ARTIFICIAL REGULATION OF ATMOSPHERIC HUMIDITY AND TEMPERATURE.

It is surprising that in an age which is remarkable for the rapid advance which has been made in sanitation and in all matters affecting the comfort of the individual in his daily life, so comparatively little should have been done to control the atmospheric conditions encountered in the various buildings—dwelling rooms, offices, factories, and places of amusement—in which the greater part of our time is spent. As a matter of fact, the only serious attempt at such control occurs during the winter months, when we raise, or endeavor to raise, the interior temperature to the 68 or 70 deg. Fah. which has been found to be the most agreeable to the average person. When we have raised the temperature to the desired degree, we are content to let the equally important question of humidity take care of itself. Consequently, in steam-heated rooms, and particularly in the apartments and flats in which the majority of city dwellers now live, the atmosphere is dried out to an extent which is answerable for an untold amount of discomfort and even disease. Unfortunately, the average individual, if he be warm in winter, is perfectly satisfied; and no doubt it is largely the lack of a demand for means to control the humidity, or ignorance of the necessity for such control, that has prevented the more extended use of the devices which have been provided for this very purpose.

As for the modifying of temperature and humidity in the summer time, the conditions are even worse; and it is really remarkable how little serious attempt there has been to develop suitable systems for the cooling and reduction of the humidity of the interior of buildings during the hot summer weather. This is said with full appreciation of what the inventor and manufacturer have already done in this direction; but attention is drawn to the fact that, in view of the enormous amount of discomfort and distress endured during the hot and humid waves which are continually sweeping over the country, it is surprising that there should not be a more widely-extended effort to bring the heat and humidity in the interior of buildings down to a point at which life would be made comfortable.

Furthermore, the artificial regulation of atmospheric humidity and temperature is a matter of vital concern to certain manufacturing interests, and particularly to the textile industries. In order to secure the best results in spinning mills, it is necessary that both the temperature and humidity be held at a certain relative proportion, and each at a certain degree. Thus, in what is known as the "Bradford spinning," to secure the best results, there should be a low temperature and a low humidity, a fair average for the former being 68 deg. Fah., and for the latter a percentage of 58 to 60. The "French spinning," on the other hand, needs a high temperature of 85 deg. Fah. and a high relative humidity of 85 per cent. Moreover, there are many other lines of business whose success is largely dependent upon the regulation of temperature and humidity, particularly those which deal in confectionery, meat, and provisions, where, if the conditions be not just right, the goods will melt, lose their crispness and freshness, and generally deteriorate in quality.

