A NEW MEANS OF USING COMPRESSED AIR IN THE MANUFACTURE OF GLASSWARE.

In the production of hollow glass vessels there have always been two obstacles which from time immemorial have very seriously hampered the glass-blower. Of these obstacles, the first is that the inlet opening of the hollow vessel can never be larger than the end of the blowpipe. The second is that the hollow vessel thus produced can never be greater than the volume of air which a strong man can blow through the pipe, or the mass of glass which he can conveniently handle. The first obstacle has been partially, though indifferently, overcome by subsequent reheating and manipulation. By spurting water through his blowpipe, the glass-blower has succeeded in producing fairly large receptacles, for the expansive force of the steam generated assists the air from his lungs. But despite these ingenious makeshifts it has not been possible to blow a glass receptacle larger than a carboy having a capacity of 25 gallons.

Since the glass-blower's lungs have but a limited power, it was but natural that inventors hit upon the idea of employing compressed air. Philip Arbogast, of Pittsburg, as early as 1881 took out a patent for an invention which contemplated the use of compressed air and which has served as a foundation for subsequent attempts. But although compressed air has been widely employed in the manufacture of certain articles, it has never supplanted the human glass blower, particularly in the making of large receptacles.

A German inventor, Paul T. Sievert, now comes to the fore with a process that bids fair to solve the problem of blowing large vessels and overcoming the difficulties which have hitherto baffled the glass manufacturer. By means of this new process vessels varying in size and shape from the tiniest watch-glass to the largest bath-tub can be blown with a facility which has never been hitherto attained. That the Sievert process is capable of fulfilling these claims is clearly shown in the sixth of our figures. All the vessels pictured in the illustration were completely blown without any subsequent grinding or cutting. The time in which these receptacles were made is almost incredible. The production of the bath-tub was a matter of not more than five minutes. Several days in the cooling oven were, however, still required before the tub was ready for use. Moreover, the process of making these vessels is singularly clean. No rubbish heap of broken glass is to be seen anywhere in the Sievert plant in Dresden.

The means by which glass is blown into pots and tubs of any size will be best understood by reference to Figs. 1, 2, 3, and 4, representing the various stages in the blowing process. The apparatus employed consists of a thick, perforated cast-iron plate having the form of the opening of the tub to be produced. On the raised margin of the plate a separable frame is placed, held in position by locking-levers, which frame serves the purpose of confining the outer edge of the glass mass within the limits of the cast-iron plate. The combined plate and frame are mounted on a hollow shaft, journaled in suitable bearings and arranged to turn. By means of the hollow shaft and the perforated iron plate, compressed air can be forced into the molten glass. From a ladle suspended from a traveling-crane a sufficient quantity of molten glass is poured on the iron plate. Our first figure represents this stage.

The liquid glass flows over the entire plate and beneath the superposed frame surrounding the plate. Since the metal cools more rapidly at the margin, the glass begins to congeal and stiffen first at its outer edge. When this marginal rigidity has been reached, the entire plate and frame is turned through a half circle. Fig. 2 shows the plate as it is describing its half turn. The glass lies on the plate in a smooth, glittering layer. It is still hot, but not self-luminous; and for that reason its color is black in our pictures.

The glass no longer rests on the plate, but hangs therefrom, supported by the chilled and now rigid outer edge. But the central portion being still ductile and plastic begins to sink. In order that the glass may thus fall uniformly throughout its mass, a bed-plate, operated by rack-and-pinion and a chain-gear, is brought into contact with the slowly sinking bag of plastic glass. Upon this bed the glass spreads and forms the bottom of the tub. Fig. 3 pictures this stage of the process.

By allowing the bed to fall slightly the glass is pulled down and the walls of the tub formed. The glass has become cool and tough by this time. Through the hollow shaft and the perforated iron plate compressed air is now forced into the forming tub, the operator so controlling the current that the tub's walls can be given any inclination. When the tub has been given the desired form the air blast is cut off.

In order to release the finished tub from the perforated iron plate the parts of the superposed frame (now, however, located beneath the plate) are separated by means of the levers previously mentioned; the bed is allowed to descend still further; and the finished bath-tub, rigid, though still hot, is liberated from the grip of the frame and iron plate. Fig. 4 shows the completed product. The hot glass tub is now hauled on a cart to a cooling oven.

