since he removed to Bridgeport, where he passed the remainder of his days.

Mr. House possessed keen powers of observation, great originality of mind, and extraordinary tenacity of purpose. He was a man of vigorous physique and attractive personality. He was in full possession of his faculties to an advanced age, and retained in his memory the minutest details of his diversified and eventful life. His first patent bore the early number of 1,200; his last was No. 533,600.

THE MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS.

Without doubt, electric lighting by incandescence is the perfection of artificial illumination, since it offers light of the desired quality without developing an objectionable amount of heat, and without vitiating the air, while it is practically free from fire risk.

It is unnecessary in these days of electrical literature to devote time and space to historical matters, and it would be equally superfluous to extol the inventors and the invention.

This article and the annexed illustrations are published for the purpose of giving to the general reader a knowledge of how incandescent electric lamps are made. Our sketches were taken from the extensive manufactory of the Swan Lamp Manufacturing Company, in Cleveland, Ohio, and it is through the courtesy of Mr. S. M. Hamill, president of the company, that we are enabled to present the facts and sketches.

It has been found cheaper and generally more satisfactory by lamp manufacturers to buy the blown glass bulbs from glass factories. These globes are sent to the lamp makers in the form shown in Fig. 2, in which is shown a bulb having an elongated open-ended neck. The first operation in the work of making a lamp is to perforate the bulb at the end, by heating it and forcing a small rod through it from the inside. A short piece of glass tubing having a diameter of about $\frac{1}{16}$ of an inch is fused to the glass, and the tube for a distance of about $\frac{5}{8}$ of an inch from the globe is reduced in diameter, leaving a small passage through which the air is removed from the lamp in the operation of exhausting. Attaching the tube in this manner is termed "tubulating."

At another table, as shown in Fig. 2, the carbonized cellulose filament is subjected to a process called "flashing." The girl having this in charge attaches the carbon ends to suitable pincers projecting from one side of a rubber disk, the pincers being connected with the wires carrying the current for heating the carbons. The carbon filament is plunged downward into hydrocarbon vapor, when the current is sent through the filament, heating it to incandescence, while it is surrounded by the vapor. The vapor is decomposed by the heat and carbon is deposited on the filament until it acquires the proper resistance, when the current is automatically cut off. Platinum leading-in wires having a cup at one end, made by flattening the wire at the end and bending it around a "former," are inserted in short glass tubes, 4. Two of these are connected together by a solid cylindrical "bridge" piece, 5, thus forming the mount, 7. The operation is shown in 12. The filaments, cut to the proper length, are then inserted in the cup shaped ends of the leading-in wires, and cemented with carbon derived from naphtha by a current of electricity, thus completing the mount and filament, 8.

Short pieces of copper wire, 9, are then soldered to the free ends of the platinum wires. The completed mount and filament is now introduced into the bulb. A girl twirls the elongated end of the bulb in a flame, seizes the end of the mount with tweezers, and gradually closes the lower end of the bulb around the lower end of the leading-in wire tubes, fusing them together and properly disposing the filament in the center of the bulb; this is shown in Fig. 10, and is termed "sealing and sinking."

Three such bulbs are now taken to a Sprengel pump and the air is exhausted by a stream of mercury, so directed and subdivided by its fall through a glass tube as to gradually pull out all the air from the bulb. The attendant is enabled to judge the progress of exhaustion by the size of the mercurial drops, and when their diminished size indicates nearing the finishing point, the current is turned on to heat and rarefy the remaining air and assist in the more complete exhaustion. A flame from a Bunsen burner is then directed against the reduced portion of the glass tube, fusing the glass and thus sealing the globe. This operation is shown in Fig. 13.

To complete the lamp now requires only the attachment of the brass cap and making the proper connection with the little copper wires. The caps are made fast to the bulb with plaster of Paris, as shown at 14. This operation is termed "capping."

The Swan Lamp Manufacturing Company's works are on Belden Street, Cleveland, Ohio. They have a capacity of 2,500 lamps per day, the lamps having a voltage of from 40 to 125 volts. Lamps made at these works are guaranteed an existence of 1,000 hours.

