IS CONCRETE STEEL A PERMANENT CONSTRUCTION?

BY J. A. FITZPATRICK.

An unusual example of deterioration of steel framing in buildings was recently discovered in the basement floor of the Eastern Power Station operated by the Brooklyn Heights Railroad Company at Kent and Division Avenues, Brooklyn.

The basement floor of the engine-room portion of the station is divided by the masonry engine foundations into several parallel galleries, each ten feet wide and running the full width of the building. A sub-basement or cellar, about six feet below the basement floor, leaves a clear space of less than five feet between the two floors. On this cellar floor rest the jet condensers for the engines above.

The basement-floor construction consisted of 6 and 7-inch steel I-beams framing into 15-inch steel I-beam girders. Between the beams were segmental concrete arches, stiffened by a wrought-iron mesh center. These arches did not cover the bottom of the beams, but left the flange exposed except for an occasional coat of paint received in the early history of the station. The steel frame was erected by the Berlin Iron Company in 1890.

Considerable rust was noticed on the exposed beam flanges; and as some of these appeared to sag in the center, a section of arch was removed, to see the condition of the upper portions of the beams. In only a few cases was there any upper portion left, the steel having corroded to such an extent that the webs and top flanges had disappeared entirely, leaving only rust on the adjoining concrete. The floor, instead of being supported by the steel framing, was in reality carried by the three-inch slab of concrete covering the tops of the arches.

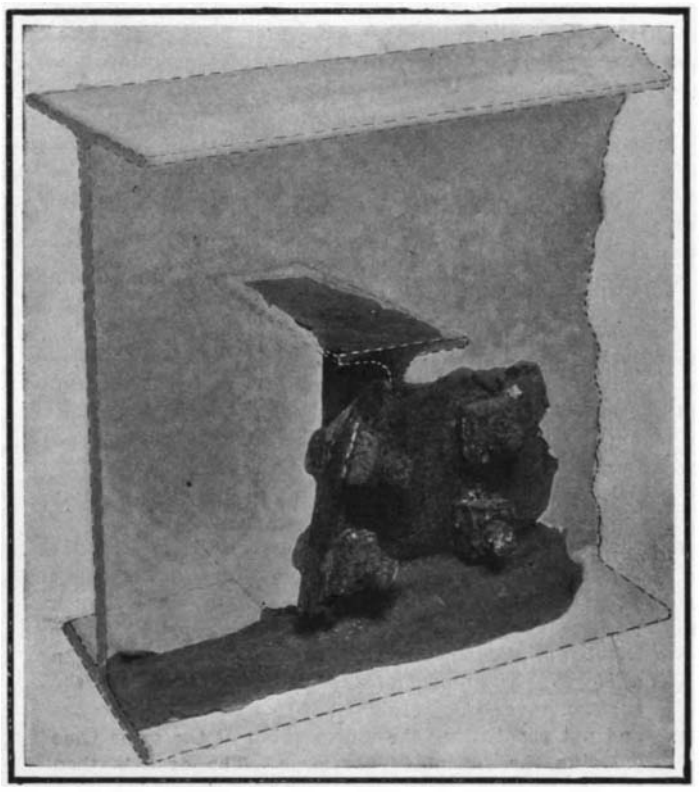
The writer carefully investigated the locality, finding the following condition to exist:

The condensers employ salt water in their operation, and much of this is ejected in the form of spray on all sides of the condenser pits. There being no chance of drainage, this has been allowed to settle for years in pools on the floor, and together with the exhaust steam from the engines above, which found its way into the cellar, the atmosphere in the space between the two floors was kept continuously moist. This moisture was absorbed by the concrete arches, and held as if in a sponge, close against the web and upper flanges of the beams. The decomposition was probably slow at first; but as the chemical action progressed, a space was made between the steel and the concrete, leaving a space for air to enter, thus accelerating the chemical action. The exposed bottom flanges were in far better condition than the inclosed portions of the steel, this probably being due to the paint they received.

The wrought-iron bolts throughout the work were in an almost perfect state of preservation. This was also found to be true of the wrought-iron mesh centers under the arches.

The illustration reproduced here shows typical examples of the 6 and 7-inch beams framing into the 15-inch beam girders. The steel being worn to a knife edge on the flanges, and the small portion of webs remaining, evidently show the effect of electrolysis.

The almost perfect preservation of the bolts is also shown, and it will be noticed that the shop rivets are in better condition than the material in the beams. The bolts, as mentioned before, were made of wrought iron, but the rivets were of rather a soft grade of steel, while the beams were of the hardest grade of steel that the writer has ever seen used in construction work. This leaves an open question as to whether the hardening elements in the high-grade steel, carbon and manganese, did not assist in the decomposition.



