understand the method of operating the machine. The player is rolled up against the piano and properly positioned with its striker levers over the keyboard and the pedal lever set. The desired roll of music is now secured between the bearings, *S S*, and the end of the music sheet is passed over the tracker-board, *B*, and secured to a hook on the roller, *T*. The motor having been wound up, a slight movement of the key-lever, *U*, starts the mechanism and slowly draws the music over the tracker-board. The desired speed is now obtained by shifting the speed-lever. For the benefit of the beginner a celluloid strip is provided behind the lever, *U*, on which eight different speeds are registered and indicated by musical terms ranging from *largo* to *presto*. On the music roll the required speeds are printed, and by shifting the speed-lever to the positions called for, the proper tempo will be obtained. Open pedal effects are had by the lever, *Z*, which is operated with the left hand. The *piano* and *forte* effects are controlled by the operation of the pedals. The greater the suction in the wind box, *A*, the more rapid will be the action of the pneumatics and consequently the more vigorously will the keys be struck; a quick thrust of the treadle gives an immediate response. On the other hand, a slow movement of the pedals results in a sluggish action of the pneumatics, which produces a *pianissimo* effect. Directions are printed on the music roll to guide the beginner in these different shades of expression, but if he has a musical feeling, these directions are soon disregarded by the performer, and his own time and expression are unconsciously embodied in the music. Especially is this so with regard to the loud and soft effects, for even the most unmusical among us know how difficult it is to keep our feet still when listening to a thrilling march, and how listlessly we move when a dreamy waltz is played. This in crude form is what musicians term "expression" or "feeling." The Simplex piano-player makes use of this peculiarity, and employs the natural impulses of a performer to express his musical feeling.

We can therefore appreciate the importance of using an independent spring-actuated winding motor; and to this in large measure is attributed the success of the Simplex player; for by using a spring motor in place of the usual wind motor, the bellows may be made sensitive to sudden changes in force, thereby giving opportunity to express the music and phrase it as one would if playing manually. Players using wind motors are confined to a given tension of the bellows at all times; otherwise, the motor would change in speed as the bellows change in tension, the result being that they must obtain their expression through mechanical levers and resistance.

The Current Supplement.

The current Supplement, No. 1394, is a number remarkable for the diversity of the subjects treated. M. Jacques Boyer has specially prepared for this Supplement a review of the methods of making natural and artificial perfumes—a subject which has received but too little attention from the technical press. A paper on the chemistry of the protection of steel against rust and fire by concrete is one of exceptional value. Automobilists will no doubt read with interest a description of the Holden motor cycle. The very full illustrations and the exhaustive explanation of the various parts, give to the article a certain thoroughness which is not always characteristic of descriptions of motor carriages. "The Roman Galleys of Lake Nemi" is the title of an archæological article distinguished for its scholarliness of treatment. One of the greatest improvements in the transmission of messages by long-distance submarine cables since the introduction of the siphon recorder is the automatic relay translating device invented by Mr. S. G. Brown. The paper which Mr. Brown read before the Institution of Electrical Engineers, describing his invention, is reproduced in full. Particular pains have been taken to illustrate the paper adequately. Prof. Conklin's paper on the relation of the psychic life to the nervous system is concluded. Mr. Otto F. Hunziker begins a valuable series of papers entitled "A Review of the Existing Methods for Cultivating Anærobic Bacteria."

The Summer Complaint Bacillus.

Victor H. Bassett, of Johns Hopkins University, and Charles Duval, of the University of Pennsylvania, have discovered the germ of the disease which is popularly known as "summer complaint." After the death of his grandson, John D. Rockefeller donated $200,000 to found an institute of medical research in bacteriology. With the means provided by the Rockefeller fund, Mr. Bassett and Mr. Duval have been enabled to make their discovery. The germ is found to be the same as that which causes acute dysentery in adults.

Wireless Telegraphy Between Italy and England.

The Marconi Wireless Telegraph Company announces that it has received perfect messages at Poldhu, Cornwall, from Gibraltar and Spezia.

AN IMPROVED DRYING OVEN.

BY EDMUND S. SMITH.