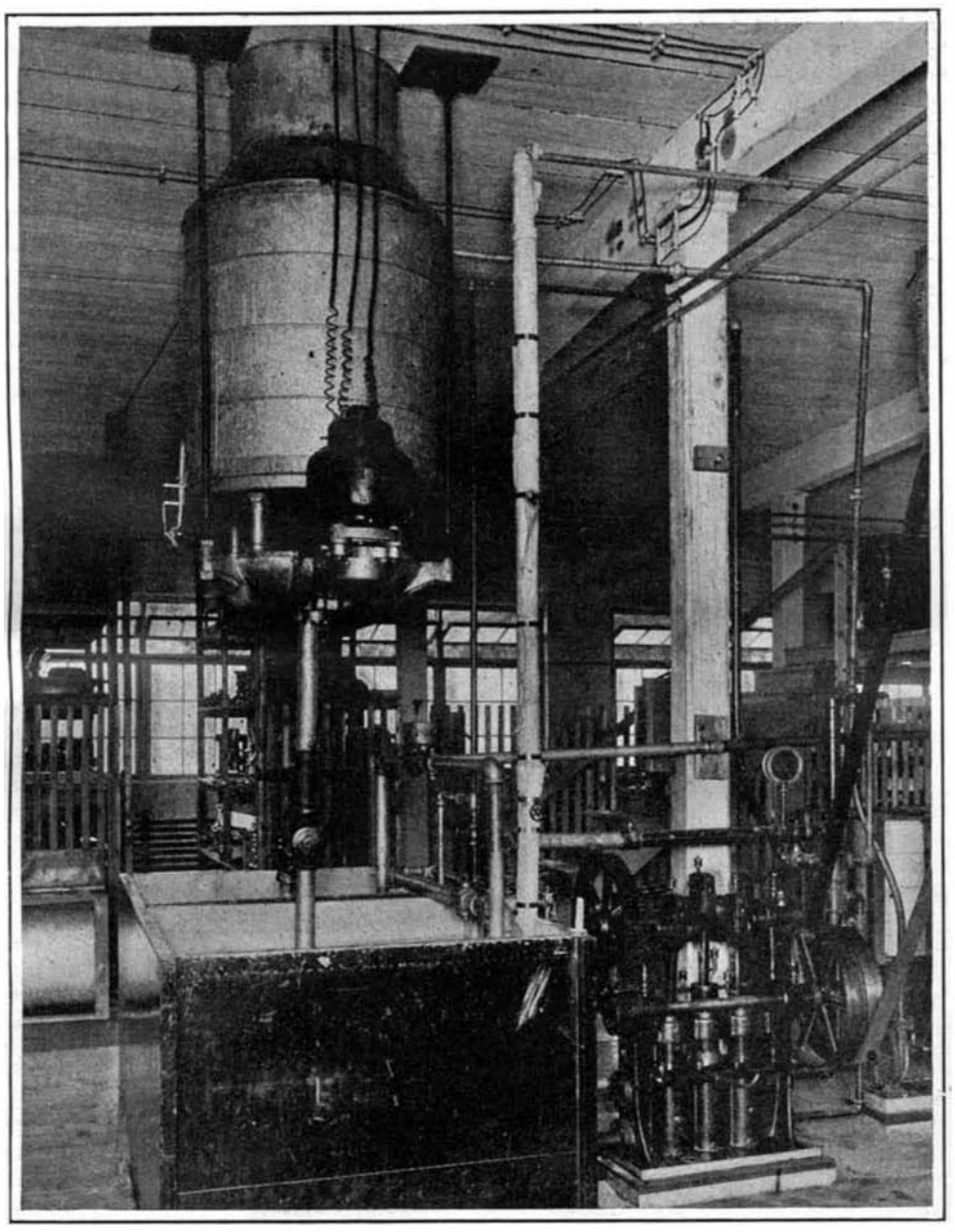
Comfortable weather is that in which there is a desirable relation of humidity to temperature. High temperature alone is not necessarily uncomfortable, nor high humidity alone. There may be days in the fall of the year when, although the relative humidity may be 100 per cent, no discomfort is experienced, for the reason that the temperature is low. On the contrary, in the dry air of the deserts one can endure a temperature of well over 100 deg. without experiencing distressing symptoms. The comfortable weather is that in which the humidity relative to the temperature is in a certain fixed ratio.

The machine which is herewith illustrated has been designed to regulate artificially the ratio between the temperature and the humidity by passing water over a large cooling surface over which, at the same time, large volumes of air are being drawn. By this simple expedient it secures the double effect of cooling the air and imparting to it the moisture of the evaporated water. The "Regenerator," as this machine is called, is made by the Regenerated Cold Air Company, of 88 Broad Street, Boston, Mass. The accompanying illustrations show two sizes of machines. The sectional view is taken through an 18-inch unit, which is capable of handling 1,250 cubic feet of air per minute. The other illustration is of a 24-inch machine, with a capacity of 5,000 cubic feet per minute.