The shadow sections show the original size of the 7-inch and 15-inch I-beams when the floor was constructed. They were eaten away by rust until nothing was left but the portions shown in dark tint, which are reproduced from a photograph.

Deterioration of steel and concrete floor.

The main sewer draining the residential section of Williamsburg flows past the station on the north side, emptying into Wallabout Creek a few feet away from the mouth of the intake tunnel which supplies the water for the condensers. Traces of chlorine have frequently been detected in the basement, and this has undoubtedly assisted in the decomposition of the beams.

HOW INDIA IS FIGHTING THE PLAGUE—THE MANUFACTURE AND USE OF ANTI-PLAGUE VACCINE.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

One of the most important and best-known scientific institutions in India is the Bombay Bacteriological Laboratory at Parel. For some twelve years it has been the scene of many notable achievements in the subjugation of the terrible epidemic which has ravaged the country. At first only a small plague-research laboratory, started by Mr. Haffkine, it has developed into an extensive institution having a wide field of investigation. Here it was that Mr. Haffkine first evolved and prepared his "plague prophylactic," which medium in the hands of the British administrators has proved a highly efficient instrument for combating the disease, and which has been the means of saving thousands of lives.

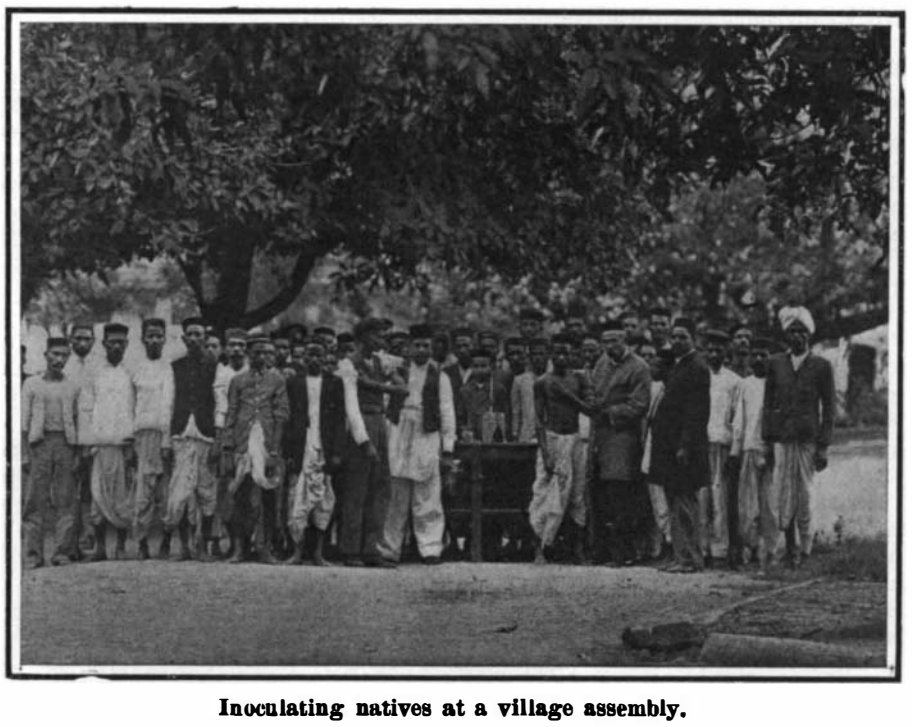
To-day the whole of Haffkine's vaccine required not only for India, but other countries throughout the East where plague is indigenous, is prepared at this laboratory. Through the courtesy of Capt. W. Glen Liston, M. D., D. P. H., a member of the Plague Research Commission, and the Acting Director of the Laboratory, we are enabled to describe and illustrate the preparation of this prophylactic agent. The vaccine may be succinctly called a culture of the plague bacillus, which after being grown in a suitable soil or broth for at least six weeks, is sterilized or killed, and to which is then added 0.5 per cent of carbolic acid. The preparation is then packed in small hermetically-sealed glass bottles or phials, each of which contains on the average 20 cubic centimeters of the material, a quantity sufficient for five full doses.

The medium in which the plague germs are cultivated is produced from goat's flesh or wheat flour, to which a certain proportion of hydrochloric acid is added. This mixture is stored in large water-jacketed jars maintained at a temperature of 158 deg. for three days. During this period the insoluble albumen of the flour or meat, under the action of the hydrochloric acid, is converted into the soluble albuminoid bodies known as peptones and propeptones. The acid liquid is then neutralized by the addition of caustic soda. Common salt is thus formed. This liquid is diluted, boiled, filtered, and decanted into large glass flasks corked with cotton wool. The flasks are passed into a large sterilizer, and subjected to saturated steam at a pressure of two atmospheres. The result of this process is the production of a clear, sterile, amber-colored liquid or broth, constituting the soil in which the plague germ is grown.

