it may be limited so as to produce an effectual remedy." The mover said the subject of the meeting was not to protest against free trade *per se*, but against the manner in which the policy inaugurated by the Manchester school of economists had affected the manufacturing and industrial interests of the country. The free trade policy of England was not reciprocated by other countries, and no more striking proof of this could be found than the fact that, according to the Board of Trade returns, the imports of this country exceeded the exports in value by £67,000,000. Mr. Cobden and his co-laborers promised the workingmen increased wages and a reduction in the cost of provisions, but what was the result? Industry after industry was being annihilated, and emigration was the only panacea suggested. There was a grevious error at the bottom of this state of things, and he hoped the working classes would unite as one man in the request to the Government to inquire how far our so-called free-trade policy had produced the present depression in trade, and the consequent pauperism and want of employment. Mr. Sangster, in seconding the resolution, asserted that we lost immensely by the French treaty, which he said was of a protectionist character, and ignored the free trade principle as far as England was concerned, and if it was not put an end to would cause the ruin of English commerce and industry. English exports were heavily taxed by every nation, and it was time that something should be done to insure fair play, else foreign manufacturers would inundate our market, and the representatives of our manufactures would become the hewers of wood and drawers of waters of Europe. Mr. Brooks, in an animated speech, attributed the increase of pauperism and its accompanying ills to our commercial policy, and denounced the notion that nothing but emigration could improve the condition of the working population. The resolution was unanimously adopted; and a petition to Parliament, embodying the views of the speakers having been adopted, the proceedings terminated.

Dust.

The atmosphere teems with dust—more, of course, in towns and cities than in the country. There are three great and never-ending sources of dust. One is the beating about of woven fabrics, such as the sweeping of carpets, brushing clothing, and making beds. The next is the wear of the roads by horses, vehicles, and pedestrians. The third is the burning of fuel. There are also other sources of dust too numerous to particularize. Nothing but air-tight vessels will exclude dust. It is pumped in and out of every watch, every bookcase, jewel-box, or casket, every cupboard, every writing-desk, immediately there is the slightest change of temperature of the surrounding air. The expansion or contraction of the air causes it to pass in and out of the most minute fissure. A glass-covered engraving will quickly show whether it is perfectly lined to exclude dust; if it is not so, at the point where the air passes in and out under the glass there will the print exhibit a pointed brown dust discoloration. This is the kind of dust which we see in cities and towns. But dust has other aspects, from the dust storms of Egypt and Australia, to the particular dust made during hay-making time, the thrashing of corn, and the grinding of grain. Starchy granules are at all times to be found in the air. Again, the atmosphere is loaded with seeds. No sooner is a new railway bank thrown up of the purest virgin gravel, than in a few weeks it is covered with verdure. The great purifier of the air from dust is rain; the air is thoroughly washed by rain, and the dust therein for a time is removed. It is the excessive dust in the air, though not visible, which in dry seasons is the cause of many diseases.—*S. Piesse*.

THE London *Spectator* says the English mechanic gains little or nothing by emigration, except the chance of a good gratis education for his children. The unskilled laborer gains, in addition, a great increase of wages, of comfort, and of liberty; while the agricultural laborer may be said to gain everything.

There has been a Providence caring for mankind millions of years before the first man stood erect in this creation. The first coal-making plant that waved in the breeze was prophetic of the coming man.