Return of Finlay's Periodic Comet.

BY PROF. WILLIAM R. BROOKS, SMITH OBSERVATORY.

Finlay's periodic comet, recently detected on its return by Koph at Heidelberg, was observed at this observatory on the morning of July 19 with the 10-inch equatorial refractor. Its position at that time was right ascension 23 hours 53 minutes 30 seconds; declination south 13 deg. 3 min. This places it on the tail of Cetus, and rather singularly, quite close to the place where the writer discovered an interesting periodic comet in July, 1889, having a period of about seven years.

Finlay's comet is at present slowly moving in a northeast direction. It is a faint telescopic object at present, slightly oval in form, with the major axis in an east and west direction, with no central condensation and no tail. The comet, however, will increase in brightness until the first week in September, when it arrives at perihelion.

This comet was discovered by Finlay at the Cape of Good Hope on September 26, 1886, and was observed for several weeks by the writer from the old Red House Observatory. The period of this comet's revolution about the sun is about six and one-half years. It was quite generally observed at its first return in 1893, but at its next return, in 1899, the comet was in such an unfavorable position that it escaped observation. At this, its third return, it is very favorably placed for observation in the eastern morning sky.

From the following ephemeris the general path of the comet may be seen, and its place projected for a little time beyond the dates here given:

	R. A.	Dec. S.
July 25	0 h. 48 m.	7 deg. 59 m.
July 29	1 h. 21 m.	5 deg. 0 m.
August 2	1 h. 56 m.	1 deg. 42 m.
		North.
August 6	2 h. 36 m.	2 deg. 35 m.

The comet, it will be seen, is moving along the back of Cetus. On August 2 it will be nearly between the stars Alpha and Mira, and early the following week in the head of that large constellation.

How Alcohol is Made from Potatoes in Germany and How the Government Controls Its Production.

The potatoes (which must be produced on the land of the proprietor) are first washed by machinery. They are then steamed and pulped, and driven through a strainer into the mash-tun where they are mixed with a small percentage of malt. The wort is then passed into the fermenting vats. Each vat is gaged, and its content marked on the outside, together with the number of the vat. The wash is left to ferment for thirty hours, and is then conveyed to the still, which is of the patent still type. On issuing from the condenser the spirit passes first through a domed glass case in which is a cup. In this cup, into which the spirit flows and from which it overflows, there float a thermometer and a hydrometer, to indicate the strength of the spirit passing. From this apparatus the spirit flows into a (Siemens) meter, fitted with an indicator which records the quantity, reduced to the standard of pure alcohol, of spirit transmitted, and from the meter the spirit passes on to the receiver.

The system of control in Germany does not require the continuous attendance of excise officers, but is compounded of (1) mechanical contrivances, (2) book entries, and (3) liability to visitation at any time.

(1) Mechanical Contrivances:—Up to the point at which the wash passes into the still, these are limited to the gaging of the vats and to the plumbing under revenue seal of all joints of the pipes leading from the vats to the still. From that point onward to the receiver every vessel is locked and sealed, and no access to the spirit can be obtained by the distiller.

In the small distilleries the meter, which no doubt is an expensive apparatus, is dispensed with, and the quantity of spirit distilled is ascertained by the excise officer from the receiver. Whether there be a meter or not, the receiver is of course under lock, and is not accessible to the distiller.

(2) Book Entries.—The regulations require entry of the quantity of materials used. But this is regarded as of little practical value, and little attention is paid to such records. It is manifest that they cannot be susceptible of any real check.

The important entries are those of the times of charging and discharging the several fermenting vats, and of the quantities of wash in each. These entries can of course be checked against the spirit found in the receiver, and on them is computed the vat tax and the distillery tax, which have to be paid by the distiller.

(3) Liability to Visitation.—It will be seen that the control under (1) and (2) provides no security against abstraction of wash from the fermenting vats. Visitation at frequent and uncertain intervals would seem to be an essential feature of the system. Visits of excise officers are even unpleasantly frequent. Whether they are so in more remote distilleries may be open to doubt.