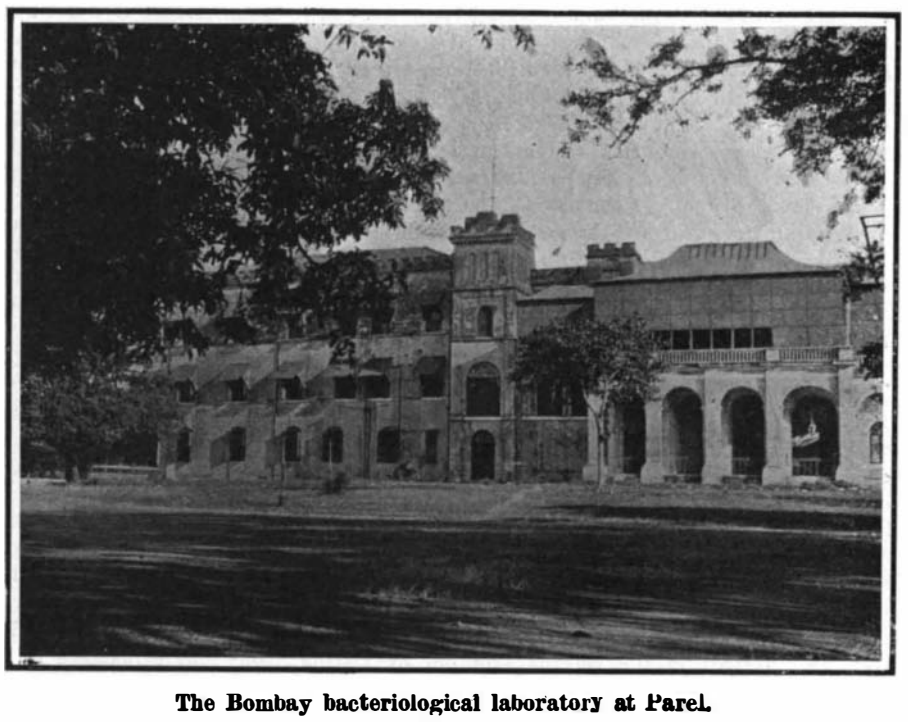
The plague germ itself is isolated either from the blood or the bubo of a patient suffering from the disease. It is first purified by cultivation in test tubes containing broth jelly formed by the addition of agar-agar to the liquid broth previously secured. At this juncture the germ is examined and tested, in order to identify it definitely as the plague bacillus. Among these tests, one of the most important is the characteristic appearance known as "Haffkine's stalactites," presented by the growth of the organism in suitably prepared broth. The plague bacillus thus isolated and identified is subjected to cultivation in a Pasteur flask for a period not exceeding fourteen days. The seed multiplies considerably, and small quantities of the material raised in this Pasteur flask are transferred to several larger flasks, each containing one liter of broth, this operation being carried out in the sowing and testing room.

As each flask receives its quantum of the plague organisms, it is removed to the adjacent incubating room. This is a large apartment in which the flasks are disposed in rows upon long tables extending longitudinally from one end of the room to the other. Some idea of the magnitude of the serum-preparing operations may be gathered from the illustration of this department, showing several hundred flasks under incubation. The flasks are left in semi-darkness for at least six weeks. During this period the germs multiply enormously. When it entered the incubating room the broth was perfectly clear, but upon withdrawal it is turbid, because of the vast increase in the number of plague bacilli.

It will be realized that in the preparation of this vaccine, it is imperative that the culture medium



Inoculating natives at a village assembly.



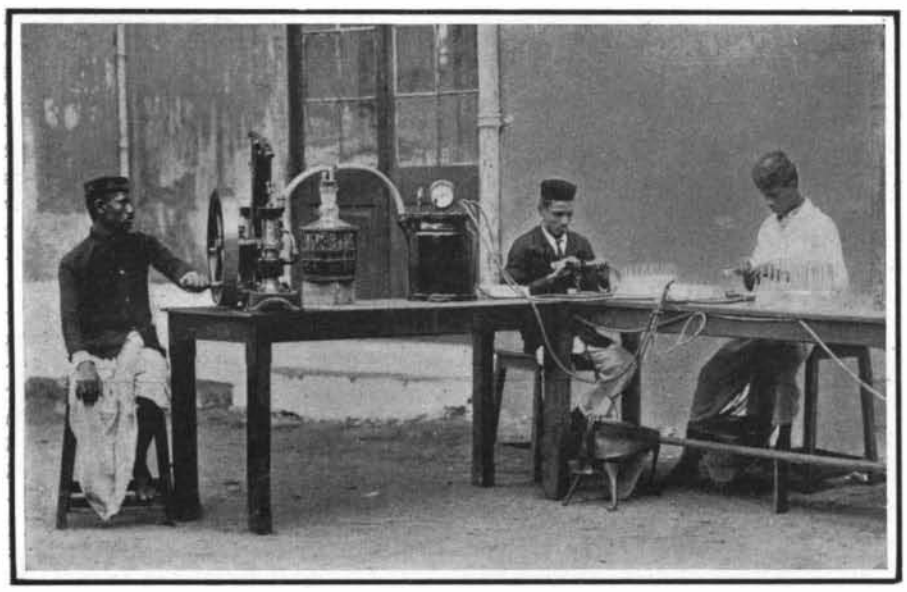
The Bombay bacteriological laboratory at Parel.

