TEMPERATURE AND HUMIDITY REGULATORS.

The automatic regulation of the temperature of an apartment heated by water, steam, gas or air may render very great services not only in industrial, but in domestic heating, as, for example, in the keeping of the temperature of a parlor, hospital ward, etc., constant. Such a result is obtained by means of the apparatus represented diagrammatically in the accompanying figure, and constructed by M. Dorian. It consists of a metal receptacle, *A*, mounted on a suitable board and terminating at its lower end in a diaphragm chamber, *D*. A passage connects the bottom of this chamber with a rubber pipe, *B*, which is inclosed within a coiled spring. The spring in turn is inclosed in a stout supporting tube (shaded black in the figure), in the bottom of which fits a movable plunger that branches out and carries a large outer spring, *R*. This spring forces the rubber tube back to its original length, after the expansive fluid within it has ceased to act.

The receptacle, *A*, contains amylic alcohol, the rubber tube is filled with mercury, and the two fluids are separated from each other by the diaphragm, *D*. A valve-box, *P*, completes the system, and serves for the setting of the apparatus by regulating the pressure, which varies from 3 to 8 kilogrammes per square centimeter, according to the use for which it is designed.

The operation of the regulator is as follows: Under the influence of the variations in temperature acting upon the receptacle, *A*, the tube, *B*, elongates or contracts, and, if its free extremity is connected with the key of a stop cock, it will be able to open or close the passage through which flows the fluid designed for heating.

Although the spring, *R*, seems useless, it nevertheless plays a special rôle, which we shall explain by seeking to estimate the force that the apparatus is capable of exerting.

Let us take a regulator and dispense with the spring, *R*. During the expansion of the liquid in the receptacle, *A*, the rubber tube will elongate, and then, if it meets with a resistance (produced, for example, by the closing of a cock), it will be arrested. Now, as the receptacle continues to absorb heat units, the internal pressure will rise until its value is sufficient to overcome the obstacle. If the liquid contracts, the tube will shorten under the action of the atmospheric pressure.

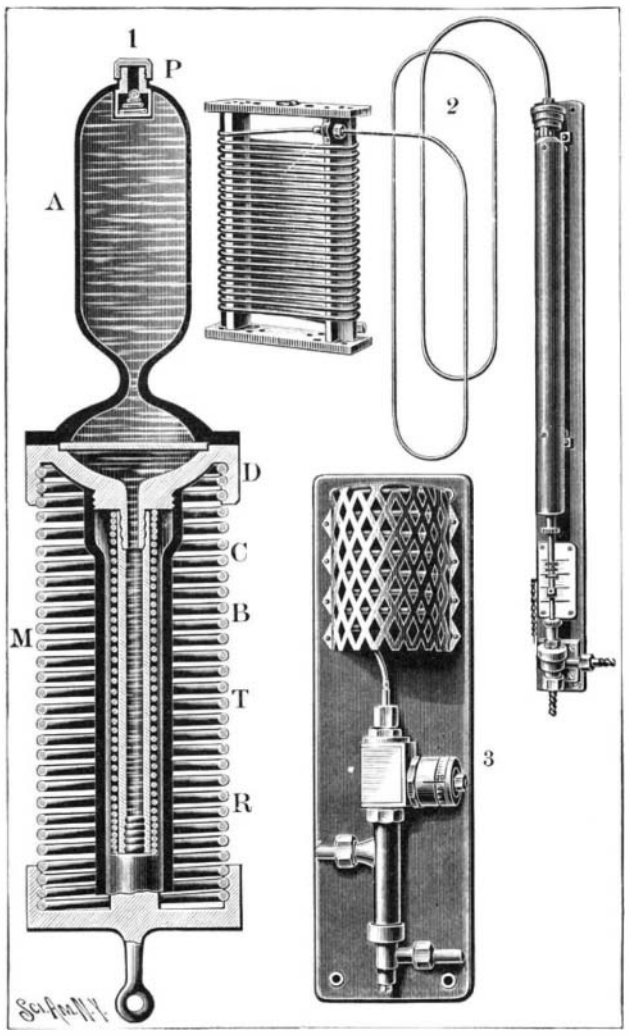
Thus, if the obstacle to be overcome requires a force of 5 kilogrammes and if the section of the rubber tube is one square centimeter, the internal pressure will rise to 6.033 kilogrammes (5 kilogrammes + the atmospheric pressure) in order to overcome the resistance. During the contraction, the force will be but 1.033 kilogrammes and consequently inadequate.

The object of the spring, *R*, therefore, is to increase the power of the apparatus at the moment of the contraction. During the expansion, the stress produced may be greater than the resistance to be overcome, and, in this case, the spring may store up the excess of energy in order to restore it in the inverse motion. During the expansion, the effective force produced is equal to the internal pressure less the contrary pressure of the spring, *R*, added to the atmospheric pressure.

During the contraction, the effective force is equal to the atmospheric pressure increased by the action exerted by the spring. This explanation shows that the power of the apparatus depends upon the section of the tube and the internal static pressure, and that the play of the tube depends upon the volume of the liquid and its coefficient of expansion. Upon causing all these factors to vary, it is possible to obtain the results desired.

