

plishes the double purpose of expelling the burned gas without waste of fuel, and leaving pure air in the explosion chamber instead of vitiated gas.

These fourth ports can all be operated together by means of a lever, and when opened, result in a marked increase in both power and speed. High-tension ignition by means of two distributors and two coils is employed. Lubrication is effectually accomplished by a force-feed system into the journals and by a spray taken by the incoming gas to the wrist-pins, connecting rods, and pistons. A clutch of the self-locking type is used, but no reversing gear is required, since the motor is readily reversible.

As is customary with boats of this type, the exhausts are open, and extend several feet above the sides of the boat. These exhausts are $2\frac{1}{2}$ inches in diameter.

The motor drives a 22-inch diameter, 44-inch pitch wheel at from 750 to 800 R. P. M. with ease, and in short test runs has turned this wheel at from 810 to 825 R. P. M. in the Pittsburg pools, giving a speed in excess of 30 miles per hour in the slight current of those pools. On the run from Pittsburg down the Ohio to Cincinnati, the engine kept up a steady speed of from 750 to 775 R. P. M. without forcing, and maintained this speed for hours at a time without perceptible heating. This speed could be maintained easily for an entire day, or even more, were the stage of water sufficient to permit the boat to run at such speed in safety.

In the run to Cincinnati, four gasoline tanks were carried, two rear tubular tanks in the stern each having a capacity of 15 gallons; one 20-gallon tank under the seat; one 30-gallon tank in front of the seat; and one 5-gallon gravity feed tank directly over the 30-gallon tank, making a total capacity of 85 gallons for long runs. The tanks all feed into the 5-gallon gravity tank, a hand pressure pump forcing the contents of the lower ones to this gravity tank. Besides an individual carbureter for each cylinder, the transfer pipes of each pair of cylinders are connected to a second carbureter, so that there are no less than 12 carbureters used on the engine.

Based on rated power, the motor in the "Br'er Fox II." consumes approximately 1.4 pints of gasoline per horse-power hour, but the engine unquestionably delivers more than its rating, so that on actual wheel performance turning a 22-inch diameter, 44-inch pitch wheel 800 R. P. M., it is very close to a pint per horse-power hour.

The boat has a capacity of 14 gallons of cylinder oil in tanks. She is designed to carry two men averaging about 155 pounds each and 30 gallons, or about 240 pounds, of gasoline. On the trip from Pittsburg to Cincinnati she carried four men, whose combined weight was 670 pounds, and 85 gallons of gasoline, weighing approximately 600 pounds, or a total of 1,270 pounds, against 550 pounds, which is her estimated capacity when speeding.

The Current Supplement.

The opening article of the current SUPPLEMENT, No. 1755, is devoted to a discussion of the wonderful Frankfort Aeronautical Exposition, which has been opened with such success in Germany. Excellent views of the exhibits accompany the text. Mr. E. F. Lake's exhaustive and instructive article on the oxyhydric process of cutting metals is continued. Mr. Newton Wright explains how the size of gas and oil engine cylinders may be determined. It is a curious fact that many of the marbles employed by the Romans, Greeks, and even Egyptians, are those most highly valued by the architects and builders at the present time. Marbles and other decorative stones from the identical localities which were sought by the ancients with so much care are now to be seen in most fine modern buildings in London and other cities. This whole subject of ancient marbles and ancient marble quarries constitutes the subject of an article by Mary W. Porter. O. Bechstein contributes a wonderfully instructive article on kieselgur and its uses. The experimental evidence in support of the atomic hypothesis is set forth by R. Ehrenfeld. Maria Parloa's monograph on canning and preserving fruit is continued. Interesting electrical notes are those entitled "How to Join Electric Wires," and "The Egner-Holmstrom Telephone Apparatus." It is sometimes necessary when designing buildings or other works to construct models in order to explain intricate points more clearly than can be shown in drawings. How this is done, Mr. Stanley C. Bailey explains. Improved deep-sea sounding apparatus is described by Capt. E. Moll. A report of the Sixth Conference of the International Commission of Meteorology is published. A calendar good from 1753 to 1952 is not the least interesting feature of this issue.

