

grain, with little or no mechanical loss during the season. The masse cuite was taken to a *mixer*, and from it taken to a

HEPWORTH'S CENTRIFUGAL,

where it was purged of its molasses. The latter was cooked to slimy, and put into cars, and stored in the hot room.

Besides the above complete outfit, a small miniature equipment, consisting of a clarifier, an open evaporator, a very small strike pan and a hand centrifugal, was frequently used for making preliminary experiments with various chemicals, etc.—*La. Planter*.

STANDARD STOREHOUSE CONSTRUCTION.

By C. J. H. WOODBURY, Vice-President of the Boston Manufacturers Mutual Fire Insurance Company.

THESE illustrations represent salient points in design for a mill storehouse several stories in height and include many features found useful in practice for

quantity of level land at disposal for this purpose, as being cheaper, more convenient, and, when separated into small divisions by fire walls, the safest method of storehouse construction. Similar designs for one-story storehouses will be sent on application to persons connected with establishments insured in this company.

On reference to the drawing it will be seen that the floors are continuous, without openings, and of the standard slow-burning construction—a type which has not yet been burned through by any fire starting under such a floor. To reduce water damage, the floors are not level, but have a camber of two inches in the middle made by iron plates inserted under the columns in the basement. If it should become desirable to use the building for any purpose requiring level floors, they can be reduced to a level by removing these plates. Inclined iron tubes, with a light swinging cap on the outside, laid in the wall at the level of the floors, act as scuppers for the purpose of removing any water.

The beams are preferably of Southern pine bolted together in pairs, leaving about one inch space between

The columns should be square Southern pine or oak, with iron cap, pintel, and base, preferably cast in one piece, and secured to the underside of the beam by six inch lag screws. The caps should be large enough to give the beams ample bearing surface.

If brick piers are placed in the basement, it is preferable, rather than to insert bond stones in the piers, to use a plate of boiler iron the size of the pier, and containing a number of inch holes punched on both sides over a board, in order to produce as large burrs as possible, to securely hold the masonry.

It is generally preferable that the roof should slope toward the center one-half inch to the foot, and the gutter should slope toward the drain pipes one-twentieth inch to the foot; but if the roof slopes toward the walls, the detail of cornice, A, illustrates the arrangement of gutters.

Access to the various stories is obtained only by means of a tower outside the main building and extending above the roof, containing stairways, elevator, and water pipes. At each story of the tower, open galleries communicate to the rooms on that level. A doorway from the upper story of the tower affords a ready means of reaching the roof. It is often a matter of great convenience if the doorway at the first story of the tower is made large enough, and at the outside grade, so that a wagon can be backed directly to the elevator. It is unnecessary to provide these elevators with automatic hatches, as guard gates serve every purpose. For the elevators in such towers, either hydraulic system or electric motors frequently furnish a more convenient means of applying the power than steam.

The system of tram rails hung from above, in connection with the triplex blocks, as constructed by the Yale & Towne Manufacturing Co., is a great convenience in handling the contents of storehouses.

The walls extend above the roof, and the parapet should be laid in cement, because the moisture readily absorbed by brick would otherwise pass downward and render walls in the top story damp. In some instances a course of brick dipped in coal tar is laid above the roof level. The illustration, A, shows a method of protecting a low parapet wall by plank which is tinned. This form of parapet also tends to reduce the amount of snow lodging on the roof.

The window openings are small, and omitted on sides exposed to other fire risks; but if there is any contingency that the building will ever be used for other purposes, it is advisable to lay the walls with arches and panels, in which openings can be made suitable for windows of large size, necessary to furnish light for manufacturing purposes.

In addition to yard hydrants near the buildings, there should be a six-inch standpipe in the tower, with two 2½ inch hydrants and hose at each story, and at top story of the tower the standpipe branches to a Morse monitor nozzle on the roof, if there are any adjacent buildings which might be reached by streams from this position.

A set of plugs from the roof drain pipes will allow the roof to be covered with water in case the property is endangered by sparks from burning buildings.

Automatic fire alarms with thermostats form a valuable auxiliary to the fire apparatus in storehouses.

If the contents of the storehouse are of such a nature that automatic sprinklers are advisable, it is preferable to shut off the water during freezing weather, rather than to rely upon the devices known as dry pipe systems.