In the apparatus as at present constructed the receptacle, *A*, has the form of a round or half-flat spiral (Nos. 2 and 3 of the figure), so that the surface influenced by heat may be increased. The sensitiveness of the apparatus is equal to that of a laboratory thermometer. The forms we illustrate, types *C* and *E*, are arranged for heating by illuminating gas.

Numerous applications have been made to domestic heating, in which case the regulator acts upon the gas, hot air, steam or water inlet, according to the system of heating employed. Among such installations may be mentioned the following: That made at the Consultation des Nourrissons du Gros-Caillou, Rue Saint-Dominique, in which all the halls of the clinic are heated by gas stoves. Two of the halls have been provided with temperature regulators. One of these is in the clinical room and the other in the pharmacy. In the first, the installation comprises one circular radiating hot-air stove and a Dorian regulator of the type *C*. The volume of air to be heated is about 90 cubic meters. In the second hall there is a stove of the same kind and a Dorian regulator of the *E* type. The volume of air to be heated is 60 cubic meters.



THE DORIAN HEAT AND HUMIDITY REGULATOR.

1. Section. 2. Type C of the regulator. 3. Type E.

The apparatus permits of fixing the regulation at any point whatever between 15 and 35 degs. C. (59 and 95 degs. F.). As the temperature required is 17 degs. the apparatus have been set at this point. The temperature obtained varies between 17 and 17.5 degs. and the output of gas has been diminished by about 50 per cent. Some other installations have been made. One, for example, in a saloon, comprises a semicircular stove of the Compagnie du Gaz with a regulator of the *E* type (No. 2 of the figure). The results obtained have been as satisfactory as the preceding.

Heating by gas offers very great advantages. It does away with the cost of the burning, storing and handling of coal, and consequently with dust. The lighting and extinction of the stove can be effected in an instant; and, since the flame is visible, it makes the room heated appear as cheerful as does a wood fire in a fireplace.

The odor that is often complained of when heating is done by gas is always due to defective installation, the means of egress from the room of the gas produced by combustion being inadequate.

The example of the heating of a clinical room is mentioned designedly in order to show that a perfect installation has no bad action upon the health, even upon that of delicate infants. Besides, the consumption of gas is considerably diminished by the use of the temperature regulator under consideration.

The same good results are obtained in industrial heating.

The mention of a single application will suffice to show the capabilities of this apparatus. In certain industries, such as the textile ones, it must be possible to regulate the degree of humidity of the air, in order to obtain proper results in the manufacture. Such regulation is effected by hand. The Société Industrielle de Mulhouse, struck by the inconveniences of this method of procedure, opened a competition for an apparatus that should permit of an automatic regulation. As the apparatus described in this article is in reality merely a thermometer with dilatable rod, the manufacturer conceived the idea of employing it as a psychrometer by using two regulators, one with a dry receptacle acting upon the heating and the other with a receptacle surrounded by canvas kept constantly moist and acting upon the conduit of humidification.

A regulating psychrometer of this type was installed at the establishment of Scheurer, Lauth & Co., at Thaun, during the month of July, 1899, in a drying house of 1,000 cubic meters capacity. The results obtained were perfect. The dry and moist temperature did not vary more than half a degree; and, as such variation occurred in the same direction with both regulators, the result was that the percentage of humidity remained constant at about one per cent. Other apparatus also are arranged for giving a constant percentage of humidity, whatever be the temperature of the room.—Translated for the SCIENTIFIC AMERICAN from La Nature.

THE WAR AUTOMOBILE.

BY DAY ALLAN WILLEY.

The use of the automobile in connection with military service for mounting light artillery in this country originated with Major R. P. Davidson, commandant at the Northwestern Military Academy of Highland Park, Ill. Major Davidson has been experimenting with motor vehicles for several years, in making forced marches, long-distance tours, and in what might be called light artillery evolutions. Twice he has essayed to make a record trip from Chicago to Washington with an automobile carrying a gun crew of four men and a rapid-fire gun. Owing to the wretched condition of the highways, which was further aggravated by rainy weather, each time the trip has been abandoned when partly completed.

This year, the cadet corps of the academy has been organized to include a bicycle and automobile gun attachment, which is probably the only military organization of its kind in the world. The gun battery consists of two Colt automatic rapid-fire pieces of 7 millimeters caliber, each firing 480 shots per minute. They are constructed to utilize smokeless powder, and each is equipped with a bullet shield to protect the operator when in action. Each gun is manned by a sergeant and three privates armed with revolvers. The motor vehicles are operated by 10 horse power engines utilizing gasoline, giving a speed of 25 miles an hour on the ordinary country pike. The carriages have reservoirs with a capacity for 22 gallons of gasoline, and are equipped with acetylene lamps for night service. The front portion of the motor contains a foundation of sheet steel upon which the gun is mounted. The general design of the carriage was conceived by Major Davidson as a result of experi-

THE AUTOMOBILE FOR MILITARY INSTRUCTION.