The 18-inch machine consists of an outer casing or covering more or less ornamental in design, which incloses inner cylinders arranged concentrically within it, within which is carried the cooling and humidifying apparatus proper, the whole being mounted upon a hollow base or collecting basin, *M*, which may be carried either upon a pillar set upon the floor, or may be suspended by rods from the ceiling of the room in which the apparatus is used. Mounted centrally is a shaft, *D*, carrying at its upper end an 8-inch impulse wheel, *A*, which is driven by a ¼-inch jet supplied through a pipe, *B*, at a pressure of 85 pounds to the square inch. Immediately below the impulse wheel is another wheel, *C*, which is carried upon a hollow shaft arranged to turn concentrically about the shaft, *D*, moving in the same direction. This movement is effected by the water, which, reacting from the buckets of the impulse wheel, strikes the blades of the lower wheel, causing it to rotate, as described. At the lower end of the hollow shaft on which the wheel, *C*, is mounted, is carried a four-armed distributor, *E*, and the water falling from the wheel, *C*, and flowing down the interior of the casing which incloses the mechanism above described, collects in the hollow hub of the distributor, and is carried thence by centrifugal force out into the four arms, *F*. These are formed with a number of side outlets, which enlarge in cross-sectional area from the center to the circumference, the openings being so adjusted that there shall be an even distribution of the water as it flows out of the arms.

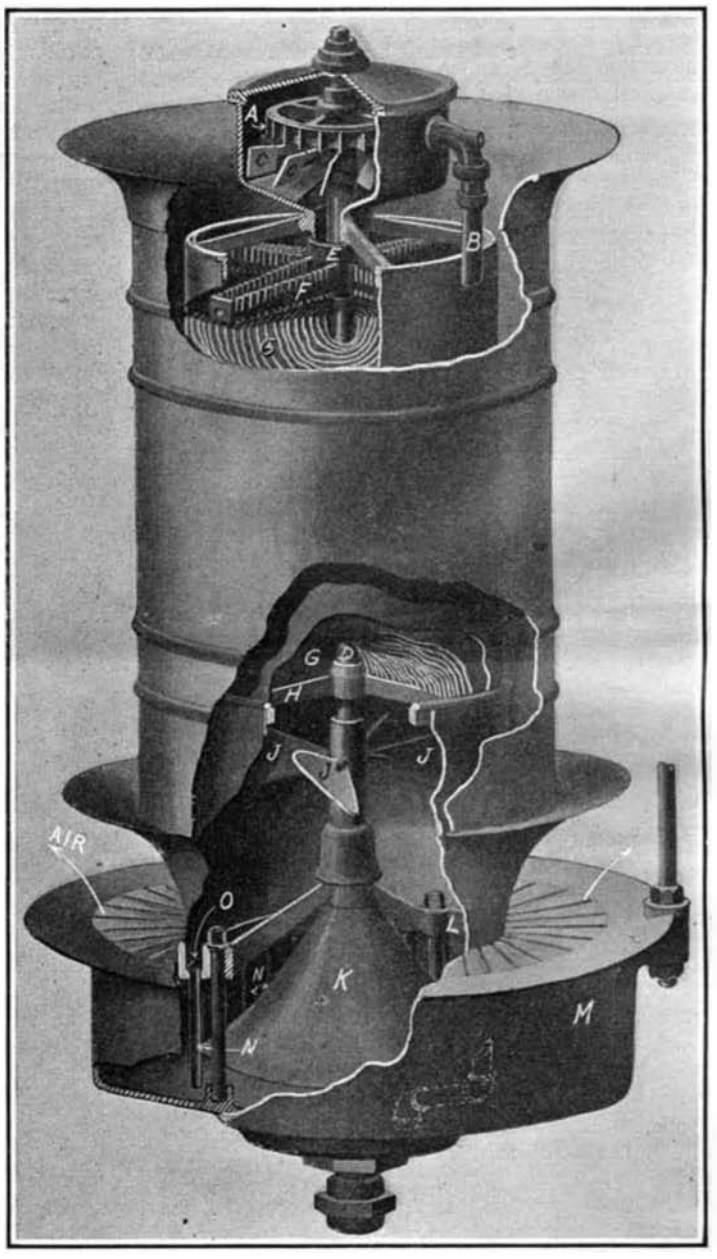
Immediately below the distributor is arranged a set of twenty-four galvanized sheet-iron cylinders, which are placed concentrically, one within the other. The outermost cylinder is 24 inches in diameter, and the whole series is supported upon the four-armed spider, *H*. The water flows down over both sides of each cylinder, the total amount of wetted surface thus afforded being 250 square feet. Immediately below this nest of evaporating cylinders, and mounted at the base of the shaft, *D*, which is driven by the impulse wheel at a speed of 900 revolutions per minute, is a fan, *J*, which serves to create a powerful down draft through the evaporating cylinders.

