conducting experiments with glycerine, and it does very nicely.

Mr. Gurney : May I ask what percentage if calcium chloride would be required ?

Prof. Carpenter : I could not tell you that exactly, but it is a two-thirds diluted solution. Practically that won't do because it acts very actively upon the iron, rusts it. The chloride calcium does very well, but we found it damaged brass very slightly. Glycerine is the best ; it don't attack any of the metals and gives practically exce lent results ; but it costs too much money.

Mr. Mansell : Is it possible to make any attachment to a hot water system to put more humidity in the atmosphere or in the air of the room. We understand that a certain amount of moisture produced the requirements, in the temperature, in the atmosphere. Is it possible to make any artificial attachment to a hot water system to give us a proper degree of humidity in the air

Prof. Carpenter : Perhaps I am not well prepared to answer that question, but I do know that an article of that kind has been put on the market by the Johnson Electric Company people, who furnished the automatic controlling device for regulating temperature, and it is claimed by them to operate very successfully. But I have had practically no experience with it. It consists of a device which is operated by a cat-gut which is very susceptible to a change in the humidity of the room ; it will shrink very quickly with the dry air, and stretch with wet and let out steam or water until the cat-gut goes back to its proper form. That is the principle of the device, and it is claimed to work very perfectly, but I am not prepared to say how much of a success it is practically.

Mr. Gurney : There has been a radiator invented by one of the Ontario Society of Architects in which the top portion holds water, and it is evaporated by a heating device inside but it is not controlled in any way that I know of.

Mr. Mansell : How do you fix the radiating surface ?

Prof. Carpenter : The method of calculating the radiating surface there is a formula that has been worked up from some experiments which I think is in this form. (Writes on blackboard)

$$\left(B \times \tfrac{1}{4} W \times \frac{NC}{50}\right)$$

$$\frac{70}{280} \qquad \overline{114}$$

$$100 = 1$$
$$166 = 1\tfrac{2}{3}$$

$$\frac{25}{40}$$

The radiating surface depends on three things, the amount of glass exposure and wall exposure and the amount of cubic feet of air which is heated. This formula has proved to be very serviceable and practicable. The coefficient which we have put down at ¼ is subject to change in different climates. In that formula the coefficient of ¼ gives very satisfactory results in perhaps New York; it is not enough for Massachusetts ; it should be about 15 per cent. more, and it should perhaps be about 10 per cent. more for Detroit. I presume for this place it should be something like 20 per cent. more. The formula is worked up on the principle that the difference in the degree of temperature between the inside and the outside air is 70 ; I think here it might run to 80. The difference between 70 and 80 would in this particular case make a difference of about 10 per cent. The reason it makes a difference of 10 per cent. is, in mathematics, you have 70 divided by 250, and it would be changed to 80 divided by 250; so that something like 10 to 15 per cent. more would probably be required here than with us because our extreme we usually consider zero; but we have colder sometimes than that; last week it was 17 below zero.

Mr. Armstrong : Taken from steam at 230 degrees and a factor of ¼ would it make any material difference whether it was in New York or Toronto if you took an outside temperature at zero and 70 degrees inside?

Prof. Carpenter : No. If you run your steam up two or three pounds that would compensate for the whole difference and then you could get along with that formula ; I don't see why in extremely cold weather people would not be willing to carry alittle more steam provided they did not run it up more than three, four or five pounds.

Mr. Denison : They do not like it above one pound.

Mr. Armstrong : It is not a formula for the first floor alone. Would you change it for the second floor?

Prof. Carpenter : Yes, in this formula I have here it was for the different floors and the hall; for instance for the hall and the first floor we have always taken "N" as three ; on the first floor rooms and other than the hall "N" as two ; and on the upper story rooms "N" as one ; the rule being the N represents the number of changes which would take place every hour, which is premising, but it appears to act pretty closely with residence practice. I like to have a hall very well warmed and this formula throws in each hall a good amount of radiating surface.

Mr. Helliwell : What are the quantities for N and C in the formula ?

Prof. Carpenter : C is the cubic contents of the room. N is supposed to be the number of changes of air which occur in the room in an hour. It would be scientifically correct if N were positively known.

Mr. Helliwell : There is one other point I would like to get some information on and that is the efficiency of running cold water through coils with the idea of cooling the air in the summer time with the use of the fan system.

Prof. Carpenter : The converse question of heating is one which has cost a good many people a good deal of trouble. It is perfectly feasible to cool air by passing it over a cold surface in the summer time. For instance, passing cold water through a coil of pipe and then blowing the air over it. That has been tried and been done and is being done in a number of New York theatres during the hot season. The first time the practice was undertaken I think quite a serious mistake was made, that of cooling the room too much. It has been found that it is not safe to lower the temperature lower than the air outside only a few degrees, possibly not more than five or six degrees, because if the air be cooled too much people who go in get chilled in a short time and the effect on the system is dangerous. It is easy to cool the air but it is not safe, for people going into a cool room from the outside are liable to be chilled, consequently this system has not found the favor that was expected, that is, it is not safe to cool the room but very little. If you have 100 degrees outside they have to keep a pretty high temperature inside. If you went went from 100 degrees to 90 degrees inside it might in a little while become chilly. The results have not been as satisfactory as they were expected.

Mr. Burke : Is the humidity in the building an object to a great extent in the fan system ?

Prof. Carpenter : In most of the systems where the system is in charge of a janitor—some of the large systems—they require a janitor to take the humidity by means of a wet and dry bulb thermometer, but in a good many of them they don't ; although in the last few years there has been a decided tendency to look to the moisture. The whole thing is the supply of the moisture ; it has been brought out more possibly during the last few years than before.

Mr. Burke : Has not it been done automatically ?

Prof. Carpenter : Only to a limited extent.

Moved by Mr. Curry, seconded by Mr. Burke, that the thanks of this Association be tendered to Professor Carpenter for his very interesting paper and his kindness in answering the questions asked him in reference thereto. Carried.

The President : I do not know whether you customarily find such an inquisitive audience but certainly the questions and answers have been of the greatest service to us.

Prof. Carpenter : It gives me the greatest pleasure