Water in Steam Pipes.

In a discussion upon steam piping, at one of the recent meetings of the American Society of Mechanical Engineers, Professor Thurston made some interesting comments. Every one will recognize the fact that the two and sufficient principles to be adhered to in designing lines of steam piping are, first, to provide for contraction and expansion; and secondly, to provide against standing water anywhere in the line of the outside or inside. If the pipe can be arranged so that the expansion or contraction can take place without causing stress of the material, and if it can be kept dry inside or out, no difficulty will arise. It is not well understood that the strains that may be produced in a pipe by water are very severe. These are very serious and severe and sometimes fatal, the results of settlement of water in a steam pipe, that may act by condensation of steam causing water hammer, or may be precipitated in such form that it may be carried over as a slug to strike where it will and act like a hammer.

An early experience of this sort is related by Professor Thurston. Steam was carried from the boiler room adjacent, down the opposite wall and under the floor, a distance of several feet, then up to the steam chest of the engine. In the U thus formed was placed a cock, to be opened for draining it, by the engineer, whenever the engine was stopped, and to be closed when the engine was running. It happened that one morning the engineer was not in the room at seven o'clock, and his assistant came in and at once stepped to the throttle valve, which was set in the pipe lying against the wall, at the point where the steam entered the U on the way to the engine. The instant he opened the valve there was a crash; the cast iron steam pipe was broken below the floor. He went below and found the engineer dead, having been killed by the exploding pipe. He had gone down to set up a joint which had probably been loosened by this very action. This fact illustrates either the force which water may exert when forced through a pipe by the impelling power of steam, or the forces that may be set in action by the sudden contraction of a moving mass of steam when coming in contact with a mass of cold water. Either action would have been sufficient for the result described.

Another instance was mentioned where the steam pipe was not sufficiently drained, and the water collected in the pipe and was carried over into the cylinder of the engine, wrecking it. Large stresses must be produced, and it would be interesting to observe how large these stresses are. No one has yet found a way of ascertaining them accurately. The fact that such accidents do occur, unquestionably due to the impact produced by the rapid condensation of steam on the surface of a pool of cold water, shows that these stresses must be enormously great. What may happen when a rapidly moving, heavy mass of solid water, in full career, strikes an obstruction we all know; but the hammering of steam in pipes produces a local strain probably quite as severe, perhaps even more serious.

This second kind of strain is known to be enormously great, but how much we do not know. He had occasion once to examine a quantity of pipe taken out of a heating system then in operation, but now extinct. He was informed that the pipes were defective and was asked to examine them for the purpose of obtaining a report to secure from the makers a reduction of their cost and possibly damages. Many of the pipes were split through good welds and bad welds, through solid iron even, and the only report he could make was that they were injured by water hammer. A quantity of the pipe was taken to the mill where it was made and the pressures they would stand were measured, split and weakened as they were. In order to obtain a fair idea of the actual pressures that the pipes would sustain, a rubber packing was arranged on the inside of each pipe, a strip covering each crack from end to end, drilling a few holes along the crack, so that the strength of the pipe should not be affected and to insure that sealing these joints should not affect the strength of the pipe. The bolts simply held that packing up against the crack on the inside, so as to seal it by the slight pressure of a line of small bolts, which were put in simply to hold the packing in place. Pipes arranged in this way, and tested in the hydraulic apparatus of the mill, carried all the way from 300 to 1,000 pounds pressure to the square inch, injured as they were. The conclusion was obvious that the water hammer to which they had been subjected was enormously in excess of these figures, representing the strength of the pipe after the crack had been made. These facts are more impressive than any possible examination, without actual measurement of these quantities, and reveal the intensities of the strains that occur, and the risks of danger which occur from allowing water to stand anywhere in a pipe. After water had once collected in a pipe, especially in steam pipes leading to engines of larger size, there is no safe way of removing this danger except by simply shutting the steam off at once, if it is moving in the pipe, or keeping the throttle shut, if it is not moving; then let the steam down and drain the pipe completely before steam is again put on. If an attempt is made to drain even a still pool of water in a pipe under pressure, the water hammer may become very severe. The disturbance of the pool by the flow of steam causes condensation; condensation causes a rush of steam upon the surface of the water, and presently there may result as serious effects as when steam actually moves through the pipe with the throttle valve open, and the pool of water is set in motion to cause accident by impact.