As the water drains from the base of the cylinders, part of it falls past the fan directly onto a hollow cone, *K*, over which it flows, and finally is caught in the collecting basin, *M*. The water which is caught upon the blades of the fan, representing about 50 per cent of the whole, is thrown against the walls of the incasing cylinder and drains down into an annular trough, *O*, formed in the periphery of a three-armed casting, *L*, which serves to support the bottom bear-



This View Shows the Regenerator, Hung from the Ceiling; the Motor for Driving the Fan; the Feed and Return Tanks; the Pump and Connections.

A 24-INCH AIR REGENERATOR; CAPACITY, 5,000 CUBIC FEET PER MINUTE.



This Machine Has a Capacity of 1,250 Cubic Feet Per Minute.

SECTIONAL VIEW THROUGH AN 18-INCH AIR REGENERATOR.

ing of the center shaft, *D*. From the annular trough the water flows through a number of vertical pipes, *N*, into the collecting basin, *M*, from which it is conducted by an outflow pipe.

The great capacity of this machine, both for cooling and humidifying, is due to the large amount of evaporating surface provided in the nest of cylinders, combined with the large volume of air which is drawn through the cylinders by the fan. The air, with its temperature raised or lowered and its humidity increased or decreased, passes out into the room through the annular opening between the cylinder and the collecting basin, as indicated by the arrow.

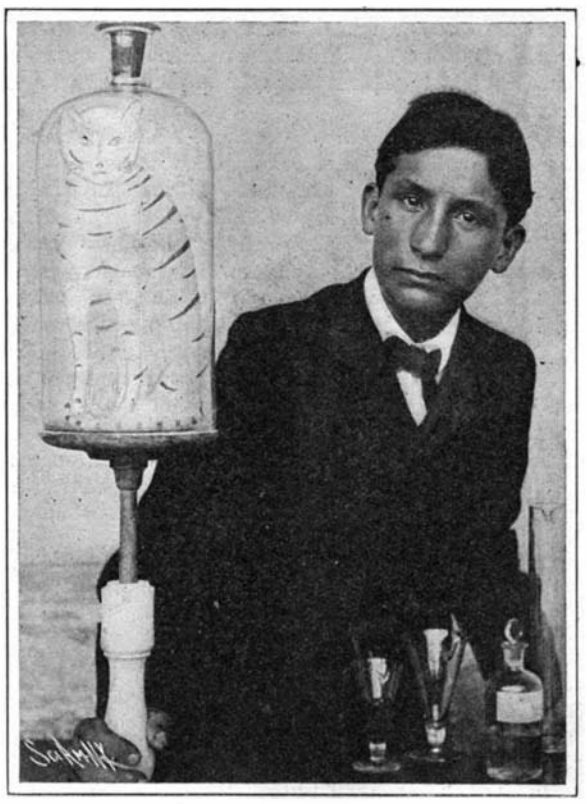
The accompanying table gives the results of an hour and fifteen minutes' test conducted for a representative of this paper, with the 24-inch machine, which forms the subject of one of the engravings. The test was conducted in a machine shop containing 105,000 cubic feet of air. The generator is suspended from the roof by rods, which pass through the base. The fan is driven by a motor which will be seen mounted upon the base, from the bottom of which will be seen the water discharge pipe, which leads down to connect with one or other of two adjoining water tanks. Connecting with each of the tanks is a series of feed pipes, provided with the necessary valves, etc., and leading to a three-throw circulating pump, which will be seen adjoining the tanks. The connections are so arranged that the water may be drawn from one tank, forced over the cooling surfaces of the machine, and discharged into the other tank, or *vice versa*. There are also steam pipe connections, by which the water in the tanks may be raised to the desired degree of temperature.

TEST OF 24-INCH AIR REGENERATOR.