HOW INDIA IS FIGHTING THE PLAGUE—THE MANUFACTURE AND USE OF ANTI-PLAGUE VACCINE.

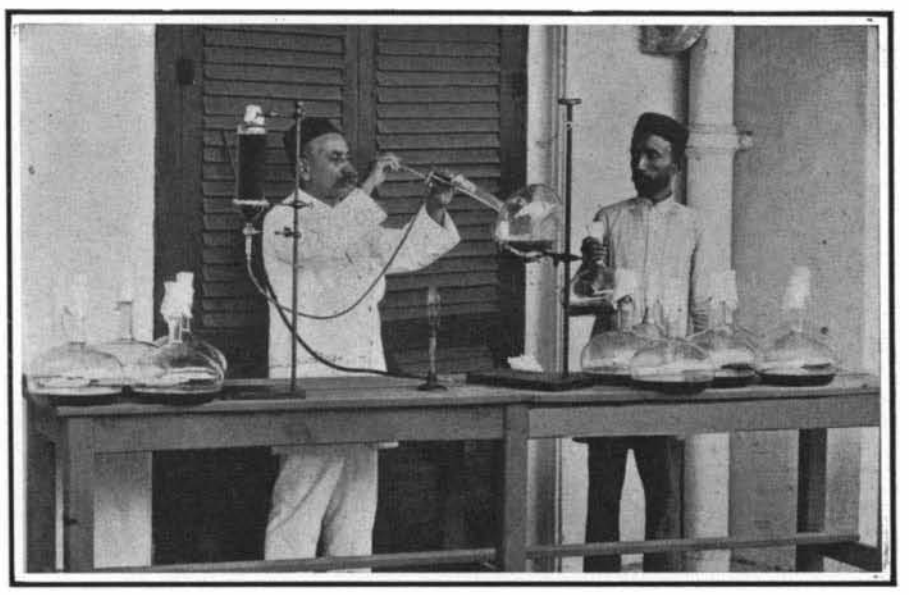
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1908, by Munn & Co.]

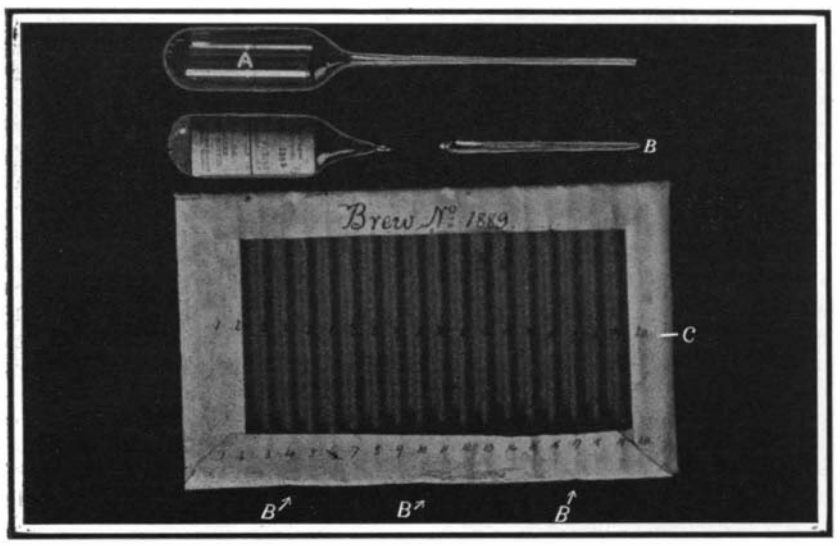
Vol. XCIX.—No. 22. ESTABLISHED 1845.] NEW YORK, NOVEMBER 28, 1908. [10 CENTS A COPY $3.00 A YEAR.



Exhausting the air of the bottles. After the vacuum is created the necks of the bottles are sealed and broken off.