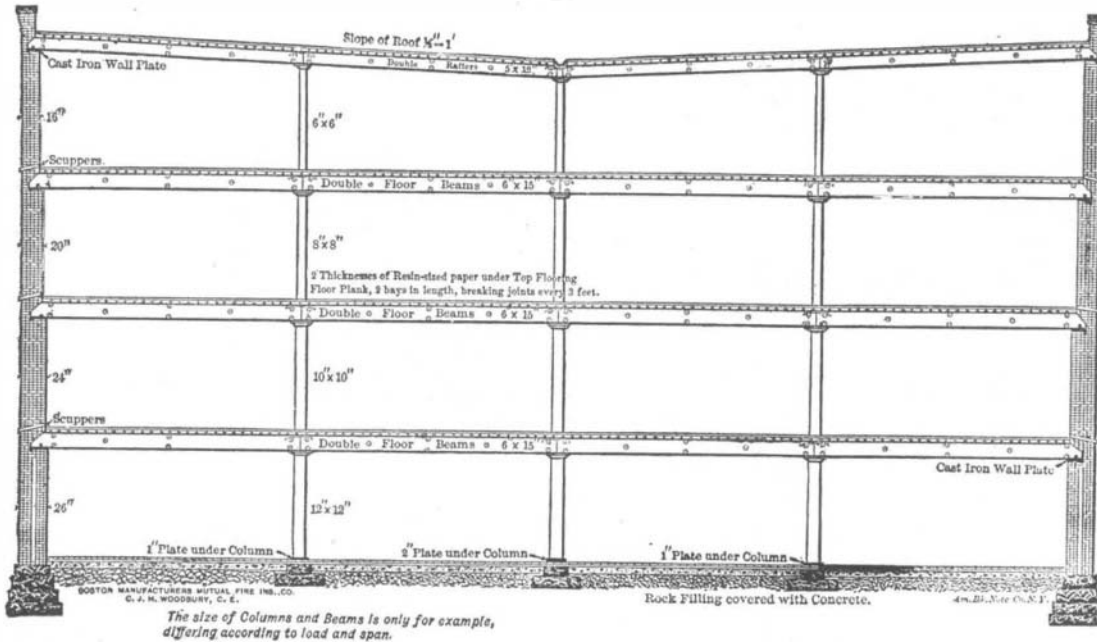
ELECTRIC HEATING.

By MARK W. DEWEY.

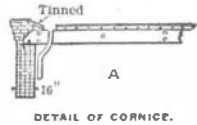
VERY little has been done up to the present time in heating by electricity, and yet enough has been accomplished to demonstrate its practicability and its superiority over all other modes of heating. The common belief is that heating by electricity would be too costly. It is generally conceded that in all other particulars it is superior to other modes of heating; and when electricity is generated a little cheaper than it is at present that objection will be removed. The only objection, therefore, is that it is not economical. This was exactly what was said about electric lighting when it was first proposed, but after it came into use it was found that it could be supplied as cheaply as gas or other illuminants, and to-day it is used in all parts of the world, and people cannot speak too highly of its merits.

One well known inventor, while he admits that electric heating is undoubtedly the most convenient and the ideal method of artificially warming our places of habitation, has said that it will not be economical until we can transform the heat in the coal directly into electricity without the intervention of boilers and engines. This inventor is wrong, and certainly could not have examined the subject fully. Even if we are compelled to employ the steam engine in the generation of electricity for heating, as in many cases at present, when we cannot get water power, heating by electricity is just as economical as heating by coal. We need not wait for the time, though it may be close at hand, when electricity will be generated directly from the heat of coal; if it is as economical to heat by electricity now, the immense advantage possessed by this mode of heating over other modes should and will soon give it the preference.

The same inventor said, although it is not understood why, as will be seen further on, that electric heating costs nine times as much as ordinary heating, so that to heat by electricity it would be necessary to burn nine pounds of coal to get the heating effect of one pound. This he explains by the fact that under the best conditions we realize in electricity about one-tenth of the energy of the coal consumed, and when we turn that ten per cent. of electricity into heat we simply get nothing more than ten per cent.; therefore, to get electric heat equivalent to the heat in one pound of coal it is necessary to burn ten pounds. This inventor seems to have lost sight of the fact that when employing a coal furnace or stove for heating we get only about 40 per cent. of the energy of the coal, and that then we must use a superior and expensive grade of coal costing from three to six times as much as the grade of coal that can be consumed at a large generating or central station. It is possible for us to get 60 per cent. of the total energy as useful heat



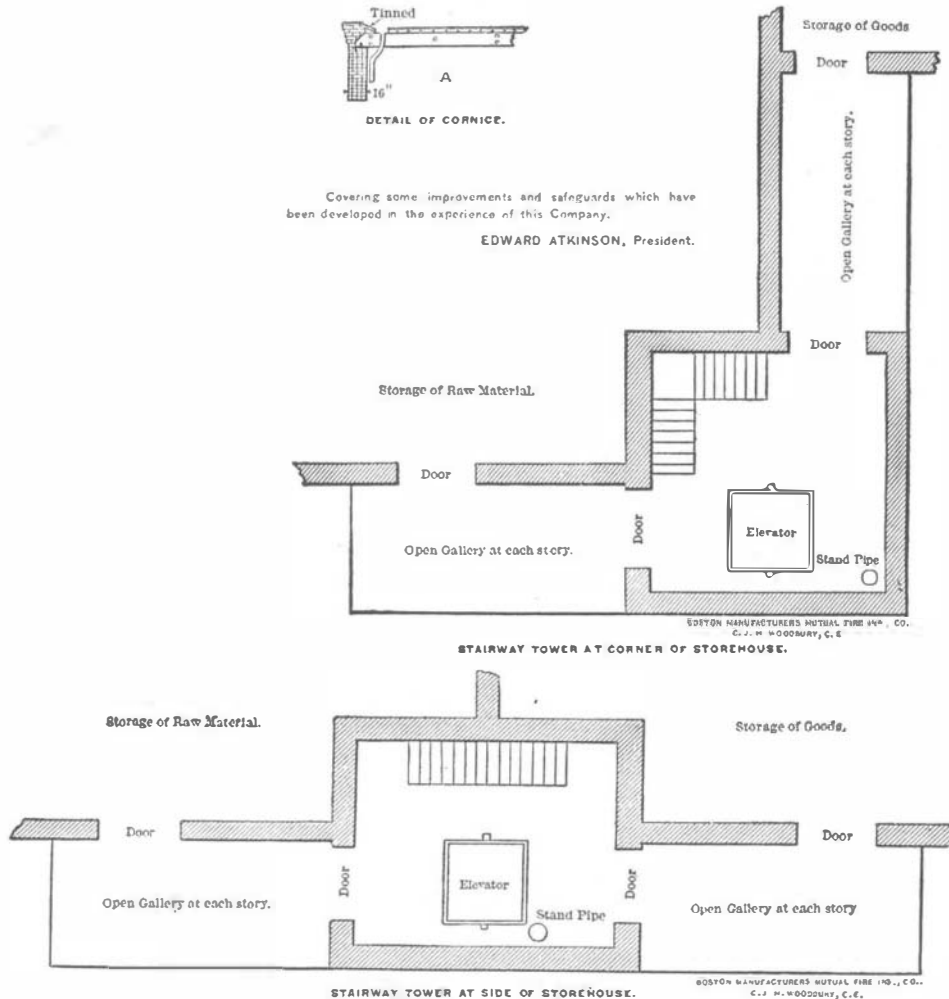
The size of Columns and Beams is only for example, differing according to load and span.