In any case the system of control rests so heavily upon confidence that, while it may be satisfactory with a low duty on spirits and with a system of rebates of duty that makes the excise a source of profit to the smaller distiller, it could not safely be adopted where the duty is high and invariable in its incidence.

The vast majority of German agricultural distilleries are to be found in the eastern provinces of Prussia and Saxony, where the soil is poor, and the cost of conveying agricultural produce to a remunerative market is high.

In normal years the return from potatoes used in the agricultural distilleries does not exceed some $5 per ton (exclusive presumably of bonuses), and in many cases is less. The average is about $4.50 per ton.

The yield of alcohol from a ton of potatoes may be taken at about 25 gallons of pure alcohol, or about 44 proof gallons.

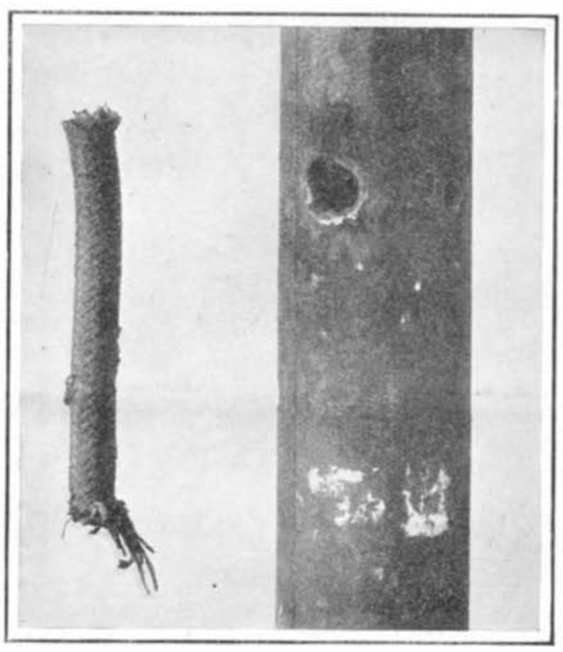
Correspondence.

Thunderstorms and Electric Wiring.

To the Editor of the SCIENTIFIC AMERICAN:

As a matter of interest and instructive value to your many readers, I am reporting an unusual and significant incident that occurred at the branch office of the SCIENTIFIC AMERICAN at Washington, D. C., during a thunderstorm on the 11th of July, 1906.

During the progress of the storm, lightning struck the electric wires that supply the office with light and power. The fuses of the various lights and fans were instantly burned out, and simultaneously therewith a torrent of water poured from the floor of the building where the wires entered, evidently flowing from the water pipe supplying the various radiators of the water-heating system, which, as is usual, had not been



HOLE BURNED IN A WATER PIPE BY LIGHTNING.

cut off for the summer months, since it is not generally considered necessary or even desirable to do so.

Careful inspection disclosed the fact that the electric wiring was close enough to the water circulation pipe to permit electricity of high voltage to jump to the fine ground connection which the water pipe afforded, and in doing so it burned a hole fully three-eighths of an inch in the water pipe, with the result above noted. I am inclosing you a section of the pipe showing the holes, of which there are two, a large and a small one, and also a piece of the wire. The torrent of water which immediately followed the discharge shows that the larger hole was the result of the discharge. The smaller one may have been produced by a ground during the removal of the pipe, as the water-heating engineer states that a flash occurred as the pipe was unscrewed preparatory to removing it, he having undertaken the work without opening the electric switch.

The lesson which the incident teaches is, first, the value of adequate lightning arresters; and second, the importance of keeping all electric wiring away from water and gas pipes. The electric wires were properly insulated, and carried by porcelain sleeves through the wooden joists of the building, but the lightning's voltage was heavy enough and the ground connection so good as to make the jump possible. If the pipe had been a gas instead of a water pipe, needless to say a fire would have occurred, which would have been difficult to control in daytime, and disastrous at night.

Washington, D. C. EDWARD W. BYRN.