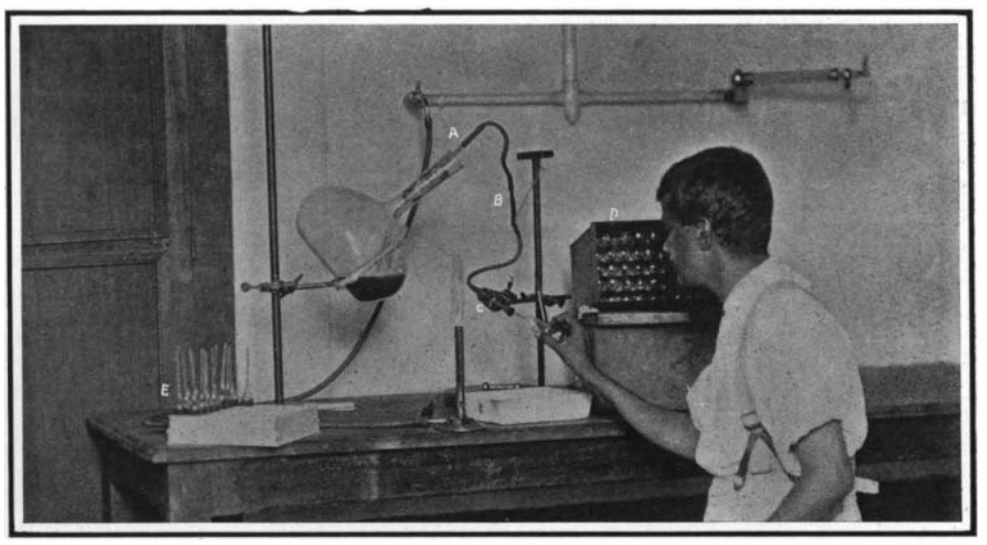


After incubation the germs are killed and carbolized.



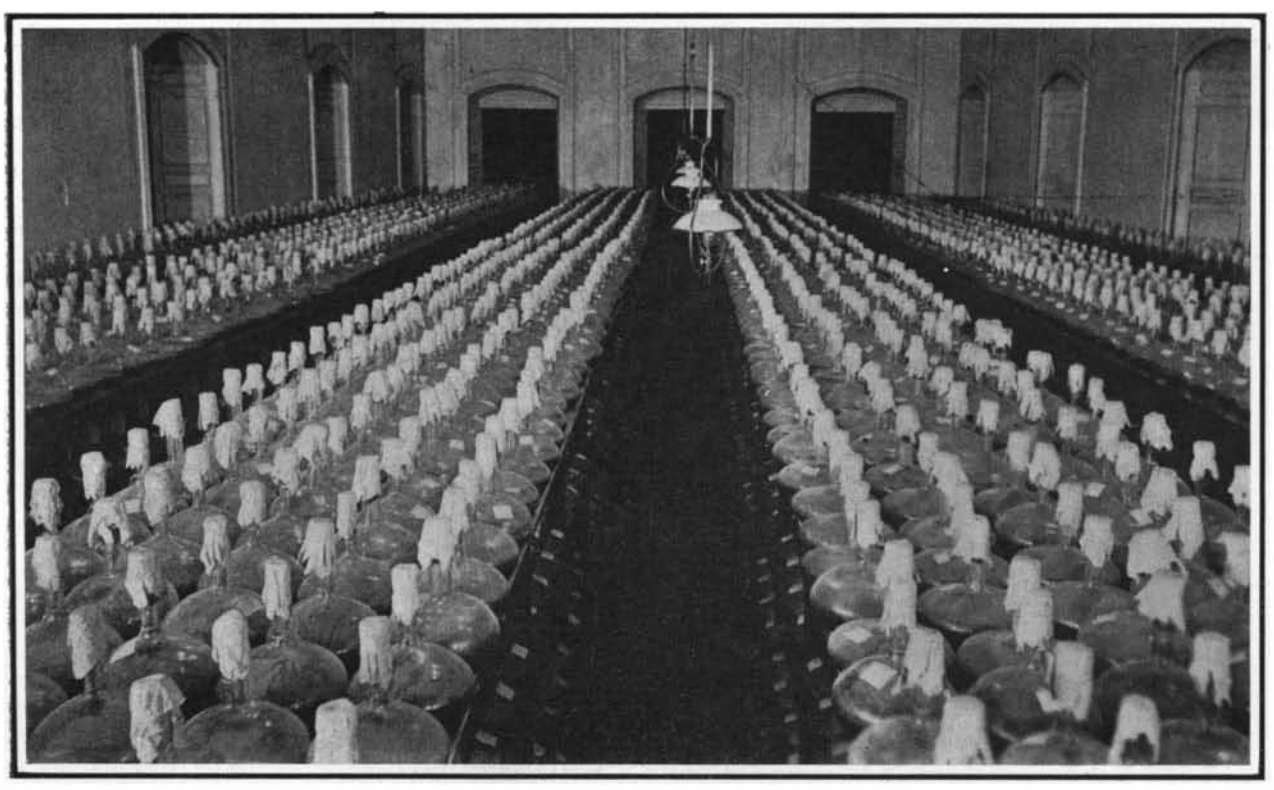
A. The bottle after it has received its charge of vaccine. B. The sealed neck containing a small proportion of the bottle contents. C. The receptacle in which the laboratory preserves the samples of vaccine.