DETAIL OF CORNICE.

Covering some improvements and safeguards which have been developed in the experience of this Company.

EDWARD ATKINSON, President.



STANDARD STOREHOUSE CONSTRUCTION.

convenience in operation and also securing the greatest measure of resistance to fire.

This plan is not intended to take the place of the services of any mill engineer, but rather to assist in such work. This office holds itself in readiness to furnish to its members estimates of the strength of floors. It is important that the floor beams should be designed to sustain the greatest load ever to be placed on them, and the stories should be made low enough to prevent overloading, and also to prevent bales of material from being piled to too great a height, the preferable method being to place bales on end.

These floors, with beams of 20 feet span, laid 8 feet on centers, will sustain a load of 180 pounds per square foot, which is as much as would be required for raw material or finished goods of a textile or paper mill. The heavy drugs and dyestuffs would be placed on the ground floor.

For convenience, as well as to separate the different hazards of raw material and finished goods, the building may be divided into two sections by fire walls extending through the roof.

A storehouse one story in height is recommended in preference to this design whenever there is sufficient

the beams. At the columns the beams are joined by dogs made of three-fourths inch round iron, driven in at the top, and they are anchored to the walls by cast iron wall plates, to which they are secured by means of a rib which fits into a groove crossing the underside of the beam. It is important that there should be a small space at each side and at the end of the beam, in order to allow free ventilation, for the purpose of preventing dry rot. The Goetz box anchor is a special form of wall plate which is especially adapted to such purposes.

The under floor is made of spruce plank, generally three inches thick, planed on the underside, and grooved at the edges, and fitted with hard wood splines. These plank are two bays in length, breaking joints at least every three feet. Over the plank are placed two thicknesses of resin-sized paper before the top floor of hard wood is laid. The floor is smoother if laid across the line of plank, and the traveling loads moved in or out of the storehouse are better distributed than when the top floor is laid parallel to the plank. The floor should not be secured to the walls, but a narrow strip, laid around the edges of the floor and fastened to the wall, covers any openings due to shrinkage.

from a first class furnace if carefully and properly regulated; but stoves do most of the heating in towns, and they give but one-fourth, or 25 per cent., of the total energy in useful heat. Three-fourths of the heat passes up the chimney. Air rushes through the crevices of doors and windows in draughts which are injurious to health.

We can get 10 per cent. of the heat energy expended at the central station, and in using a stove we may get 25 per cent. Electric heat, therefore, would cost two and a half times more than heat derived from the consumption of coal in a good stove, if the same grade of coal is used in both cases; but as the central station can and does use coal costing one-fourth or one-third of what we must pay for coal to burn in a stove, electric heat can be obtained as cheap as the heat obtained by means of a coal stove.

It is evident from the above that electric heat is as economical as the heat ordinarily derived directly from coal, but when we consider the numerous advantages of electric heating it appears to be more economical still. Take, for instance, a house heated by electricity in a town. Let the current come from the central station and heat coils of iron wire. These coils are very cheap, may be placed in any part of the house and arranged in almost any conceivable and desirable way to produce the best results for heating or cooking purposes. These coils can be placed just under or around the vessel holding the article to be cooked or baked. Less heat than usual would be required, for no soot would collect upon the bottom of the containing vessel. The fire risk would be much less than at present, as the wire never need be hot enough to cause fires or can be easily and completely protected. The heat supply can be turned on or off instantly; thus there will be no loss of fuel when the need of heat has ceased. This applies with great force to summer use. In heating, cooking or baking, the temperature can be kept uniform or controlled as desired. In cooking or baking, many things are spoiled and wasted because the heat cannot be regulated as desired or appears to be different than it really is. Many regulators have been devised for the automatic regulation of coal heaters, but none of them accomplish their purpose fully, for the reason that a coal heater cannot be automatically regulated except in a small degree. We must visit the furnace or stove now and then, supply it with coal, rake down the ashes, carry them out, clean the soot out of the flues so that it will have draught, and many other things. None of these things would be necessary with an electric heater. It can be thermostatically regulated perfectly the year around, and when the weather is warm enough or whenever from any cause the temperature of a house is raised above the point beyond which artificial or electric heat is not required, it will shut itself off and there will be no waste whatever; when the temperature falls below the predetermined point the current will be automatically put on again, so that the temperature will be kept uniform and healthful. A meter can be placed in the circuit to the heater which will register perfectly the amount of current consumed in producing the heat used, which of course is all that must be paid for. Coal stoves or furnaces do not possess this great advantage, and are often in use and wasting energy when an electric heater would be consuming nothing, and, not being in use, are not worn out as quickly as a stove. A coal stove is often run continuously during the summer season when two or three hours per day would be sufficient. This is done for various reasons; sometimes to save time or the undesirable job of cleaning out the stove and building a new fire, which necessitates the handling of kindling wood, ashes and coal, which in turn produces more or less dust, smoke and gas; and sometimes the fire is kept not only for these reasons, but because the weather is liable to change or become rapidly cooler, and at a time when time cannot be conveniently spared; so we keep the fire going day after day, especially in the spring and the fall, although it is warm enough to dispense with it, because we expect the weather to grow cooler; and often it does, and then we feel repaid for the heat energy we have wasted because it has saved us from building a new fire. But very often the weather does not grow cooler for several days and sometimes not at all; then much heat energy is wasted. With electric heat this would not be so, for the simple turning of a handle or switch, more or less, if automatic regulation was not used, would be all that would be required to turn the heat off or on as desired. We would therefore not waste the heat half a day or an hour.