A London inventor has succeeded in evolving a novel improvement upon the ordinary celluloid film used for cinematographic purposes. The pictures are taken in a spiral manner upon circular glass plates, thereby enabling a long series comprising several hundred pictures to be contained in a small space. The diameter of the plate is 15 inches, while the photographs themselves do not exceed half an inch in length. In this way it is possible to record a story lasting about four minutes upon one plate. Very slight alterations are necessary to the projecting lantern, and by revolving the plate the pictures are thrown upon the screen.

TUNNELING THE EAST RIVER.

Subaqueous tunneling, particularly in soft ground, is hardly past the experimental stage, despite the fact that its history dates back to the time of the Assyrians, who built a tunnel 15 feet high and 12 feet wide under the Euphrates River. It may seem remarkable that such an engineering enterprise could have been carried out before compressed air was known, but the ancients often displayed remarkable originality and simplicity in their methods of overcoming apparently insurmountable difficulties. The idea of tunneling the Euphrates proved no great problem to them. They merely diverted the course of the river, built up their brick tunnel in the dry bed, and then restored the waters to their original channel.

Strictly speaking, then, this work was not of a subaqueous character, so that the true history of subaqueous tunneling in soft ground properly begins with the Thames tunnel, which was built about eighty years ago. Since then, a dozen or more such tunnels have been built, but despite the experience they afforded, there is still a great deal to learn on the subject. Each tunnel has its own individual characteristics, and offers its own puzzling problems. For example, three different lines of tunnels are now being built under the East River, two of which are within a half mile of each other, yet the material through which they are being cut is different in each case and, furthermore, is of an entirely different character from that encountered in the Harlem River and the Hudson River. Not only do these tunnels differ in the nature of the soil and rock through which they pass, but also in their depth below the surface of the water and in their size, which variations govern the air pressure necessary in the tubes and working chambers and introduce complications that do not appear at a casual glance.

The furthest advanced of the tunnels now building under the East River is the Rapid Transit Subway tunnel, which comprises two tubes running from the Battery to Joralemon Street, Brooklyn. At present, the two shields of the northern tube are less than 800 feet apart, while 940 feet of rock and sand intervenes between the headings of the southern tube.

Before commencing these tubes, careful borings were made in the river bed along the line of the tunnel. At first, wash borings were made, these consisting in sinking a tube into the river bed with a water jet until it struck rock. The mud and sediment in the tube indicated the nature of the materials of which the river bed is composed. A large number of these borings were made. They might be called soundings rather than borings, because they did not penetrate the rock but merely indicated the depth below water level at which rock was encountered. Such borings in themselves are apt to be quite misleading, because only the surface of the rock is indicated and there is no way of determining whether the rock is solid or merely a large bowlder. Only by diamond drill borings into the rock itself carried below the depth of the tunnel floor, is it possible to make an accurate estimate of the conditions which will be met when driving a tunnel. With a diamond drill a core is cut out which serves as an actual sample of the rock or other materials encountered; consequently it was decided to verify the wash boring statistics with diamond drill borings. But the driving of a diamond drill boring from the surface of a body of water subject to such tidal currents as prevail in the East River is no small task. In borings of this type it is imperative that the drill be kept in perfect vertical alignment. This necessitated the building of a firm, stationary platform in the river wherever a boring was to be made. A pile driver was used to carry the drill-operating mechanism, and the working platform was supported on piles driven into the river bed. Much difficulty was experienced in maintaining the working platform, as barges in the river were frequently swung by the tide against the piles, knocking them down or out of alignment. Several drills were lost by accidents of this character. But results proved that the precaution of verifying the wash borings was well taken. The original profile showed rock near the Brooklyn shore, but when the rock was drilled, it was found to be merely a large bowlder beneath which, in the line of the tunnel, there was nothing but soft material. Discrepancies were also found in other places, so that the true profile which we publish here differs very much from the original one based on wash borings.

The rock profile along the New York and Long Island Railroad tunnel at 42d Street, popularly known as the Belmont tunnel, was also based on diamond drill borings and a number of wash borings. A novel method of establishing working platforms for the borings was used. The water here was deeper than at the Battery and pile foundations were out of the question. Instead, a steel tower 68 feet high was procured, one which had