those of rubber and gutta-percha; but, all the same, it does seem an unenlightened policy to cut down the trees, unless, as we believe has long been the case in some districts, the wood is looked upon as being of more importance than the balata. There is certainly no waste of balata when the tree is felled, because a process, the exact nature of which is kept a secret, is in use for extracting the balata from the bark by a solvent. The product is prepared in two forms—sheet and block. The former is obtained by the gradual sun-drying of the milky sap in shallow pans, which are made either of tin-plate or of wood lined with leaves. The block is prepared by boiling the sap in large kettles until it is of doughy consistency; both sorts are found in the London market, the sheet, however, being the better quality of the two. The statement that from 15 pounds to 21 pounds of balata are yielded by each full-grown tree brings to an end this brief synopsis of the procedure in the forest.—Engineering.

THE MILK QUESTION AND MORTALITY AMONG CHILDREN.

EMILE BERLINER has published an interesting comparison of the mortality of children in America and in Germany, for the purpose of showing the effect of the proper handling of milk on social conditions.

Not long ago some one remarked that the rate of mortality among children was an excellent measure for the standard of civilization which a community enjoyed. It was asserted that not only is the vitality of children a true guide to the physical and mental condition of the parents and their environments, but that the degree of care, both qualitatively and quantitatively, bestowed by governments on preventive sanitation can well be judged by the amount of sickness contracted by children, or by both.

Emile Berliner selected for his purpose two cities of approximately the same size—Hanover and Washington—both justly claiming a highly advanced civilization, both favored by good municipal government, both in the category of cities not situated within the direct reach and influence of transoceanic traffic with its attending danger from far-off infection.

One should suppose that Germany with its splendid schools, its fine literature, its thousands of professors, its army of authorities on scientific subjects, and its highly organized police supervision, would turn out to be foremost on the subject of preventive sanitation, and exhibit a percentage of child mortality below the average. This at least was the conclusion which would naturally force itself on anyone who would be asked to give, prior to investigation, an offhand opinion on this subject.

In the case of the city of Hanover in particular would that offhand conclusion be supported by the fact that this town of about 200,000 inhabitants had for years enjoyed a particularly fine drinking water, and had probably on that account escaped the ravages of a great cholera epidemic which at one time devastated the rest of Germany and the immediately surrounding countries. Furthermore, Hanover had for years been the seat of a magnificent Institute of Technology, its streets had always been kept scrupulously clean, its parks and woods reach the very heart of the town, and its gymnasiums and swimming and bathing establishments are sources of pride to the old citizens and the new.

Compared with such a favored German city, the capital of the United States showed several decidedly weak spots. Truly Washington also has its army of advanced thinkers employed by the national government, its streets are clean, its parks are scattered everywhere, and its municipal government is equally free from the boodler and the professional politician.

But on the other hand, it has nothing but unfiltered Potomac water to drink, and of its population one-third are negroes, a majority of whom are ignorant, careless regarding sanitation, superstitious in a high degree, and naturally sluggish when it is proposed to institute reform and the advantages of modern ideas.

If, therefore, the mortality among children had proven to be twice as great in Washington as in Hanover, it would not have caused surprise, when comparing the conditions in both towns as they appear on the surface. When, therefore, Berliner found that the mortality among children in Hanover was 60 per cent greater than in Washington, it at once occurred to him that the condition of the milk traffic and the milk question in general would probably furnish a clue to this surprising state of affairs.

In the year 1901, the total number of deaths in Hanover was 4,132, of which 1,871 were children under 5 years of age. Rate: 45 per cent.

In the year ending June 30, 1902, the total number of deaths in the District of Columbia was 5,947, of which 1,652 were children under 5 years of age. Rate: (under) 28 per cent.

If the white population alone be here considered, the figures are: Number of deaths among the whites, 3,259, and among the children under 5 years of age, 730. Rate: 22 per cent.

All these figures are from the officially published records of both cities.