Without rising in the morning, a button touched at the bedside may be made to turn the heat on in any or all parts of the house. The nuisance of kindling, smoke, gas, ashes and soot will be abolished, and no stovepipes, chimneys, scuttles, shovels, ash sifters, kindling wood, coal, or coal bins will be needed. Taking into consideration the cost of the articles above named, the trouble and fire risk, I am positive that electricity will not only be found as cheap, but much cheaper than heat supplied directly from coal as usual.

When the dynamo at the central station can be driven by water power, as is done in very many places at present and will be done in the future at a great many more, or when the central station is at places, such as Scranton, where coal mines are situated, greater economy can be obtained. Water power can be supplied ten hours a day at \$20, and steam at \$50 annually per horse power. In this case steam costs two and a half times as much as water.

It will be apparent from the above that electric heating would cost two and a half times as much as heating by stoves, if the same grade of coal was used in both cases, and in using water power to generate electricity the heat will cost the same as when produced in stoves, even neglecting the cost of the many articles above named that would be dispensed with.

Platinum wire has heretofore been used almost entirely for electric heating, but iron is as good and will be used in the future. The conductivity of soft iron is nearly as low as soft platinum, the ratio at the temperature of melting ice being as 20.73 to 18.03, and the cost nearly as 1 to 5,000.

Electric heating apparatus is much cheaper than other heating apparatus, as wires may be used in the place of pipes for conductors for the heat or the heating medium. No heat need be wasted, as each room

can have its heater, and though small, will consume no more energy accordingly than a large heater.

Another thing to be noticed is that the electric current for heating may be the same as for lighting. The electric lighting station can produce it; the same wires that conduct the current for your lamps, whether arc or incandescent, may conduct the current also for the heaters: in fact, all that is necessary is that sufficient current be furnished a consumer to supply both his lamps and heaters. One of the greatest advantages possessed by electricity over the ordinary stove for heating, from a commercial standpoint, lies in the fact that the same current that is utilized for heating can also be used for lighting and power, and the current generated for all those purposes may be transmitted to the various points of consumption over the same circuit. Instead of numerous small heat generators, such as furnaces and stoves, a single large generating station, equipped with modern appliances for the economical production of electrical energy, such as improved boilers, furnaces, triple or quadruple expansion compound

engines constantly working at full capacity, and storage batteries to store the electricity when the consumption is low, would be sufficient to supply a district with all the heat that may be required, without mentioning light and power, at a cost to the consumer that will compare favorably with what he is now called upon to pay for the fuel, attendance, etc., required by the present crude and wasteful methods of heating employed by him. The large increase in the size and earning capacity of these stations, due to the vastness of the field to be occupied by electric heating, will also greatly reduce the cost of current.

With the encouraging progress that has been made in the direction of providing more efficient and satisfactory methods of utilizing the current so as to obtain the greatest amount of heat therefrom, the problem of successful heating by electricity is practically solved, and there is every reason to believe that the time is short before electric heating will be generally adopted. It may be said further that it has been proved beyond a doubt that electric cars can be heated as economically by electricity as by other means, and if electric cars, why not others, and also houses of all kinds where the electric current is used for lighting or other purposes? One form of apparatus devised by the writer to render electric heating effective and economical is a floor or mat that can be electrically heated. This form of heater is capable of distributing the heat throughout the room or car in which it is placed more uniformly and exposes a large radiating surface to the atmosphere in all parts of the room or car. Floor mats are commonly used in street cars to prevent wear upon the floors and to keep persons from slipping. Mats the same or similar to those already in use are employed for the heater, the only essential requirements being that the mats be provided with heat-radiating conductors and connected to suitable supply conductors. These mats are perfectly safe and effective. A very low tension current is employed to heat the mats and this current is passed through them. They can be and are arranged in some cases so that it is impossible to touch the conductor of the mats, but even if the conductor in the mat is not protected or shielded, it is utterly impossible to receive a shock by contact in any manner with the mat. In some cases flexible steel coiled spring mats will be employed for the purpose, as they offer the required electrical resistance, expose