The vaccine phials.

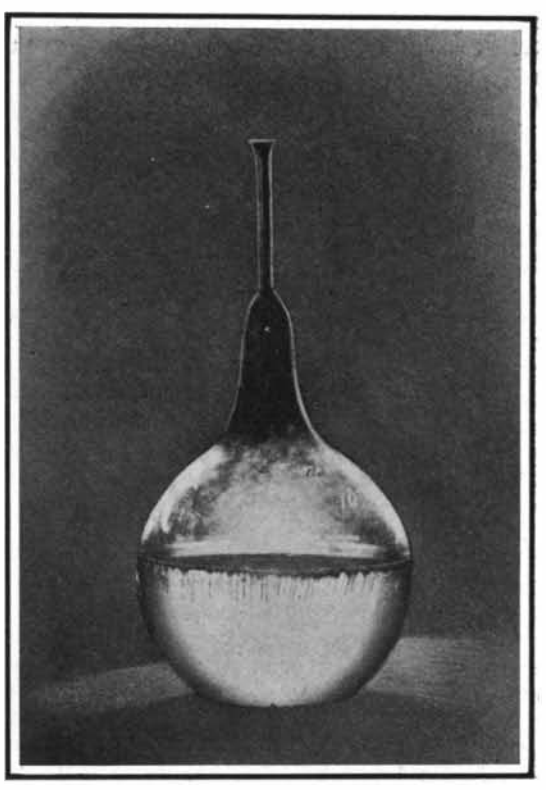


Each flask containing the boiled, filtered, and decanted liquid is passed into a large sterilizer and subjected to saturated steam at 30 pounds pressure. The result is a clear, sterile broth.

Decanting the vaccine into the bottles.



The incubating room. Here the germ broth is left in darkness for six weeks, during which the organisms multiply enormously.



Testing the culture for identification.

HOW INDIA IS FIGHTING THE PLAGUE—THE MANUFACTURE AND USE OF ANTI-PLAGUE VACCINE.—[See page 378.]

should propagate plague organisms solely. Consequently, upon the conclusion of the incubation period, the flasks are returned to the sowing and testing room. A small quantity of the contents of each flask is carefully withdrawn with aseptic precautions, and transferred to a broth jelly tube. In the course of from twenty-four to forty-eight hours, the germs grow upon the surface of this tube. In precisely the same manner as the farmer can recognize the nature of the crops on his land, so can the bacteriologist distinguish the appearances of his germs, and detect the presence of any other bacillus in addition to that of the plague. Should the appearance indicate that plague organisms alone are existent, the flask which has been so sampled is passed on to other departments for further manufacture and tests.

The next stage is the sterilization of the vaccine. The germs, which up to this point have been so carefully tended and cultivated, are killed. The flasks are immersed in water, and subjected to a temperature of 131 deg. F. for fifteen minutes. At the end of this period the material will be found absolutely sterile and containing no living organism. At the same time, however, it might be possible for some latent organism to develop and thrive in or enter the broth subsequently, in which event serious complications would result, as experience has strikingly demonstrated. Consequently, at this stage the vaccine undergoes what constitutes one of the most important phases in its production, and upon the fulfillment of which its purity and safety vitally depend. This is the addition of 0.5 per cent of carbolic acid to the broth, to render it an unsuitable soil for the growth of any germ.

After carbolization the serum is ready for bottling. The vessels in which it is sealed for distribution are of peculiar shape, as may be seen by reference to the illustration. By means of an air pump and other special apparatus, the bottles are vacuumized and hermetically sealed. They are then packed into iron boxes, which are placed in large ovens and submitted to a temperature of about 390 deg. F. for three and a half hours, which action kills any bacteria that may be lurking within the bottles. As it is withdrawn from the oven, each iron box or crate is immediately sealed, and the word "sterilized," together with the date, is imprinted on the exterior. The boxes are now ready for receiving the charges of the vaccine, and this work is carried out in the decanting room.

The charging of the bottles from the flasks of carbolized vaccine is a delicate operation, requiring great skill in order to prevent any possible chance of the vaccine coming into contact with the open air even for an instant.