In exactly the same manner a glass receptacle of any size or shape can be blown. The weight of the plastic mass is no longer a hindrance to the glass-blower; it is even utilized in the production of the finished product.

The Sievert process is not limited to the making of pots, trays, tubs, bottles, and like utensils. It seems destined to have no small influence on our methods of making plate-glass. From the recent articles which have appeared in the SCIENTIFIC AMERICAN, our readers will understand that the window-glass which we employ is rolled out and then polished. Herr Sievert, however, intends to dispense with all rolling machinery and to blow his plate very much as he blows his bath-tubs and pots. So far as we are at present informed two methods are pursued in blowing plate glass, which methods are respectively pictured in Figs. 5 and 7.

The first of these methods consists in blowing a cylinder (Fig. 5) after the manner previously described; in allowing this cylinder to cool; in cutting it lengthwise into two parts and severing the bottom from the body; and in causing these severed portions to flatten into plates by the application of heat. The second of these methods (Fig. 7) consists in blowing glass into the form of a huge box by means of a cubical mold and in breaking away the five plates formed by the bottom and sides. Fig. 7 shows the box in process of formation and represents a gigantic bubble of glass 4 feet high and 5 feet wide, the thickness of the walls being somewhat more than one-tenth of an inch.

Although the Sievert process can be followed in blowing all kinds of receptacles, it is found in actual practice in the making of small utensils that the glass chills too quickly to be blown into shape. Another method has, therefore, been devised no less ingenious than the first.

We all know that a drop of water that has fallen upon a hot object—a stove, a glowing sheet of glass—does not come in contact with the hot surface, for the reason that it is buoyed up by a cushion of vapor. Nor does the drop boil rapidly away. It is slowly converted into steam and then gradually disappears. This "caloric paradox," as it is sometimes called by physicists, is profitably employed by the glass-blower; for, the water does not cause the glass to crack, and generates enough steam to assist in expanding the vessel at the end of the blow-pipe. Upon the same phenomenon Herr Sievert bases his method of forming small glass utensils, reversing it, however, by placing his hot glass on a layer of water instead of blowing water into his hot glass.

In order to make a developing tray such as every photographer uses, very hot and therefore very liquid glass is poured on a sheet of wet blotting-paper. The glass does not touch the paper, does not even scorch it, but dances on the wet surface as it flows in all directions. By means of a wet roller, such as every housewife uses in flattening dough, the glowing mass is distributed evenly in a thin layer. The plate thus formed is lifted with a pair of tongs and laid on a sheet of wet asbestos upon which it still continues to dance. Upon the plastic plate a mold of the tray to be produced is then placed. The steam generated, which is the cause of the restlessness of the plate, then forces the plastic mass up into the mold. The tray is finished. And thus it is possible to produce a glass vessel of any shape whatever.

Zeppelin Ruined by His Airship.

Count von Zeppelin, who has the distinction of having built the largest of all airships, has been financially ruined by his aeronautical experiments. Unable to obtain means for carrying out his new projects, he is now breaking up the old framework of his airships in order to sell the aluminium of which they are composed. Zeppelin is sixty-seven years of age. He is something of a historical personage. He was military attaché of the German Embassy during the civil war, and made several balloon ascensions from battlefields of the South in 1863. He was the leader of the famous cavalry raid into France in 1870 which marked the commencement of hostilities of the great Franco-Prussian war.

Austria Adopts the Braun Wireless Telegraphy System.

It is announced that Siemens & Halske, the owners of the Braun patents, have signed a contract with the Austrian government for the installation of the Braun system of wireless telegraphy on the Adriatic coast.

Several designs of hods are now made of steel, and they are said to be much lighter and more serviceable than those of wood. These are pressed out of a single piece of metal, which fact is said to account for their great durability.

Correspondence.

That Frozen Mammoth.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with great interest in your issue of April 12, the note on the recent discovery of the body of a mammoth, in cold storage, by Dr. Herz in the ice-bound region of Eastern Siberia. This, it seems to me, is more than a "Rosetta Stone" in the path of the geologist. It offers the strongest testimony in support of the claim that all the glacial epochs and all the deluges the earth ever saw, were caused by the progressive and successive decline of primitive earth-vapors, lingering about our planet as the cloud vapors of the planets Jupiter and Saturn linger about those bodies to-day.