mat, and a thermostatic current controller in the circuit to regulate the heat. Two different styles of mats are shown in this figure. The conductors leading from the source of electricity to the mats are of large cross-section and better conductivity than the mats, consequently the heat produced by the current is located in the mats. Both of these mats are formed of conducting and non-conducting material, as iron and wood, the conducting material forming the heat-radiating electric conductor and the non-conducting material forming the shield or protecting part. The conductor in the mat on the left of the figure is formed of zigzagged strips of iron or other metal placed between slats of hard wood thicker than the width of the strips, thus forming a shield for the strips or preventing contact with them. The strips of metal are connected by rivets extending through the slats. On account of the form of construction of this mat it is rigid and stiff, but the mat shown on the right of the figure is flexible, as coiled springs extend lengthwise through the slats and form the radiating conductors. The mats are provided with suitable terminals, to which the terminals of the circuit are connected. They can be quickly and easily connected to and disconnected from the circuit when desired by means of specially designed clamps.

Fig. 2 represents a combined fan, or means to keep the air in motion, and an electric heater. When the air surrounding a heating conductor is kept in rapid

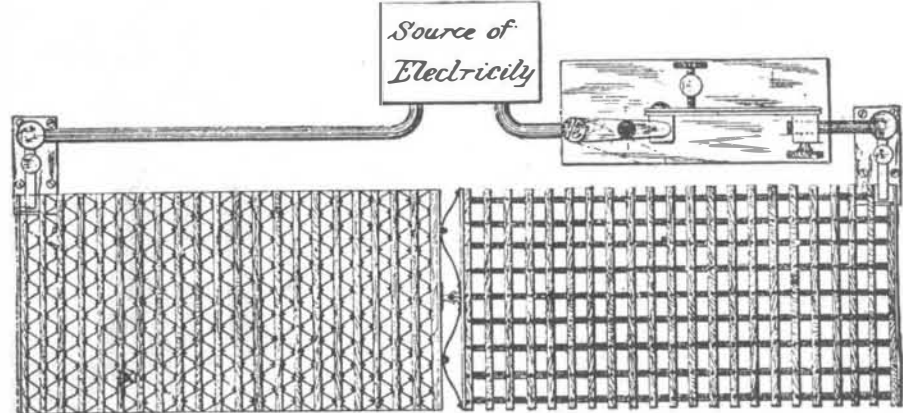


FIG. 1.—FLOOR MAT ARRANGED FOR ELECTRIC HEATING.

engines constantly working at full capacity, and storage batteries to store the electricity when the consumption is low, would be sufficient to supply a district with all the heat that may be required, without mentioning light and power, at a cost to the consumer that will compare favorably with what he is now called upon to pay for the fuel, attendance, etc., required by the present crude and wasteful methods of heating employed by him. The large increase in the size and earning capacity of these stations, due to the vastness of the field to be occupied by electric heating, will also greatly reduce the cost of current.

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It may be said further that it has been proved beyond a doubt that electric cars can be heated as economically by electricity as by other means, and if electric cars, why not others, and also houses of all kinds where the electric current is used for lighting or other purposes?

One form of apparatus devised by the writer to render electric heating effective and economical is a floor or mat that can be electrically heated. This form of heater is capable of distributing the heat throughout the room or car in which it is placed more uniformly and exposes a large radiating surface to the atmosphere in all parts of the room or car. Floor mats are commonly used in street cars to prevent wear upon the floors and to keep persons from slipping. Mats the same or similar to those already in use are employed for the heater, the only essential requirements being that the mats be provided with heat-radiating conductors and connected to suitable supply conductors.

These mats are perfectly safe and effective. A very low tension current is employed to heat the mats and this current is passed through them. They can be and are arranged in some cases so that it is impossible to touch the conductor of the mats, but even if the conductor in the mat is not protected or shielded, it is utterly impossible to receive a shock by contact in any manner with the mat. In some cases flexible steel coiled spring mats will be employed for the purpose, as they offer the required electrical resistance, expose

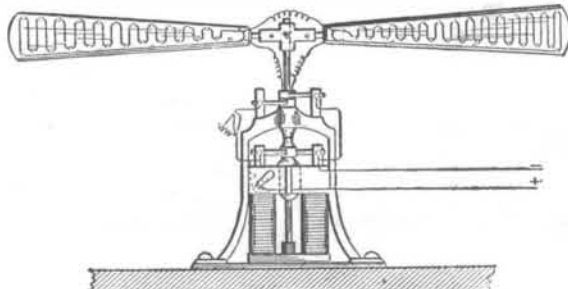


FIG. 2.—ELECTRIC HEATING APPARATUS.

a very great radiating surface, and are easily removed for cleaning purposes.

By the employment of a mat heater the disadvantages common to the usual modes of artificial heating are removed, these disadvantages being due to the fact that the heat is concentrated in a particular locality, and therefore is not equally distributed as it should be, since the space in the vicinity of the old heater must be heated to an undesirable degree in order that remote localities may be raised to a comfortable temperature.

The large exposed radiating surface area of the mat heater will enable it to develop and radiate a great amount of heat without becoming very hot; that is, not hot enough to burn wood, leather or rubber in contact with it. It will be unnecessary to raise the heat in the mat above 100 degrees Fahrenheit on the coldest day in the winter to produce a comfortable

motion, the conductor is able to produce more heat in a given time, and a heat-conducting medium, as asbestos or fire-clay, surrounding the conductor is unnecessary and may be dispensed with. With this heater all parts of the room are heated uniformly. It also ventilates the room and maintains a healthy atmosphere. In warm weather the heater may be cut off and the fan used for ventilating purposes only. Many forms of apparatus may be devised having this principle; for instance, the heating conductor need not be mounted upon the fan, but on the stationary support in proximity to the fan, or the heating conductors may be arranged in a suitable manner in a pipe or flue, with a fan at one end to cause a current of air to pass through it.