The bottles after being filled are set on one side for a week, a sufficiently long period to permit of the multiplication of any germ that may have gained an entrance to the vaccine during decanting. The average number of bottles that can be charged from the contents or "brew" of each flask is forty-five, and each batch is preserved, so that in the event of a "brew" subsequently evidencing contamination, the bottles charged from that particular affected flask may be instantly ascertained and destroyed. Two bottles are selected from each "brew," and are subjected to searching tests carried out in two ways—aerobically and anaerobically. In the former tests, all those bacilli which require oxygen for their development are discovered, while the second process serves to reveal those organisms which can thrive only in the absence of oxygen, such as the tetanus bacillus. These tests proving satisfactory, the brew is pronounced fit for use, and is passed through the last stage of its manufacture. This is the securing of a small sample of each phial for retention in the laboratory. A small portion of the fluid is forced into the long neck of the phial. The neck is then heated in a blow-pipe flame near the shoulder of the bottle, melting the glass and separating the neck from the body of the phial, and at the same time hermetically sealing both the bottle and the neck simultaneously. Each sample carries a duplicate of the label and date on the body of the phial, while all the samples collected from a single "brew" are stored in a sheet of corrugated paper and preserved in the laboratory. Should, therefore, any suspicion regarding the condition of a phial when sent out arise, or complications attend inoculation, the laboratory can easily substantiate the sterility of the vaccine sent out by testing the sample, and moreover can ascertain whether the serum has been retained for too lengthy a period before being used. In this way not only is the public safeguarded, but the laboratory is protected against false charges.

Haffkine's serum being a dead prophylactic agent, it has to be injected beneath the skin and introduced into the blood stream of the patient by means of a syringe, unlike vaccination, where the living vaccine is simply placed upon an abrasion of the skin. The operators who are privileged to carry out the inoculation are specially trained in the methods of fulfilling the operation, and the vaccine is supplied only by the laboratory to those certified as competent for the work despite its simple character. There is thus no possibility of the vaccine falling into the hands of unskilled or unscrupulous persons. Should any calamity befall a patient from inoculation, the responsibility for the misadventure can be brought home, since the various hands through which that particular dose of vaccine passed can be traced and checked from the first stage of preparation to its application.

The vaccine thus prepared, if preserved in a cool dark place, will retain its full efficiency for a period of eighteen months, though of course it is expedient that it should be used as soon after being received as possible. After retention for eighteen months, however, the old vaccine should be destroyed.

The medical officers experience no little difficulty at times in securing the consent of the natives to inoculation. As a rule, the operators collect the influential leaders of the people, and secure their interest in the proposal. The advantages of inoculation are carefully explained, and they are urged to persuade their less educated tribesmen to consent to the ordeal. About one hundred people are thus possibly assembled, and those who volunteer to undergo the operation are duly inoculated before the community. The painlessness of the operation thus being demonstrated, many waverers will frequently follow the example of their friends, and in this manner a number of people may be inoculated at the one meeting.

Inoculation itself is simply and quickly carried out. The most convenient spot on the body is the back of the left upper arm about midway between the shoulder and the elbow. The skin is first well scrubbed with a five per cent of carbolic lotion, and is then puckered up between the thumb and fingers of the left hand, the needle being injected into the skin in a sloping direction more or less parallel with the surface, care being observed to avoid the big vessels and not penetrating the muscles, but at the same time entering the subcutaneous tissue. The dose is then slowly injected, the needle withdrawn, and a few pads of cotton wool dipped in the carbolic solution applied for a few minutes.

The symptoms of inoculation commence as a rule in from three to five hours, and consist chiefly of swelling and pain at the seat of inoculation, accompanied by a rise of temperature. As the pain becomes more acute by the movement of the affected part, it is advisable to give it a complete rest for about thirty-six hours. The fever generally lasts from twenty-four to thirty-six hours, but pain at the seat of inoculation generally prevails for three or four days. As, however, the vaccine acts differently on various people, a uniform reaction cannot be obtained, fever being almost absent in some cases; but the fact that there is an absence of reaction does not necessarily imply that the inoculation has not "taken," as would be said under similar circumstances after vaccination for small-pox. The doses range from 0.2 cubic centimeter for an infant to 4 cubic centimeters or a full dose for an adult.

Careful observations have been carried out to ascertain the efficacy of the anti-plague vaccine in decreasing the mortality arising from the disease. Although inoculation does not necessarily signify immunity from attack, yet as in small-pox vaccination it insures a lower proportion in mortality. For instance, in the Punjaub, out of 49,433 cases of plague among 639,630 uninoculated persons, 29,723 cases proved fatal—a case mortality of 60.1 per cent. In the same area there were 186,797 members of the population who had undergone inoculation. Out of this number, 3,399 fell victims to the plague, but the mortality was only 814, representing a case mortality of 23.9 per cent. In other districts even more striking results have been obtained, the sum of which conclusively proves that in this prophylactic agent the authorities have an efficient scientific instrument for reducing the effects of the scourge. In addition to supplying the whole of the country with the necessary vaccine, the Bombay Bacteriological Laboratory prepares supplies for the medical officers in other parts of the world where the epidemic is rampant; and it speaks volumes for the care and skill with which the agent is prepared, that since the above-described processes of manufacture have been adopted, and the many precautions enforced to insure absolute sterility of the vaccine, out of the thousands of phials that have been distributed, not one single instance of contaminated vaccine has been discovered. The institution, moreover, performs other highly valuable offices in connection with the bacteriological treatment of disease and plague research, and it was here that the epoch-making discoveries in connection with the etiology of plague were made by a commission working on the facts and materials which had been accumulated after ten years of patient labor on the part of the staff of the laboratory.