For the benefit of chemists and others who desire a more convenient apparatus than the gas-heated air-baths commonly in use for drying precipitates, coal and coke samples, clays or any other substances requiring only a moderate degree of heat, a simple and easily constructed oven is described below.

The heating agent employed is the ordinary incandescent lamp, thus eliminating the troublesome "scaling" and "burning" of the common gas-heated oven bottom. Nor are cleanliness and durability its only advantages. The temperature obtained is practically constant, and there is no danger from overheating, a fault not infrequently found in direct-heated ovens when the gas pressure fluctuates. In the bath here described two 110-volt, 20-candle power lamps are employed. One lamp will heat the oven to 70 deg. C. (158 deg. Fahr.), while two lamps yield a temperature of 110 deg. C. (230 deg Fahr.). By the use of other sized lamps or by increasing their number, it is obvious that quite a range of temperature may readily be obtained.

In the oven made by the author, the box was 9½ inches high, 7½ in width and 6½ inches deep, cut and shaped in one piece from No. 28 galvanized iron and lined with asbestos. (See Fig. 1.) The edges of the iron on the front side are bent over for a distance of ⅝ of an inch, making a wide seat for the door. At the back of the bottom is a jog 3 inches high and 2 inches deep to carry the lamp sockets, as shown in Fig. 2, which is a side elevation of the box with the wall removed. The back wall is protected at *a* by soldering a strip of galvanized iron to the wall. This strip extends the full width of the box and is also soldered to the side walls, hiding the jog from all points of view except the bottom, which is shown in Figure 3. This strip is drilled with two ⅝-inch holes to carry the outer

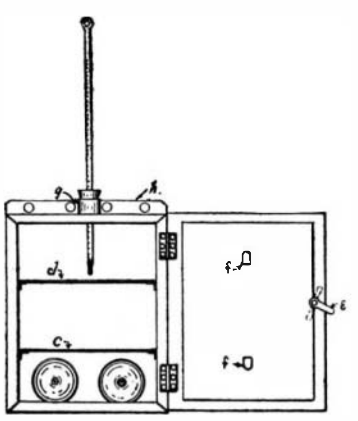

Fig. 1.

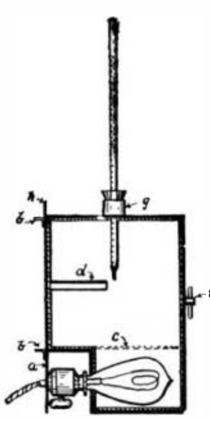

Fig. 2.

DIAGRAM OF IMPROVED ELECTRIC DRYING OVEN.

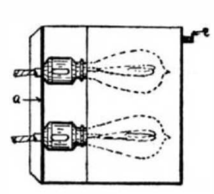

Fig. 3.

ends of the lamp-sockets, while the inner ends of the sockets are held in place by the lamps passed through the holes in the front wall of the jog, of just sufficient size to hold them securely. No rubber fittings of the socket must pass within the box-lining, since the heat within would soften them. The lamp keys are accessible from the bottom only.

As the bath is designed to hang upon a wall, the small angle-irons soldered to the back at *b b* furnish clearance for the lamp connections and at the same time afford protection against overheating the supporting room-wall.

The shelf, *c*, made of perforated sheet iron or coarse wire screen, is supported by small tin or galvanized iron angles soldered to the side walls. The upper shelf, *d*, is but 3½ or 4 inches wide and is drilled and slotted to hold funnels containing precipitates, etc.

The door is hung by small brass hinges soldered in place. (See Fig. 1.) The latch, *e*, carried by the rotating handle engages the door-seat when closed, tightly locking it.

When the box is completed it is lined throughout with asbestos board ⅛ inch thick. If proper care be used in cutting, no rivets will be necessary, as the board is sufficiently stiff to support itself. The side-linings will hold the top in place. The inside of the door is covered with asbestos board, of just sufficient size to fill the opening inside the door seat. This board is held in place by two small clips, *f f*, soldered to the door. These pass through the asbestos and are then bent over to secure it firmly.