Fig. 3 represents a system for electrically supplying

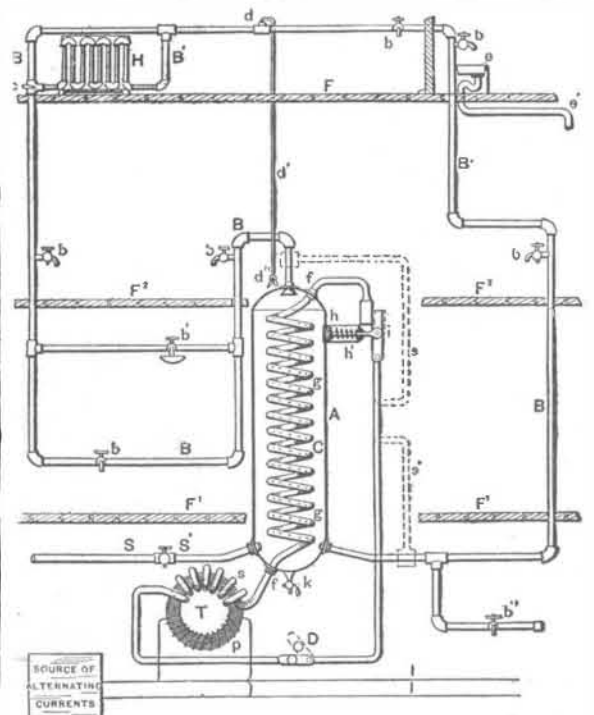


FIG. 3.—SYSTEM OF ELECTRICALLY SUPPLYING HOT WATER.

Fig. 3 represents a system for electrically supplying

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Fig. 3 represents a system for electrically supplying

hot water for domestic or heating purposes, or both. With this apparatus the water is supplied to the boiler, A, by the pipe, S. The water is supplied from and to the boiler through the house by the circulating pipe, B. H is a hot water radiator connected with the pipe for giving out heat. By means of the cock, c, the water may be shunted around the radiator when heat is not desired. Many radiators may be connected with the pipe either in series or otherwise. When the system is used largely for heating purposes, although it is possible, it is not thought to be advisable to use the water for domestic purposes, as the temperature of the water becomes lower and the radiators may not give out the amount of heat desired. The water is drawn from the pipe at the faucets, b. The water is preferably heated in the boiler by means of a perforated coiled pipe located within the same and connected with the terminals of a suitable source of electricity, which is shown in the figure as generated by an induction transformer, T. The current is automatically regulated by the pressure of the water in the boiler through the current controller, z. Although not shown, this controller is made adjustable, so that the water may be heated to any degree of temperature desired. When the water becomes too hot or rises above the temperature desired, the controller is moved to break the circuit, and when the water becomes cool again, the decrease of pressure in the boiler allows the controller to close the circuit. In some cases the heating current is also passed through the distributing pipe, B, which then becomes a heating conductor also. If preferred, the water may be heated by the passage of the current through the distributing pipe alone. In the latter case the boiler may be dispensed with. The heating of the distributing pipe may be done, however, for the purpose of assisting the boiler heater in maintaining a constant temperature.

Many forms of electric heaters or radiators may be employed for heating purposes that are directly heated by the electric current without using water. Such radiators may be made both efficient and light, and much more attractive than steam or hot water radiators and will not produce noise or give out unhealthy gases.

Electric heaters may be used to heat air which may be distributed to or circulated through rooms in houses by pipes and registers similar to those used with our coal furnaces, which are so hard to feed, clean and regulate.

Cooking stoves may be electrically heated and automatically regulated. Such stoves may be constructed so that the oven alone may be heated or any other part of the stove without heating the entire stove. The oven may contain an incandescent lamp and be provided with windows to enable the cook to see the contents without opening the door and allowing the heat to escape and the contents to be spoiled.