Emile Berliner next turned his attention to the milk question as it exists in Hanover. There are two so-called sanitary dairy establishments which charge a much higher price than the average dairy for their output, and which are patronized by the better classes and by the physicians. Both establishments are supposed to be occasionally visited by physicians for investigating their condition and the health of the cows.

Outside of these two favored dairy places, the rest of the milk is brought into town from the surrounding villages under conditions which, to say the least, are deplorable.

That these conditions are not altogether unknown to the authorities at Hanover, was shown by the fact that these physicians recommended that the milk be boiled at least five minutes in order to kill all bacteria. But it has been proven, notably by Dr. Park of New York City's Board of Health, that the chemical products of bacteria are not wholly destroyed by boiling, and certain one not at all. Furthermore, prolonged boiling

renders milk harder to digest for children with weak stomachs.

There occurred in Hanover in 1899:

23 deaths of scarlet fever.

82 deaths of measles.

551 deaths of intestinal troubles, including cholera infantum.

To the student of the milk question, the first two figures are closely connected with the purity, or lack of it, of the milk supply.

In the year 1899-1900 there occurred in the District of Columbia:

23 deaths of scarlet fever and

41 deaths of measles.

In the following year:

7 deaths of scarlet fever and

17 deaths of measles.

And in 1901-2:

15 deaths of scarlet fever

8 deaths of measles.

And it is noteworthy that these decreases were coincident with the instituting in Washington, both by the Health Office and by other parties, of a crusade against milk contamination.

The death rate alone is not entirely a measure for

and re-insert the latter in the hole, pressing it home as strongly as possible. Remove the excess of glue or dextrin, wiping it cleanly off with a rag dipped in clean water, then let dry. The nail will then be firmly fastened in place. If the loose plastering be touched with the glue and replaced it will adhere and remain firm.

PORTABLE WIRELESS TELEGRAPH EQUIPMENTS IN THE GERMAN ARMY.*

By A. FREDERICK COLLINS.

In a series of rigorous experiments of the Braun-Siemens & Halske system of wireless telegraphy, performed at the instigation of the Imperial German government, the Royal Military Airship Battalion, which was detailed to make the tests, reported favorably on the practicability of the scheme.

For this purpose the Braun-Siemens & Halske Company, of Berlin, constructed some especial equipments, consisting of transmitters and receivers for wireless telegraphy to withstand the exceptionally heavy service which would necessarily be exacted by the strenuous conditions and the harsh treatment which are characteristic of army service. The instruments, which were

INTERIOR OF A BRAUN WIRELESS TELEGRAPH STATION.

the state of health of a city. This is more perfectly judged by a number of cases of different diseases; and unfortunately the number of cases of scarlet fever, diphtheria, and typhoid which are reported and published weekly by the Health Office in Washington are not so reported in Hanover.

Measles are likewise not reported either in Washington or in Hanover. With the number of deaths from measles being sometimes two to three and one-half times greater than scarlet fever, why cases of measles are not reported in Washington is something Berliner is unable to find an explanation for. But in the District of Columbia scarlet fever and diphtheria decreased under the above-mentioned campaign against milk contamination.

To Make Solid Loose Nails in Walls.—As soon as a nail driven in the wall becomes loose and the plastering begins to break around it, it can be made solid and firm by the following process, which we republish from the Druggists' Circular and Chemical Gazette: Saturate a bit of wadding with thick dextrin or glue, wrap as much of it around the nail as possible

mounted on the regulation gun carriages, were made as compact as possible, the entire arrangement being shown in the accompanying photographs.

These accouterments for military signaling without wires consisted of apparatus installed at two permanent stations—at Gross Möllen and at Saprintz—both of which employed masts for suspending the vertical wires, and three portable equipments, the maneuvering taking place in a zone or field of force approximating thirty-five miles.