Aluminum Alloys and Solder.

The solder consists of silver, nickel, aluminum, tin and zinc, in the proportions as follows:

	Per cent.
Silver	2
Nickel	5
Aluminum	9
Tin	34
Zinc	50

No flux is necessary, and any soldering iron or tool may be used, though one of aluminum is preferable.

The alloy consists of copper, tungsten, aluminum, tin and antimony, for either of the two latter manganese or nickel being at times substituted. The proportions preferred are somewhat as follows:

	Parts.
Copper	0·375
Tin	0·105
Antimony	1·442
Tungsten	0·038
Aluminum	98·040
	100·000

Tungstic acid and cryolite are melted together, equal proportions being employed. When the temperature reaches 1,200° C., aluminum is added so as to produce a 10 per cent compound of aluminum and tungsten. A second alloy is made containing equal proportions of aluminum and copper. These two alloys are then melted together with pure aluminum in the proper proportions to form the alloy required as above; tin, antimony, or their substitutes being added in the necessary proportions; or they may be left out altogether when the copper and tungstic acid originally employed are chemically pure.

Another alloy consists of aluminum, silver and copper, preferably in the following proportions or approximately so: Aluminum, 96·25; silver, 3·50; copper, 0·25 per cent = 100·00.

Medical and Surgical Aspect of the Japanese War.

Great progress has been made in Japan in medicine, and especially in military surgery, in the last few years. The surgeon-general has pointed out that the mortality among the wounded in the Satsuma war was 17 per cent, while in the present war it has dropped to 4 per cent. The armies of Japan are accompanied by 1,350 medical attendants, of whom 380 are surgeons. The barrack hospitals in Japan are large, and are equipped with the latest appliances.

The largest of these hospitals is at Hiroshima. The staff consists of 56 surgeons and 501 nurses, in addition to 173 surgeons and nurses from the Red Cross Society, in which many representatives of the Japanese nobility serve. The same society has 138 practitioners and nurses in the field. The remarkable results which have been obtained in the present war in Japanese surgery, medical practice and sanitation are largely due to Dr. Kitasato and other pupils of the great medical schools of Germany.

Dr. Kitasato was one of the most eminent of Dr. Koch's students and was associated with Dr. Behring in some of the researches which culminated in the discovery of antitoxine.

The army of Japan has been fortunate in regard to disease as it has been in the results of its numerous encounters. The London Times states that the combined mortality from disease and the loss in battle has only been about 1,300 lives out of the armies, which number 50,000 men, and the navy, which consists of 29 ships. The comparative immunity from sickness is believed to be largely due to the rice diet. It is probable that such achievements were never before realized in the history of warfare with so small an expenditure of human life.

English Express Trains.

The present exhibits some striking accelerations compared with ten years ago. The broad gage is gone, and the "Cornishman" has superseded the "Dutchman" and "Zulu" as the fastest G. W. train to Exeter. The timing is: Paddington, depart, 10:15 A. M.; Swindon, arrive 11:42, depart 11:52; Bristol, arrive 12:45, depart 12:52; Exeter, arrive 2:20. The up leaves Exeter 3:40, and makes exactly the same time over every section. With only the two stops 194 miles are covered in 228 minutes, or upward of 51 miles per hour. A train now leaves Birmingham at 8:45 A. M., and reaches Euston at 11:10, a speed, with three stops occupying seven minutes, of 49·1 miles an hour. The London and Southwestern now runs the 79 miles to Southampton West in 98 minutes without a stop, the 12:30 P. M. down doing this at 48·3 miles an hour.