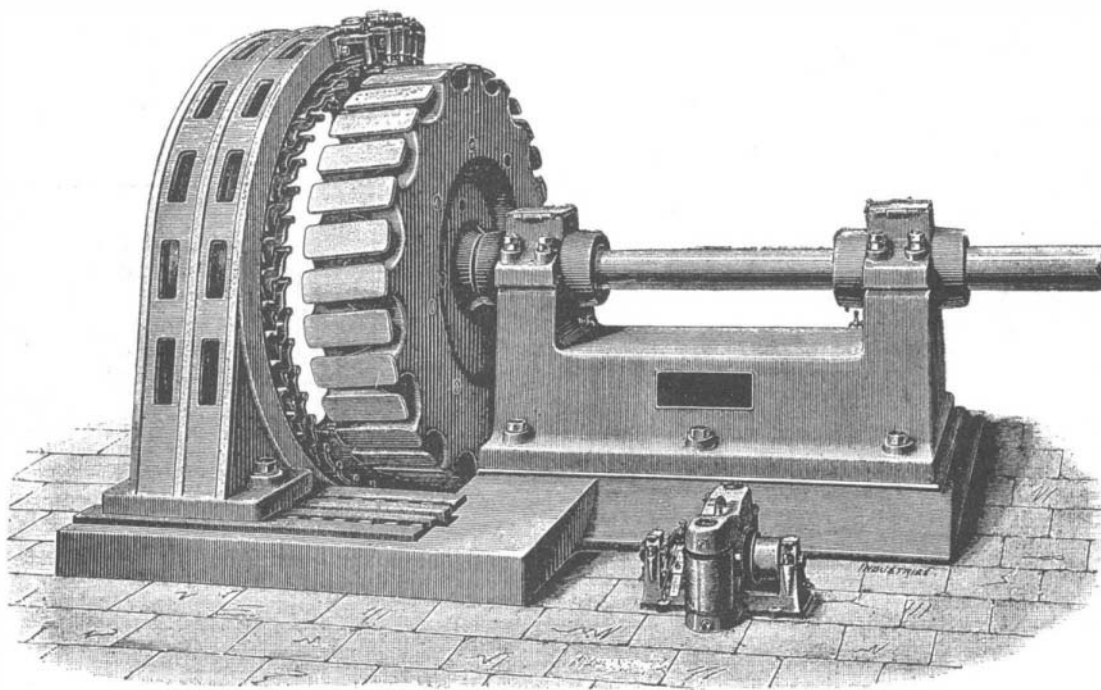
Those who admire the bright fire in a grate can enjoy it without the consumption of coal, wood, or other fuel by placing the incandescent lamps or an arc lamp beneath a body of glass, formed and covered, if need be, to represent a bed of coals or pieces of log wood, placed in the fireplace. The back and sides of the fireplace may be formed of mirrors if desired to magnify the effect, and if the heat is also desired, a small flat electric heater may be placed beneath, back of the ash guard.—*Electrical World*.

THE FRANKFORT ELECTRICAL EXHIBITION.

OUR illustrations show a triple current generator used for the transmission of 300 horse power from Lauffen to Frankfort. Distance 108 miles. It has been designed by Mr. C. E. L. Brown, and built by the Oerlikon Works. The field magnet rotates, and has thirty-two poles, which are excited by a single coil of wire. This admits of a very simple field magnet, and saves copper and loss of power in excitation. The armature is stationary, and has ninety-six conductors. These are embedded in the iron of the armature, a method that has been employed at Oerlikon for years with great success. The embedding of the armature conductors allows the air space to be reduced to a mere mechanical clearance, so that smaller field excitation can be employed. It also admits of the use of large solid bars without excessive Foucault currents. At no load the Foucault currents are obviously

inappreciable. At full load, with solid conductors, there is an action somewhat analogous to the "Thomson effect" in transformers with one layer of thick wire in the cylinder. The stationary armature has several advantages. If it revolved there would have to be collectors for three circuits, each of 1,400 amperes. Instead of that, a few hundred watts are all that have to be carried to the rotating part of the machine.

The armature is wound for three currents differing a third of a period in phase. Each circuit has a pressure of 50 volts, a transformer being used to produce the pressure necessary for transmission to long distances. The armature conductors are a little over $1\frac{1}{2}$ in. diameter. The armature disks are mounted on a cast iron ring resting on the bed-plate, so that the whole armature can be moved along clear of the rotating field magnets for inspection or repair, if such a



TRIPLE CURRENT GENERATOR WITH FIELD MAGNET WITHDRAWN.

thing should ever be necessary. The field current is not led in by brushes in the usual way, but is brought to two grooved rings by means of two metal bands. The field magnets carry 750 lb. of copper, and demand only about 150 watts, which are supplied by a small direct current machine. The stray power is given as 1.6 to 1.7 per cent., and the loss in the armature by resistance is 3,500 watts at full load. The commercial efficiency is thus 96 per cent., a remarkably good result for a machine run at such a low speed as this—viz., 150 revolutions per minute.

The Maschinenfabrik Oerlikon have made several large machines of this type, and they have been used both as generators and motors. When used as motors, we believe they are generally started by separately exciting both the generator and motor, and starting both from rest together in the way already described.—*Industries*.

THE KOUSMINE DIFFUSION BATTERY.

THE diffusion battery of M. Kousmine has been much used in Russia. By making use of the phenomenon of diffusion, M. Kousmine has succeeded in overcoming the increase in internal resistance of the bichromate of potash battery due to the formation of crystals on the positive electrode. The positive carbon electrode consists of four strips attached to the lid of the battery. The negative zinc electrode consists of a circular grating resting on the bottom of the battery. By means of a funnel a 15 deg. Baume solution of sulphuric acid is introduced until it just reaches the lower end of the carbon strips. A 6 to 7

per cent. solution of bichromate of potash is next introduced. The two liquids do not mix on account of the great difference in their densities. When the battery is short-circuited it is easy to see that chemical action only takes place close to the lower end of the carbon strips, which are gradually surrounded by a violet ring two or three millimeters deep. Above this region the bichromate solution retains its original color. The bichromate solution being very weak, the chromic crystals dissolve as soon as they are formed, and the positive electrode is not covered by a deposit as in other batteries. The solution of these crystals, having a greater density than the surrounding liquid, falls to the bottom. The sulphate of zinc also falls to the bottom of the cell, causing more sulphuric acid to rise. A cell having the following dimensions has been tested by a committee of experts: Height, 20 centimeters; diameter, 15 centimeters; surface of zinc, 176

MOTHS.