The coherer employed as a wave detector in wireless telegraphy is an instrument of exceeding sensitiveness, and usually it has been regarded as an extremely delicate contrivance also; but in the light of these tests, while it was found to be almost ideally sensitive, it was far from being delicate, as the following illustration will show.

The wagon carrying the transmitting and receiving apparatus was drawn at high speed across country, and in five minutes after the order was given the commander of the battalion to "make ready," the

* Specially prepared for the SCIENTIFIC AMERICAN SUPPLEMENT.

entire equipment was in working order, including the aerial wire or antenna, which had been in this short interval elevated to a height of three hundred feet by means of a kite. Under these trying conditions the receiver—of which the coherer is the most delicate part—operated perfectly.

The Braun-Siemens & Halske coherer is, however, constructed on radically different lines from its predecessor, in that it is not a vacuum coherer, i. e., the tube is not exhausted of its air; again, glass does not enter in its make-up, polished hard rubber tubing taking its place, making it practically unbreakable.

When the wind is light the vertical wire is raised by means of a tailless kite, such as the Malay or, as its improved form is termed, an Eddy kite; when the weather is heavy and the wind stiff, a cellular kite, such as the Blue Hill box kite, is utilized; and should there be no wind blowing at all, a small hydrogen balloon is used. A cylinder of compressed hydrogen gas for filling the balloon is part of the outfit, and it is thus evident that provision has been made for meeting any emergency which may arise.

The induction coil of the transmitter is operated by a direct-current dynamo connected with a gasoline engine, all of which is placed in the rear carriage,

paratus is shown to the right; the switch on the board serves to throw the receiving apparatus into connection with the antenna and capacity.

The antenna and cylindrical capacity are connected with the primary of a small transformer 10, the secondary of which is connected to the coherer 10a through a condenser not shown in the picture. The coherer is in series with a sensitive polarized relay 12, and is actuated by a single dry cell; the auxiliary circuit of the relay actuates a mechanical toppler 13 and the Morse register 14; or all this heavy apparatus may be supplanted by a coherer and a pair of head telephones shown in 15.

In the summer of 1902 two experimental stations were erected on the East Sea (Ostsee); these were located at Sassnitz on the Rügen and Gross Möllen on the Pomeranian coast. These stations have masts 75 feet in height; the antennæ consist of a single wire leading from the apparatus upward to the yardarm, the upper third portion being inclosed in a net of six parallel wires.

The Austrian and Danish navies have been recently supplied with the Braun-Siemens & Halske system of wireless telegraphy, and the United States navy is at the present time testing its merits. The

effects of Röntgen rays, as they somewhat resemble the effects of ultra-violet light. Besides this acute radio-dermatitis, which is practically confined to over-exposed patients, there is a "chronic radio-dermatitis" which attacks the operators. It effects more especially the fingers. The skin becomes red and swollen, and it is often impossible to close the hand. The nails usually become thin, brittle and creased—sometimes they fall off entirely. There is no treatment for this malady except the suppression of the cause. The author uses fencing gloves containing a padding of very fine brass wire to protect his hands. To protect his patients he uses fairly strong rays and short exposures, gradually increasing in duration. He never lets the anti-cathode become brighter than cherry-red, but brings the tube within 5 cm. of the skin. For difficult radiographs he gives an exposure of 30 seconds at the first sitting, one minute two days afterward, and so on until the exposure is increased to three minutes. Then the sitting is interrupted for eight days, and if, after that, no redness shows itself, the exposure can be gradually raised to five minutes, which must not, however, be surpassed. As regards the precise action of the rays in producing the disease, we are as yet in the dark.—Oudin, Archives d'Electricité Médicale, September, 1902.