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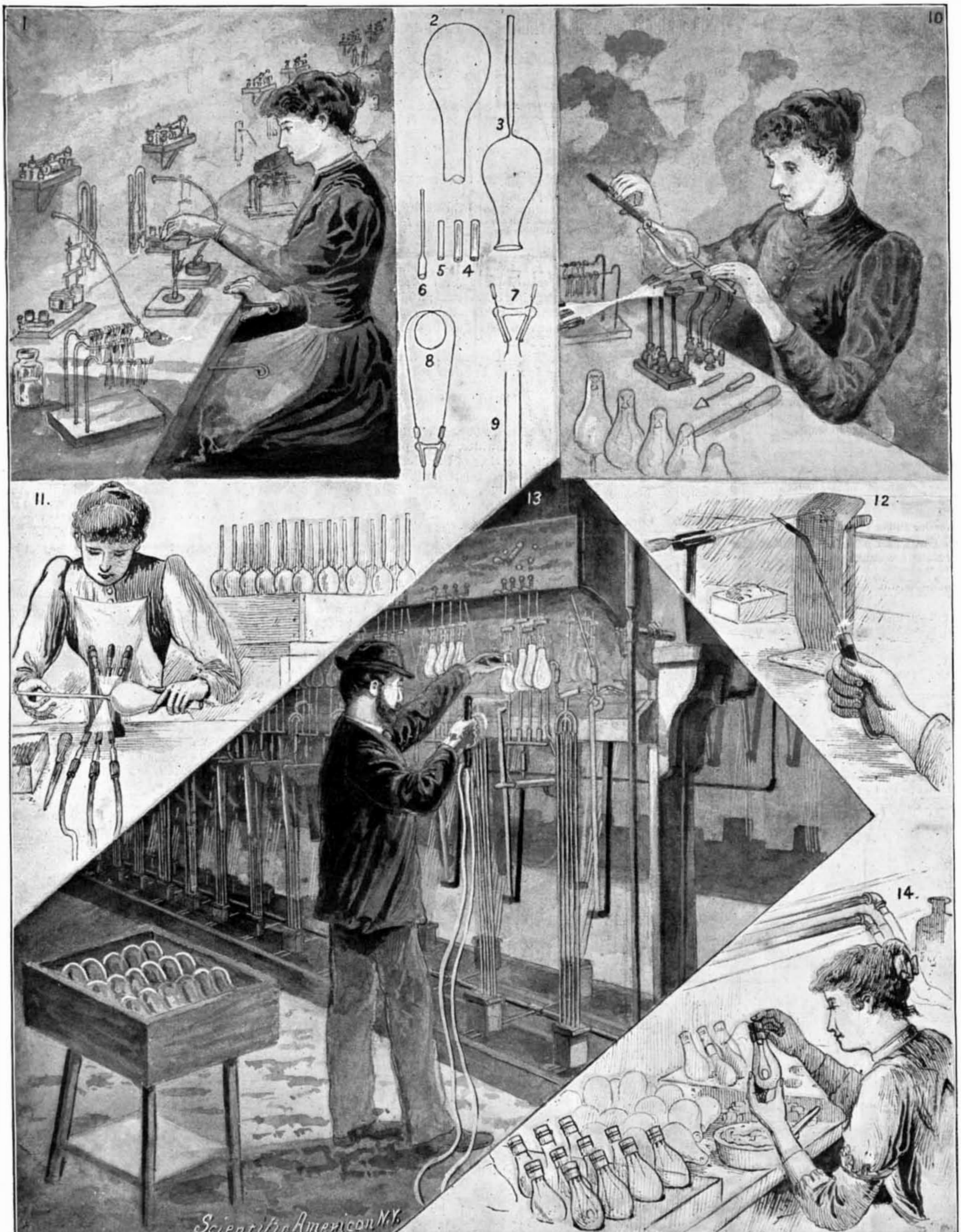

1. Flashing in. 2. Bulb. 3. Tubulated bulb. 4. Insulating tubes. 5. Bridge. 6. Platinum leading-in wires. 7. Mount. 8. Mount and filament complete. 9. Copper connecting wires. 10. Sealing and sinking. 11 Tubulating. 12. Insulating. 13. Exhausting. 14. Capping.

THE MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS.—[See page 230.]