An authority states that the best test for cylinder oils is to heat them in a current of air for one hour at the temperature corresponding to the steam pressure at which they are to work. The loss in weight should not exceed 0.6 per cent.

Correspondence.

THE MYSTERIOUS AEROLITE.

To the Editor of the Scientific American:

In your issue of November 7, 1908, under the heading "Was This an Aerolite?" Mr. Park Marshall, of Nashville, Tenn., writes a very interesting account of what be believes to have been a meteor. He declares that from his position the crash of the impact was as a great explosion of dynamite accompanied by a slight vibration of the earth, and that it was audible throughout several counties, including Franklin, Coffee, Warren, and Grundy, of Tennessee.

He adds that "so great was the interest and excitement created by this aerial disturbance, that citizens telegraphed to and fro from town to town seeking information, and that it is the chief subject of query and discourse to this day at the places mentioned."

I find that on September 8, at about 10 A. M. (which he mentions as the exact date and time in his correspondence to have been the hour in which that section was so terrified by this "aerial disturbance") a shipment of dynamite was exploded at Wartrace, Tenn., on the N. C. & St. L. Railway.

As the writer states that he was at Estill, Tenn., at the time, which is only a very short distance from the scene of the explosion, may I with apologies suggest that it was this explosion which your correspondent, Mr. Park Marshall, heard? E. B. Hoyte.

Nashville, Tenn., November 14, 1908.

A $500 Prize for a Simple Explanation of the Fourth Dimension.

A friend of the Scientific American, who desires to remain unknown, has paid into the hands of the publishers the sum of $500, which is to be awarded as a prize for the best popular explanation of the Fourth Dimension, the object being to set forth in an essay the meaning of the term so that the ordinary lay reader can understand it.

Competitors for the prize must comply with the conditions set forth in the Scientific American of November 21, 1908.

Oliver Weldon Barnes.

Oliver Weldon Barnes, a well-known old-time civil engineer, died on November 17, still active in his profession up to the last, despite his advanced age.

Mr. Barnes in 1847 joined the pioneer surveying corps of the western division of the Pennsylvania Railroad. He made the final location of the daring lines which then distinguished that division.

Mr. Barnes in the course of his career was in charge of the engineering for many railroads, including the Boston, Hartford & Erie.

The Current Supplement.

The current Supplement, No. 1717, opens with a plea by Frederic A. Lucas for the preservation of the fast-disappearing whale. Prof. P. Gruner gives a historical review of theories of electricity. S. E. Brown tells how the Paris telephone switchboard, recently destroyed by fire, was rebuilt by an American firm in record-breaking time. The construction of the German automatic stamp-vending machine is described in detail. Stanley C. Bailey discusses the question whether precious stones can be manufactured. The manufacture of catgut for surgery is described at length. Dr. Gustav Glock propounds a theory of the ascent of sap in plants. The Kuch quartz mercury lamp is described by O. Bechstein. The Scientific American's English correspondent writes on a 325-horse-power kerosene motor for use in Italian submarine boats. The Cowper-Coles process of making copper tubes, sheets, and wire direct is explained. Prof. J. C. Kapteyn presents a very striking picture of the motion of our solar system through space. The usual notes are also published.

A New Method of Electric Welding.

L. S. Lachman has devised a new process of electric welding which makes it possible to employ steel instead of malleable iron in the manufacture of numerous articles. As two pieces of metal of unequal sections cannot be welded together satisfactorily Lachman has one piece cast with a projecting edge and the other with a point. The two projections, forced together by a hydraulic press, are included in an electric circuit, of which they form the segment of highest resistance. Hence, when a strong current is caused to flow through them, they are heated nearly or quite to the melting point and, being subjected to great pressure, quickly become welded together, and attach themselves to each other more firmly than they could be attached by means of rivets, because there is no break in the continuity of the metal.

Acid-resisting Cement.—A recent issue of the Brass World gives the following formula for an acid-resisting cement, for tanks, floors, etc.: Silicate of soda (water glass), 6 parts; glycerine, 1 part; red lead, 3½ parts; fine cinders, 10 parts. The silicate of soda and glycerine are mixed and then the red lead and cinders added to make a mass resembling putty. This cement soon sets or hardens, and when heated to the temperature of boiling water, unites with brick or Portland cement to form a strong joint.