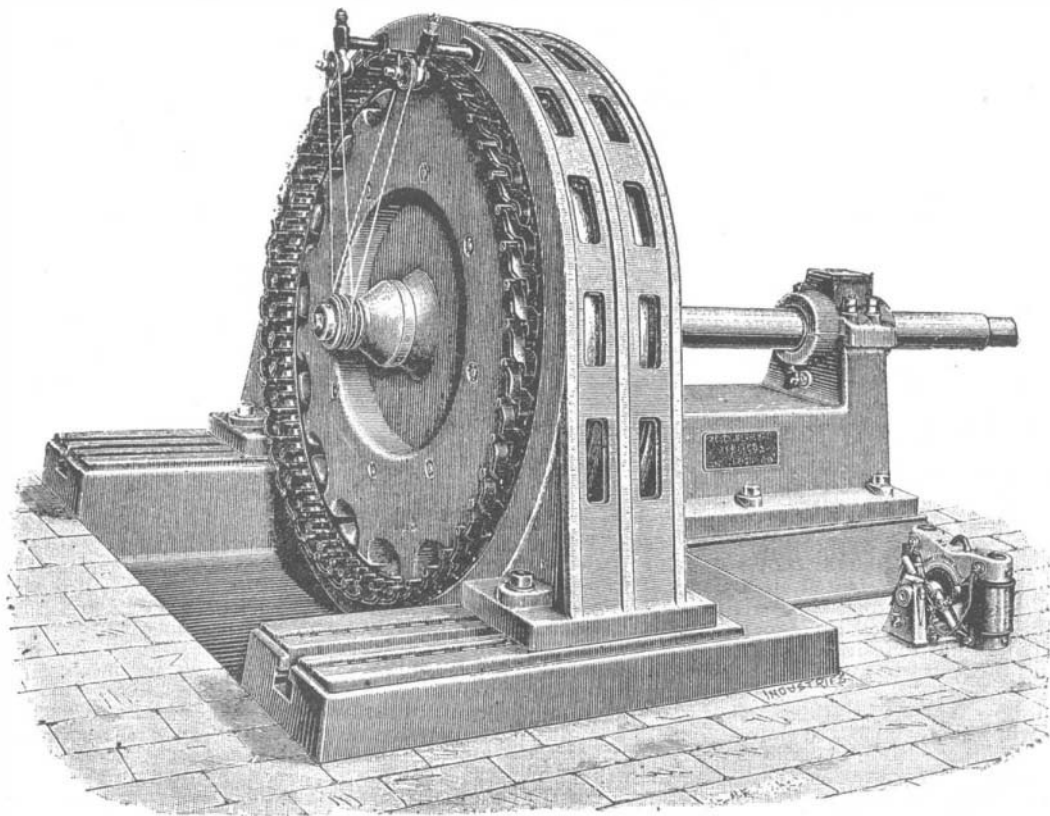
THE moth works in the dark, too. But there are three of him—*Tinea pellionella*, Linn., *T. tapetzella*, Linn., and *Tineola biselliella*, Hummel. The insects of the first and commonest species, says a writer in the *Upholsterer*, are light brown, and distinguished by the spots. They begin to appear late in April, and may occasionally be seen flitting about as late as August. They pair off, and the female then searches for suitable places for the deposition of her eggs, working her way into dark corners, crevices of the walls, cracks in the floor, or deep in the folds of garments, apparently choosing by instinct the least conspicuous places. The moth lays from 18 to 140 eggs at a time. From these eggs hatch, in a period of from three to seven days, the white soft larvæ, or worms, all of which begin immediately to make a case for themselves from the fragments of the cloth upon which they feed. The case is in the shape of a hollow roll, a thirty-second to an eighth of an inch long. As the worms grow, they enlarge this case by adding material which they get by feeding.

The worm reaches its full growth in thirty-six days, and then crawling into some yet more protected spot remains torpid during the winter within its case, which by this time is thickened and fastened at either end, and is the full sized cocoon. The transformation of moth takes place within the case during the following spring. Such is the life round of the species. The worm feeds on woolen fabrics, furs—ah! every housewife knows all that it attacks too well.

Remedies for moths are varied and peculiar, and many a rich harvest has been reaped through the ignorance of people regarding the moth and its habits. Folks have bundled up their woollens and packed them away in their wardrobes and drawers full of tarboline, or carboline, or cedarline, or camphorline, and actually believed that they would be safe until the autumn. They have wrapped up hundreds of moth eggs, which eventually hatch the grubs. These odors will never kill a moth or destroy its life germs. True a moth will not voluntarily seek a nesting place where the odor exists, but if boxed up with an odor it cannot escape from, it simply proceeds to lay its eggs in the atmosphere, which becomes a second nature to the grub when hatched.

Anything saturated with arsenic, or creosote, or even salt, or impregnated with sulphur, the moth or worm will not touch; but these articles are obviously objectionable. The point which we would enforce is that the housewife should look out for the worm. It is difficult to kill the eggs by reason of their almost imperceptible diminutiveness, and difficult also to eradicate this moth by reason of its secretive habits. A benzine spray is sure death, but there are many objections to its use and danger from its inflammable character; still, if the ordinary ball atomizer is filled with benzine, and the vapor thrown into crevices against moth or eggs, it will destroy them, but no light should be brought into a room thus treated, until after it has been thoroughly aired and the odor dissipated.

Camphor, tobacco, naphthalene, and other strong



THE OERLIKON TRIPLE CURRENT GENERATOR.