Allow me to suggest to my brother geologists that remnants of the terrestial watery vapors may have revolved about the earth as a Jupiter-like canopy, even down to very recent geologic times. Such vapors must fall chiefly in polar lands, through the channel of least resistance and greatest attraction, and certainly as vast avalanches of tellurio-cosmic snows. Then, too, such a canopy, or world-roof, must have tempered the climate up to the poles and thus afforded pasturage to the mammoth and his congeners of the Arctic world—making a greenhouse earth under a greenhouse roof. If this be admitted, we can place no limits to the magnitude and efficiency of canopy avalanches to desolate a world of exuberant life. It seems that Dr. Herz's mammoth, like many others found buried in glacier ice, with their food undigested in their stomachs, proves that it was suddenly overtaken with a crushing fall of snow. In this case, with grass in its mouth unmasticated, it tells an unerring tale of death in a snowy grave. If this be conceded, we have what may have been an all-competent *source of glacial snows*, and we may gladly escape the unphilosophic alternative that the earth grew cold in order to get its casement of snow, while, as I see it, it *got its snows and grew cold*.

During the igneous age the oceans went to the skies, along with a measureless fund of mineral and metallic sublimations; and if we concede these vapors formed into an annular system, and returned during the ages in grand installments, some of them lingering even down to the age of man, we may explain many things that are dark and perplexing to-day.

As far back as 1874 I published some of these thoughts in pamphlet form, and it is with the hope that the thinkers of this twentieth century will look after them that I again call up the "Canopy Theory."

ISAAC N. VAIL.

Pasadena, Cal., April 16, 1902.

Crossing the Sahara by Balloon.

The aeronautical problem which is just now receiving most attention in France is a voyage across the great desert of Sahara. M. Deburaux considers it absolutely practicable to travel from Tunis to the Niger by means of the winds traveling in that region. He declares himself ready to make the experiment. Up to the present time his ambition has remained unrealized, for the reason that the necessary funds have not been forthcoming. To construct and equip a balloon with a carrying capacity of several passengers would entail a cost of about $160,000. For economical reasons the plan has been advocated of sending up an experimental balloon controlled by automatic devices. The expense involved in this undertaking would be only about $4,000.

The equilibrium of this experimental balloon is to be maintained by means of a steel cable weighing half a ton. Ballast in the shape of 5,000 pounds of water is carried in the tank. Automatic means are provided to discharge this ballast when the balloon falls to within 150 feet of the ground. The balloonette, which has figured so prominently in the Santos-Dumont airship, will be used to keep the gas bag in shape, in spite of the leakage of gas. Prof. Deburaux believes that the nomadic tribes of the desert, who might pick up this balloon, would probably convey the information of their find to civilization. But whether the nomads of the desert are sufficiently imbued with the scientific spirit, is a matter of some doubt. Perhaps a better plan would be to offer a reward for the return of the balloon or of some account of its fate.

St. Louis Airship Races.

The conditions of the races for the capital prize of $100,000, offered by the World's Fair management have been published. Tentative rules for the time of the races, shape of course, type of airship, and the like have been drawn up. It has been definitely decided that $200,000 shall be appropriated for the contest, to be divided as follows: $100,000 for a grand capital prize; $50,000 to be divided into a number of subsidiary prizes; and $50,000 devoted to the conduct of the competition and the payment of general expenses.

The Chemistry of Confectionery.

An interesting lecture was recently delivered before the Society of Arts in London by Mr. William Jago upon "Chemistry of Confectionery." In flour confections or cakes—not sugar confections or sweets proper—the principal substances used are flour, milk, eggs, and sugar. For confectionery the weaker and softer flours, containing much starch and little gluten, are preferable. Milk is used as a moistener instead of water, because of its richness, average pure new milk containing 4.0 per cent of fat, 3.6 per cent proteids, 4.5 per cent sugar, 0.7 per cent ash, 8.8 per cent non-fatty solids, and 78.4 per cent of water. It is not only the fat in the milk that is of service to the confectioner, but also its proteids, which, though like the white of eggs have no very pronounced taste, yet confer a fullness of flavor which a simple solution of lactose in water would not possess. In baked goods the proteids of milk produce a moistness and mellowness of character, and new milk therefore gives to confectionery richness through its fat, sweetness through its sugar, and mellowness through its proteid.