RADIO-ACTIVITY OF CAVE AIR.—Elster and Geitel have shown that any conductor becomes radio-active when charged and exposed to air, especially when the air is contained in a closed subterranean space. To shed some light on the origin of this radio-activity, the same authors have made experiments on air inclosed for three weeks in a boiler and on air sucked up out of the ground. If the activity is due to a process within the air itself, it will be evolved in the boiler, and if it is due to contact with the earth, it will be shown in the air sucked up. The authors pushed an iron tube into loose garden soil, and inserted a glass tube into it, through which the air was sucked into an electroscope. The results were altogether in favor of the view that the activity of the air in a cave or cellar is due to contact with the earth and to exhalation of ground air. For the electroscope was discharged in a few minutes by the air sucked up, whereas the air in the boiler did not show any extraordinary radio-activity. The authors, therefore, claim to have traced two distinct sources of radio-activity, one of them being the action of the sun upon the higher strata of the atmosphere, and the other being the exhalation from the soil of air which has been in intimate contact with it, and which diffuses up through capillary passages in the ground.—Elster and Geitel, Physikal. Zeitschr., September 15, 1902.

BEQUEREL RAY PHOTOGRAPHS.—J. Elster shows how to obtain Becquerel radiographs with the simplest means. The radio-active substance is obtained by exposing negatively charged copper wires to the air, and rubbing off the surface layer after exposure. If cotton wool is used for rubbing it off, it should be moistened with a little hydrochloric acid. This is afterward neutralized with ammonia and eliminated by igniting the cotton wool. The activity of the ashes is the same as that of the cotton wool. The radio-activity lasts for about five hours. As its loss is greatest at first, the exposures must be made as soon as possible. To save time it is advisable to substitute a piece of leather, moistened with ammonia, for the cotton wool, since it can be quickly dried in a spirit flame. The exposure is then made for about four hours, and the leather is renewed. After about five such renewals good radiographs of lead stencils are obtained through aluminium foil 0.1 mm. thick. The radio-activity of the exposed wires depends, of course, to a great extent upon the weather. Air free from mist and dust is specially favorable. But the best of all is a cellar free from dust, and the author has found that the leather rubber over charged wires suspended in a cellar exerted some visible action upon a fluorescent screen. He points out that the whole surface of the earth is practically a cathode.—J. Elster, Jahrbuch für Photographie, 1902.

OLONIUM.—If pitchblende is powdered and ignited in a porcelain crucible, and the lid is kept cool, the latter is covered with a reddish-gray deposit which shows a strong radio-activity. This substance, referred to as "volatile" by Giesel, cannot have a merely "induced" radio-activity, since its activity is about six times that of the pitchblende, whereas radium never induces an activity equal to its own in a body it influences. O. Behrendsen proves that the deposit consists largely of polonium. On covering the deposit in question and a radium preparation with imitation gold film of the same thickness, he found that the former lost 85 per cent and the latter only 20 per cent of its original radio-activity. This great absorption of the rays from the deposit is only found in polonium rays. Another point of resemblance is the volatility of the substance and the comparatively short duration of its radio-activity. Like polonium, the volatile deposit has a preference for bismuth. If pieces of various metals are covered with it and ignited, bismuth shows as a result an activity ten times greater than any other metal. This preference for bismuth has been utilized by Marckwald for the electrolytic preparation of polonium. The author considers it definitely established that polonium is an independent element.—O. Behrendsen, Physikal. Zeitschr., September 15, 1902.

ELECTRICITY IN THE ALIZARINE INDUSTRY.—Alizarine was formerly obtained from the root of *Rubia tinctorum*, but since Graebe and Liebermann discovered that alizarine is a derivative of anthracene, it has been manufactured from coal tar by treating anthracene with sodium bicarbonate and sulphuric acid. This gives anthraquinone, and according to the modern process, this is treated with fuming sulphuric acid, and the monosulphite is fused with caustic soda. To obtain anthraquinone from anthracene, sodium bicarbonate is necessary. Up to the present, the methods for recovering the chromium salt contained in the mother liquor as chromium sulphate have been very troublesome. The electrolytic recovery of the chromium has hitherto been hindered by the fact that between the two electrodes a diaphragm is necessary, and that no diaphragm was found capable of holding the strongly acid solution for any length of time. This difficulty has been overcome by Leblanc's invention of dia-

BRAUN PORTABLE WIRELESS TELEGRAPH OUTFIT FOR MILITARY USE.