Time.	Thermometer in Room.		Relative Humidity	Water.		Air Delivered by Machine.		
	Dry.	Wet.		Feed.	Return.	Dry.	Wet.	Relative Humidity
	Deg.	Deg.	Per Cent.	Deg.	Deg.	Deg.	Deg.	Per Cent.
12.25	78	67	57	105	93	87	82	80
12.40	79	72	72	110	96	87	82	80
1.10	81	75	75	110	96	88	85	88
1.10	81	75	75	67	96	88	85	88
1.25	81	74	72	71	72	77	72	78
1.40	81	73	68	71	72	76	70	74

Although the air regenerator is designed primarily for cooling the air and reducing humidity, its range of application is much wider than its name would indicate. It is capable not only of decreasing the humidity and lowering the temperature in a room, but, if desired, as in the case of a room in a textile factory, it can increase the humidity and raise the temperature. Furthermore, it can be used to increase or decrease the humidity while maintaining the temperature the same. The method of securing these results is as follows: When it is predetermined to increase the humidity and raise the temperature, the water in the feed tank is heated by steam to a certain desired temperature. This hot water is fed to the machine and distributed over the evaporating surface, where its heat and vapor are imparted to the air, as the latter is drawn through. Conversely, when it is desired to decrease the humidity of a room and lower the temperature, the flow of water is reversed, the cold tank being used as the feed and the hot tank as the return. The resultant effect upon the air is that its moisture is condensed on the cold water which is flowing over the plates, and its temperature lowered.

At the beginning of the test of one hour and fifteeen minutes, above referred to, the dry-bulb thermometer, placed about 50 feet distant from the machine, showed a temperature inside the room of 78 deg.; the relative humidity was 57 per cent; and the outside temperature was 81 deg. As the first half of the test was designed to increase the temperature and humidity, the feed water had been raised by means of a steam jet to 105 deg. The air was taken in from the outside of the building at a temperature of 81 deg., and drawn over the evaporating surfaces. The test started at 12:25, and forty-five minutes later the dry thermometer inside the room showed 81 deg., and the relative humidity had risen to 75 per cent. At 1:10 the operation of the machine was reversed, and the process of cooling and reduction of humidity commenced, the



A CHEMICAL TRICK.

feed water being passed into the machine at 67 deg., and the feed of air being drawn from the interior of the building. Half an hour later, the temperature inside was 81 deg., the relative humidity had fallen to 68 deg., the outside temperature at the time being 82 deg., and the relative humidity of the outside air being 74 per cent.

It should be mentioned in conclusion that inlet air ducts are provided in each regenerator, by which the air may be fed either directly from the atmosphere or taken from the upper strata of air in the room itself. The manipulation of these air dampers, the control of the temperature of the feed water, and the further control of the speed of the fan, render it possible to secure a very delicate regulation of the interior atmosphere of any room in which they are installed. Furthermore, the introduction of large volumes of pure air from the outside, its passage over running water where the dust is caught and removed, and its thorough circulation through the room or building, is in itself a potent safeguard to the health of the inmates.

The American Society of Civil Engineers has admitted a woman to membership in one of its lower grades.

A CHEMICAL TRICK.

BY GUSTAVE MICHAUD, D.SC.

When we happen to witness a phenomenon which seems to violate natural laws, we are not likely to forget its cause if it be explained to us. The following experiment, which I devised for my students, helped them to understand as well as to remember some chemical data.

A white cat, made of flexible pasteboard and imprisoned in a glass jar, is shown to the audience. The lecturer announces that, without opening the jar or even touching it, he will cause the cat to undergo a zoological as well as a chemical transformation. He takes the support of the jar, and pushes it forward in full view of the students. The change occurs almost instantaneously. The cat takes a rich orange color on which black transversal stripes rapidly paint themselves. The cat has become a tiger.