A small tube, *g*, soldered around a hole in the center of the top holds a cork carrying the thermometer, as in other drying-ovens. The box is hung from the drilled strip, *h*.

If a higher temperature than 110 deg. C. is desired, it is suggested that ¼-inch asbestos board be used for lining, as the loss of heat by conduction with ⅛-inch board is quite appreciable.

A Single-Phase Railway.

A contract has recently been awarded for the equipment of an important interurban road with alternating current apparatus throughout. The road in question is the Washington, Baltimore & Annapolis Electric Railway, which is to operate a line from Washington to Baltimore, about 40 miles in length, with a branch to Annapolis, 15 miles in length.

This contract marks a great step in advance that has long been awaited by engineers, both in this country and in Europe. In the ordinary method of operating street railways direct current is fed to the trolley line for the car motors. For city lines and densely populated districts, the current is often generated as direct current, but for long-distance interurban roads this would involve a cost of copper conductors entirely prohibitive. To meet the latter objection a system has been used thus far in this country involving the generation of alternating currents at high pressures of from 10,000 to 30,000 volts and the transmission of the same to substations, where by means of transformers and rotary converters the current is supplied to the trolley wire as direct current at the usual railway voltage from 500 to 650 volts. The rotary converter substation, however, has always been an undesirable feature, chiefly on account of the cost of the apparatus and building and the attendance required. The plans that have been proposed to do away with this feature are numerous, but before this, none have appealed to practical American street railway engineers.

In Europe the polyphase induction motor has been used to some extent, but it implies the use of two or three overhead wires, and, moreover, the characteristics of the induction motor in regard to starting and average efficiency in railway service are said to be not of the best. Other systems which have been proposed involve the use of single-phase motors upon the cars driving generators which in turn supply power to the motors on the axles. However, this involves the placing of a substation upon the car itself, and so cannot be considered a great improvement over the ordinary alternating current-direct current system.

For the road which is now being constructed between Washington and Baltimore, single-phase, alternating current will be generated in a main power house, located at Hyattsville, by three 1,500-kilowatt, single-phase, Westinghouse generators, delivering current at 15,000 volts and drived by cross-compound, Hamilton-Corliss engines. This station is of more than average size and is in no sense experimental. The power house will be built of brick with stone and concrete foundations, and will contain in addition two 125-volt direct-current generators to be used as exciters for the alternators and a large switchboard with electrically-operated oil switches, circuit-breakers, lightning arresters, etc. Current will be distributed from the power house at 15,000 volts to transformer stations located at suitable intervals along the line. These transformer stations will contain only stationary transformers with the necessary switches and fuses, but no moving machinery, and will, therefore, not require the presence of an attendant. From these stations current will be fed to the single trolley wire at 1,000 volts. The pressure of 1,000 volts which has been adopted for the trolley wire is not a necessary part of the system, as a much higher voltage could have been used if it had been deemed advisable by the engineers of the road.

The cars will probably be sixty feet in length and weigh about fifty tons each. They will be supplied with Master Car Builders' trucks designed for high speed. The track is laid with 80-pound rails, and it is expected that the distance of thirty-one miles will be made in forty-five minutes, including stops. The cars are to be equipped with four motors, each of 100 horse power. The designers believe a normal speed of forty to forty-five miles can be attained, and a speed of sixty miles reached when necessary. The motor, which is the novel part of the equipment and the key to the entire system, is a variable-speed motor having characteristics adapted to railway service and in all respects equal to the present direct-current railway motor. It has been developed and tested in severe service during the last few years by the Westinghouse Electric and Manufacturing Company, under the supervision of Mr. B. G. Lamme, assistant chief engineer.

It is to be remarked that this latest development in electric railroading follows in a path already traced by electric lighting. The first electric lighting systems employed direct current at low voltage, but as the area to be supplied increased, this involved an increased cost of copper cables. To meet the difficulty, alternating-current distribution at high voltage was adopted, with rotary converter substations, to enable the current to be distributed on the existing mains as direct current. However, most electric power plants now being installed distribute low-voltage alternating current directly to the lamps and motors, thus avoiding the expensive rotary-converter substations.

The results obtained on the first trials of this line will be awaited with interest.

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