While the auxiliary apparatus, including the receiver and reserve parts, are arranged in the front carriage; the carriages are constructed on lines identical with the regulation gun carriage.

One of the notable features of the Braun-Siemens & Halske apparatus is the absence of earthed terminals, which have been found so essential in all other systems; instead of the earth, cylinders of zinc or copper are employed, having the requisite electrical capacity, which is a decided advantage.

In the portable sets no material effort has been made toward the timing of the various instruments operating in the same zone; but for purposes of symmetry of the electrical proportions, adjustable capacities and inductances are included.

The portable apparatus is similar to that of a permanent station equipment except that it is constructed much more compactly; the principal features of the system are well brought out in the accompanying interior view of one of their test stations.

The induction coil 1 is shown resting on the floor;

field for signaling through space is ever broadening, and it will not be long until every vessel in the merchant service will be equipped with some system; at the present time, while the public eye is fastened on the commercial value of wireless telegraphy, the great work of installing systems in the armies and navies of the world powers is overlooked in virtue of the secrecy with which it is done; the effort, nevertheless, is being directed systematically in these branches of organized warfare, and when completed, one more link in the great chain of peace will have been forged.

CONTEMPORARY ELECTRICAL SCIENCE.*

PHYSIOLOGICAL EFFECTS OF RÖNTGEN RAYS.—The skin disease called radio-dermatitis is the consequence of excessive exposure of the skin to Röntgen or Becquerel rays. Its pathology and treatment are fully described by Dr. Oudin. It is a painful and troublesome malady which may last for eighteen months, and is difficult to cure, though it does not appear to give rise to infec-

THE PORTABLE MILITARY WIRELESS TELEGRAPHIC APPARATUS IN USE.

its primary is connected to a source of electromotive force through the electrolytic interrupter 2 by means of the feeders 3, 3'; the terminals of the secondary 4, 4' are connected with spark-balls forming the air gap in a glass cylinder 5, which is filled with a viscous compound such as vaseline. To either side of the spark-gap 5 are a series of miniature Leyden jars 6, 6', and by removing from or adding to their number a capacity of the desired value is obtained for the oscillator or radiator system, which will correspond in frequency to the natural period of the resonator or receiving circuit.

The frequency of the oscillations may be stepped up or down to any given rate per second by means of the high potential transformer shown at 7. The primary of this oil transformer is connected to one of the spark-balls, and the opposite terminal to the opposite spark-ball. The secondary terminals of the transformer lead to the antenna or vertical wire through the switchboard, and thence through the window, and to the zinc cylinder, representing a capacity equal to that of the suspended wire and approximately a capacity equal to that of the earth. The receiving ap-

paratus is shown to the right; the switch on the board serves to throw the receiving apparatus into connection with the antenna and capacity. The antenna and cylindrical capacity are connected with the primary of a small transformer 10, the secondary of which is connected to the coherer 10a through a condenser not shown in the picture. The coherer is in series with a sensitive polarized relay 12, and is actuated by a single dry cell; the auxiliary circuit of the relay actuates a mechanical toppler 13 and the Morse register 14; or all this heavy apparatus may be supplanted by a coherer and a pair of head telephones shown in 15. In the summer of 1902 two experimental stations were erected on the East Sea (Ostsee); these were located at Sassnitz on the Rügen and Gross Möllen on the Pomeranian coast. These stations have masts 75 feet in height; the antennæ consist of a single wire leading from the apparatus upward to the yardarm, the upper third portion being inclosed in a net of six parallel wires. The Austrian and Danish navies have been recently supplied with the Braun-Siemens & Halske system of wireless telegraphy, and the United States navy is at the present time testing its merits. The

* Compiled by E. E. Fournier d'Albe in the Electrician.