The whole transformation is produced by emanations of hydrogen sulphide, which is generated in the jar itself without any visible apparatus. The cat has been previously coated with a solution of chloride of antimony wherever the orange hue was to be produced, and with a solution of basic acetate of lead wherever the black stripes were to appear. Both solutions are colorless. After the coated cat has been introduced in his glass cage, a small piece of pasteboard is placed under the wooden support so as slightly to incline the jar forward. A few decigrammes of pulverized sulphide of iron folded in a piece of blotting paper are deposited behind the cat, on the elevated side of the bottom of the jar. Two or three cubic centimeters of diluted sulphuric acid are dropped with a pipette on the opposite side. When the performer wishes the transformation to take place, he takes the wooden support and pushes it forward as if he wanted to enable everybody to see better what is going to happen. By so doing he suppresses the slight inclination which kept the iron sulphide beyond the reach of the sulphuric acid. The gas is evolved, and the formation of the orange sulphide of antimony and black sulphide of lead takes place in a few seconds.

THE ART OF INVENTING.

BY EDWIN J. PRINDLE, OF THE NEW YORK BAR.

It seems to be popularly believed that the inventor must be born to his work, and that such people are born only occasionally. This is true, to a certain extent, but I am convinced there are many people who, without suspecting it, have latent inventive abilities, which could be put to work if they only knew how to go about it. The large percentage of inventors in this country compared with all other countries, shows that the inventive faculty is one which can be cultivated to some extent. The difference in ingenuity is not wholly a matter of race, for substantially the same blood exists in some other countries, but it is the encouragement of our patent laws that has stimulated the cultivation of this faculty.

The popular idea seems to be that an invention is produced by its inventor at a single effort of the imagination. It is, undoubtedly, true that every inventor must have some imagination or creative faculty, but, as I shall seek to show, this faculty may be greatly assisted by method. While reasoning does not constitute the whole of an inventive act, it can, so to speak, clear the way and render the inventive act easier of accomplishment.

In the making of all inventions which do not consist in the discovery of the adaptability of some means to an end not intentionally being sought after, the first step is the selection of a problem. The inventor should first make certain that the problem is based upon a real need. Much time and money is sometimes spent in an effort to invent something that is not really needed. What already exists is good enough or is so good that no additional cost or complication would justify anything better. The new invention might be objec-

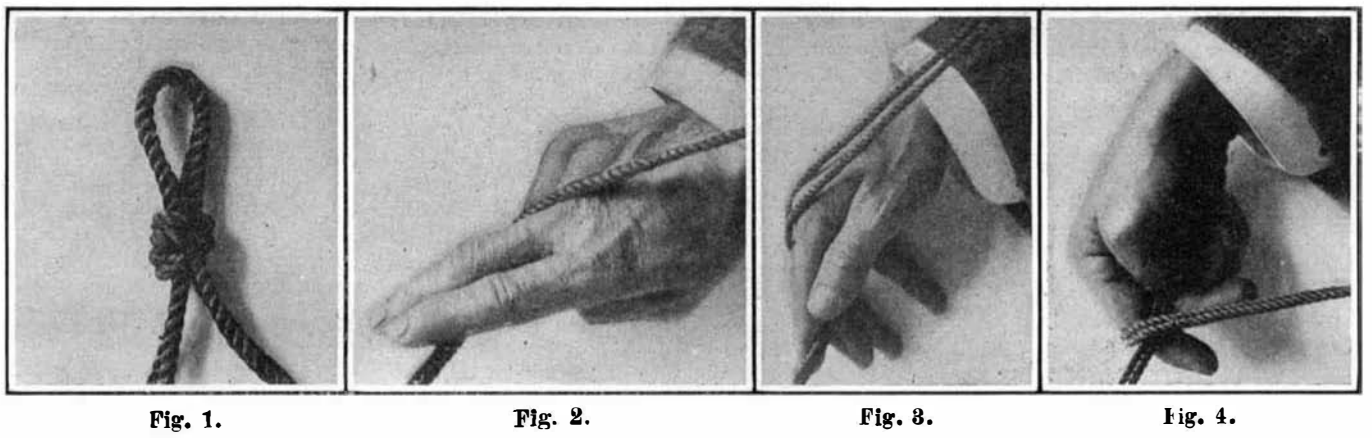


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

Fig. 5. Fig. 7. Fig. 6.

HOW THE CORD KNOTTER OF THE SELF-BINDING HARVESTER WAS INVENTED.