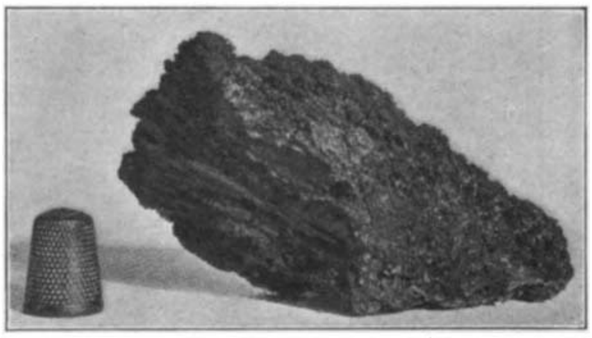
Next to milk, eggs are one of the most important moistening agents to the confectioner. In composition the white of eggs consists of proteids dissolved in water, while the yolk contains in addition to the proteid, fat and coloring matter. The white of eggs may be viewed as a solution of one part albumen in seven parts of water, while in the whole egg about two-fifths of the solids consist of fat and three-fifths of proteid, while the water of the whole egg amounts roughly to three-quarters of its weight. Another moistening agent used by confectioners is glycerin. If exposed to the air glycerin increases in volume through absorption of moisture. Chemically glycerin is a compound of carbon, hydrogen, and oxygen, belonging to the alcohol type. When used in small quantities in cakes the result is that drying is much retarded and the cake remains fresh and moist for a considerable time longer than would otherwise be the case.

Many aerating agents are used by confectioners, the chief of them being ammonium-carbonate, usually called "ammonia," or volatile sodium bicarbonate, tartaric acid, and cream of tartar. The chemical action of these on the confectioner's paste is to change the sugar present by fermentation into alcohol and carbon-dioxide gas, which has the mechanical effect of distending and lightening the dough. If, for instance, ammonium carbonate be mixed with other constituents of a dough, there is very little change perceptible until the dough is placed in the oven. With a rising temperature the liberated carbon dioxide and ammonia gases distend the mass and so produce the desired lightness. Like ammonium carbonate, sodium bicarbonate only commences to evolve gas when subjected to the heat of the oven, and even then it only evolves half its gas. When, however, it is treated with an acid the whole of the carbon dioxide gas is evolved, and of all acids the most convenient for this purpose is tartaric acid. When tartaric acid and sodium bicarbonate are mixed with flour in equivalent quantities, the result by moistening with water is that the acid attacks the carbonate, liberating all its carbon dioxide and forming normal sodium tartrate. The latter salt is comparatively tasteless, and the presence of the quantity produced as a residue from the amount of acid and soda necessary for the aeration of an average dough is not sufficient to injuriously affect the flavor of the resultant goods.

The British Admiralty has been carrying out a series of important armor-plate tests at the Whale Island butts, Portsmouth, for the first time with the 2-inch armor plates used in protective decks, and intended to form the splinter screens behind the guns in the central battery of the new 16,500-ton battleships. Plates from all the armor works were tested. The manufacturers were not on this occasion called upon to submit special sample plates. The Admiralty used those plates which they had already bought for the splinter screens. The results were highly satisfactory.

LONDON SMOKE DEPOSITS.

Of late years a great deal of attention has been drawn to the question of London smoke, and during the recent great fogs in that city, a number of experiments were conducted by Sir William Thistleton-Dyer, which showed that solid matter, consisting of soot and tarry hydrocarbons, was deposited during the worst fogs at the rate of so many tons to the square mile every week.



The size of the mass is shown by comparison with the thimble.

SMOKE DEPOSIT FROM ST. PAUL'S CATHEDRAL.