From the returns compiled by Lloyd's Register of Shipping, it appears that, excluding warships, there were 308 vessels of 745,705 tons gross under construction in the United Kingdom at the close of the quarter ended June 30th, 1909.

Correspondence.

THE NUMBER OF OUR ANCESTORS.

To the Editor of the SCIENTIFIC AMERICAN:

The difficulty that some of your correspondents have with the ancestral puzzle is in disregarding the marriage and intermarriage of distant relatives. Thus if one of B's grandparents on his mother's side was cousin to one of his grandparents on his father's side, B would have only 14 great-great-grandparents. The one divergent series would be extinguished and the number of his ancestors in any one generation would be $2^n - 2^{n-4}$. If, instead, two of his eight great-grandparents were cousins the formula would be for any generation $2^n - 2^{n-5}$. If there were two sets of cousins among his great-grandparents the formula would be $2^n - 2(2^{n-5})$, etc.

When we consider that our ancestors for hundreds and thousands of years lived in small and more or less isolated villages and communities and that families of as many as ten or twelve children were not uncommon, we can see that could we trace all lines of descent of any one person we would find them constantly running into each other and merging into common ancestors. Thus in the fifteenth generation we might trace descent from two parents through any one or through all of their twelve children. And if the blood of these children had commingled at other times in the line of descent, as it must at least in an isolated community, two persons in the fifteenth generation might represent a hundred or even several thousand of B's theoretical ancestors.

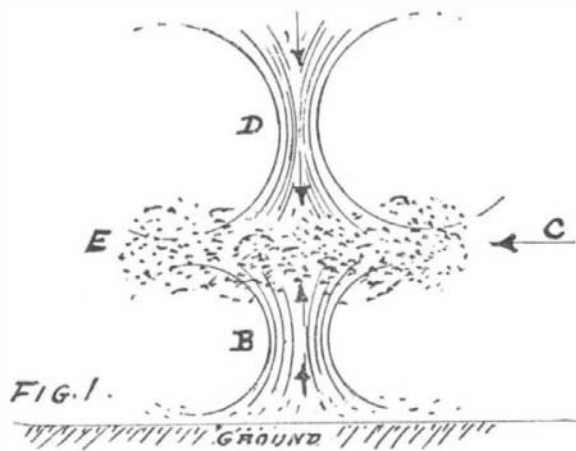
Nora Springs, Iowa.

W. A. ECKLES.

THUNDERSTORMS.

To the Editor of the SCIENTIFIC AMERICAN:

The explanation of thunderstorms ordinarily given is that clouds are formed of minute particles of moisture, each having an electric charge on its surface. These particles agglomerate in drops of rain, and their electric charges spread over the surface of the drops with a resulting greater electric density, because the surface of a drop is much less in extent than the aggregate of the surfaces of all the particles of which it is made; the increase in surface being proportional to the square of the diameter, when the increase in volume is proportional to the cube of the diameter. For instance, the electric potential (depending on the electric density on its surface) of a drop of rain $\frac{1}{8}$ of an inch in diameter will be 125 volts, if it is formed of particles $\frac{1}{1,000}$ inch in diameter whose potential is one volt.



The drops of rain in a cloud being separated by air acting as a dielectric, electrify each other by influence; the resulting influence at the center of the cloud being an enormous electrostatic strain, which is relieved by lightning.

This simple explanation is that generally given in the lecture room, but is not sufficient to explain the thunderstorms without rain frequent on the Western plains in hot dry weather. The writer has observed many in northwest Texas. One day at noon I was resting in my house, when I was startled by a sudden clap of thunder, followed by others. I had not seen a sign of a cloud a few minutes before when coming home. Stepping out doors, I saw toward the zenith a very thin yellowish cloud somewhat broken, from which emerged the thundering. No lightning could be seen, the glare of the sun through that misty cloud being too intense. From its rapid motion and the distinctness of the claps of thunder, I judged that it could not be very high. This phenomenon lasted about three minutes and vanished.