The fogs of the Thames Valley can, of course, never be avoided; but that particular quality of fog which takes its distinctive name from the great city itself could be prevented if its citizens were willing to use smokeless coal in place of the highly bituminous coal which they favor at the present time. There is a society in London known as the Coal-Smoke Abatement Society that has strenuously grappled since 1898 with the problem, and with the very best results. At a recent meeting of the Society, Prof. A. H. Church exhibited a specimen of a remarkable atmospheric deposit, which had been taken from the cornice below the dome of St. Paul's Cathedral. It is believed that this specimen, which is herewith illustrated, had taken about two hundred years to form. According to the Illustrated London News, to which we are indebted for our illustration, the mass contains one grain of carbon per 100 grains, and about half a grain of tarry matter in the same weight of deposit. The chief constituent is gypsum or crystallized sulphate of lime, produced by the action of the sulphuric acid of the city atmosphere on the carbonate of lime of the stone of which St. Paul's is built. This sulphate of lime is first dissolved by, and then deposited from the rain water. During the formation of the coral-like mass, the tarry particles of soot are inclosed within it. In order to give an idea of the size of the piece, an ordinary thimble is shown beside it in the illustration.

NOVEL USES FOR THE TROLLEY CURRENT.

BY DAY ALLEN WILLEY.

In making repairs and building extensions to its system the Union Traction Company, of Philadelphia, has in service an interesting variety of apparatus, most of which is operated by the current from the trolley wire. The company makes use of welded track joints, and for making the joints they use a portable welder, which is mounted upon a truck especially built for the purpose. The cupola has a capacity of about 1,800 pounds of iron. The blower mechanism is operated by a five horse power motor, carried on the center of the truck, which also has space for fuel, tools, etc. Two men only are required to operate it. To avoid the danger of melting the overhead construction by the heat from the cupola, a screen of asbestos, mounted on framework, is placed below the trolley wire.

For breaking joints and pigs of iron for the cupola a drop hammer has been designed, which is also mounted on a special truck, but is hauled by another car. The hammer proper weighs 1,500 pounds and has a fall of 16 feet, giving it sufficient force to break the heaviest joint in service. The winch is operated by an ordinary railway motor, and the mechanism, as will be noted, can be readily operated by one man. For supplying illumination for repair work, Mr. H. B. Nicholls, the maintenance-of-way engineer, has devised among other appliances some portable street lamps, which are connected with the overhead wiring by what is known as the fishpole circuit. The poles sustaining the wiring are merely hung to the trolley wire, so that they can be lifted off instantly to allow a car to pass, then replaced without delay. The lamps, which are of the incandescent type, are arranged in series of ten each, and furnish ample illumination for the most intricate repair work.

Another appliance which is of much practical value is the rail grinder, which is utilized for smoothing the welded joints. It consists of an emery wheel, driven by a two horse power motor which is placed on a barrow. It is carried on a motor car to the locality where it is to be operated, when a workman merely trundles the barrow to the joint. The motor is first connected to the trolley wire, then by a flexible shaft with the emery wheel, which polishes the joint in a few minutes. The current is then disconnected and the motor wheel backed to the car and taken wherever its services may be needed.

The charter of the company requires it to keep a certain portion of the pavement of the streets traversed by its lines in good repair. For surfacing the macadam and asphalt it employs a 15-ton road roller, which is transported by electric motor power on a flat car especially built for the purpose. On arriving at the street where the work is to be done, a detachable inclined platform is fastened to the end of the roller car, and the roller easily transferred to the surface. It can be loaded again by its own power. It is about the only special application in which steam is used in repair or other work by the company. Even in the system employed of greasing the curves, a large number of men have been dispensed with by the use of what the engineer poetically terms "grease chariots." These consist merely of small carts drawn by one horse, the greaser standing on a low rear platform. Each chariot is equipped with a broom, a crowbar for removing stones and other obstacles from the switches, a pail of grease, and swabs.

Another valuable addition to the company's equipment is a portable sand-blast apparatus. This is also hauled by horse power, and consists of an air compressor driven by an electric motor which takes current from the trolley wire. The work of cleaning the

STREET ROLLER READY FOR TRANSPORTATION.

PORTABLE WELDING MACHINE, WITH ASBESTOS SCREEN FOR PROTECTING OVERHEAD WORK.