The appearance of that cloud was unusual for a dry thunderstorm. Ordinarily, in such occurrences there are several scattered small white clouds, embryo cumuli in shape but diaphane, they look "dry," and do not cast any appreciable shadow on the ground. They appear and vanish with more or less sharp thunders, seemingly at a high elevation. No lightning can be seen because of the sunshine through them. These electric discharges begin about noon,

to last until about two hours before sunset. During the day there are occasional flushes of breeze, but no continuous wind in a certain direction.

This condition of weather may last without rain for two or three weeks, and is generally followed by a stubborn drought, with a smoky appearance of the sky and very little or no dew in the morning. The absence of rain, the small size of the clouds, and their diaphane, evanescent appearance, indicate that other agencies besides those mentioned in the lecture room are active for the presence of electric potentials widely differing in a dry thunderstorm.

Observations have shown that the electric potential of the air increases with the distance from the ground. Now suppose that a portion of the upper atmosphere be brought near a portion of the nether atmosphere within a medium like mist, where electrification by influence can take place; the requisites for an electric discharge are present, and apply to dry thunderstorms. They occur when atmospheric conditions are favorable for causing local ascending currents of warm air with a small quantity of aqueous vapor to an elevation where they meet a cold current, whose cooling effects contract the hot air and condense the vapor it contains, creating a vacuum that sucks the air from the highly electrified upper atmosphere, as shown in Fig. 1, where B is a warm ascending current, C is the initial cooling current (which has disappeared), D is the descending current, and E the cloud formed by the condensation of the vapor in the ascending current B.

From the absence of rumbling thunder the electric discharges seem to be confined within each separate cloud, and originate mainly from differences of potential brought from different strata in the atmosphere.

The ordinary thunderstorms with rain happen also when atmospheric conditions cause ascending currents of warm air containing aqueous vapor. There is low barometer and a preceding period of calm high temperature; the clouds are cumuli and pile very high up, especially for hailstorms.

When rain is brought by a wind that has been blowing for a few hours or days in the same direction, the clouds are of the nimbus class; they overcast the whole sky, and though the drops of rain may be large, there is no appreciable thunder and lightning, the electric potential being too uniformly distributed throughout the cloud.

Pittsfield, Mass.

HENRY GETAZ.

THE EFFECT OF POLAR CURRENTS ON GULF STREAM PLANKTON.

To the Editor of the SCIENTIFIC AMERICAN:

It was announced some time ago that very interesting communications were to be published shortly from the pen of Prof. Frithjof Nansen and assistants upon the most recent results of the investigations which have been carried on for a series of years with a view to ascertaining the influence which the water in the polar currents has upon the water in the Gulf Stream in the way of creating very favorable conditions of existence in the latter for plankton and higher marine life.

The results may be shortly summed up thus: From the investigations carried on during the "Fram's" voyage across the north polar basin it has been proved conclusively that in the polar water which is protected by a thick layer of ice from the influence of light, accumulate matters which have a fertilizing effect upon the vegetable life in the open sea and which in the cold, dark polar water are not used. The polar basin is like a large tract of fallow land in which fertilizing matters accumulate without being used.

The warm water in the Gulf Stream, on the contrary, when reaching the northern part of the Atlantic is desert water, so to say. It has been used up and contains only scanty means of subsistence for any animal life.

The more polar water that sets in and mixes with the warm water in the Gulf Stream, the more luxuriant seems to be the growth of plankton and higher marine life. It is the cause of colder summers in northern Europe, but the fisheries seem to be better in proportion.

The results of these investigations, of which only a short summary is just published in the press, will be issued in book form, and seem to open up prospects of our being able to foretell good or poor fisheries and to explain many interesting phenomena which seem to be dependent upon the temperature in the northern part of the Gulf Stream.

Christiania, Norway.

J. A. MÖRCH.

Rubber Substitute.—According to a foreign patented process, a substance resembling rubber or gutta percha is produced by mixing gelatine, bichromate of potash, and glycerine, and molding the mass obtained. The components are used in an anhydrous state to retard the working of the bichromate of potash on the gelatine; by heating, the chemical effect may be increased or reduced.