PERMANENT STEAM ENGINE INDICATOR.

In describing the general principles of the permanent indicator of Mr. Perry, we have shown the difficulties encountered in obtaining exact diagrams when the angular speed of the engine is considerable. It is necessary in tracing a good diagram that the duration of the oscillation of the indicator should be less than one-twentieth of the duration of a revolution of the machine. At one-fifteenth the tracing becomes indefinite and indistinct, at one-tenth it is absolutely impossible. The system of Mr. Perry remedies this defect in the operation of even good indicators, for the card which receives the record, and which comprises the only movable part of the system, has usually a period of vibration of one five-hundredth of a second.

It is possible, therefore, to procure correct diagrams with a engine that has attained an angular speed of 1,500 revolutions a minute. But since it is possible to employ cards whose period of vibration is only one one-thousandth of a second, and even less, it may be said that in practice there is no speed so great that the diagram will not be accurately traced.

The indicator, shown in elevation and cross section in Fig. 1, consists of a thin box of bronze or brass, closed on one side by a thin sheet of steel, D. A disk used for ordinary pressures does not exceed two kilogrammes to the square centimeter to three centimeters of diameter and 0·4 mm. in thickness. For more sensitive work folded disks may be used, but they are more expensive. The plane disks are sufficiently sensitive for ordinary work. When the indicator box is connected with the cylinder of the engine, it is inflated more or less according to the internal pressure. The degree of displacement is considerably increased by putting on the disk, midway between the center and the edge, a small mirror, B, similar to those that are used in electrical laboratories for measuring displacement by reflection. The mirror is mounted on a screw which enables it to be rapidly attached to or removed from the disk. The ray of light from an ordinary oil lamp which falls on the mirror, and is reflected on a sheet of white paper, will trace a path exactly similar to an indication a meter in length.

In this way a diagram of 5 or 10 centimeters may be obtained.

If a lens and a magnesium or oxhydrogen lamp is used, the screen may be placed 12 meters away, and a diagram 2 meters high may be procured without difficulty. The extremity of the arm, F, receives, through a system of levers properly arranged, a slight oscillatory movement synchronic with the piston, and in a direction perpendicular to that of the luminous ray produced by the displacement of the disk. It is easy to understand that the combination of the two movements reproduces exactly the diagram of the engine. New and interesting though the discovery is, it is not necessary to have recourse to a photograph in order to preserve the diagram thus procured. Even at a speed of 60 revolutions the ray leaves its impressions on the retina long enough to enable the observer to trace a diagram on the screen with a pencil. In order to determine the scale of the diagram, the chamber, A, of the indicator is first connected with the atmospheric pressure. A straight line is thus obtained corresponding with atmospheric pressure.

Then the chamber is put in direct communication with the boiler, and a second line is obtained parallel to the first, which defines the height that corresponds to the full pressure furnished by the boiler and indicated by the manometer, at the time the experiment is made. The diagram being thus outlined, the indicator is connected with the cylinder, and the real diagram is obtained. When the engine has attained a speed of 250 revolutions the diagram takes the form of an absolutely continuous line, and it is difficult for even an inexperienced person to make a mistake which exceeds one in one hundred in making a tracing with a pencil. The diagram is thus visible like a black line in the middle of the luminous line which has been traced by the indicator. With an ordinary petroleum lamp a diagram 12 centimeters in width and 10 centimeters in height is perfectly visible, even in a light room. In case the ray is projected into a dark space, it becomes very brilliant, and produces a particular impression on all persons who are in the habit of studying and analyzing similar indications.

Fig. 2 shows the indicator of Mr. Perry mounted on a little steam motor constructed by the students of Finsbury College. The ray of light proceeding from the petroleum lamp passes through the hole, A. B is the indicator, the mirror of which reflects the image on the screen, C. Mr Holland succeeded in making photographs of these diagrams by simply surrounding the screen with a box. Excellent proofs were obtained after a minute's exposure with an ordinary petroleum lamp, and only a few seconds are required when a magnesium ribbon is burned behind the opening in place of the lamp. Mr. Perry prefers to use the dark room, not only for taking the photograph, but for drawing the diagram with the pencil, by applying a piece of tracing paper against ground glass. Fig. 3 shows the reduction of the two diagrams thus obtained by the little engine of Finsbury College. One of the diagrams, No. 1, is traced at the speed of 200 revolutions a minute, the other, No. 2, at 500 revolutions.

With an ordinary indicator, it is necessary to stop

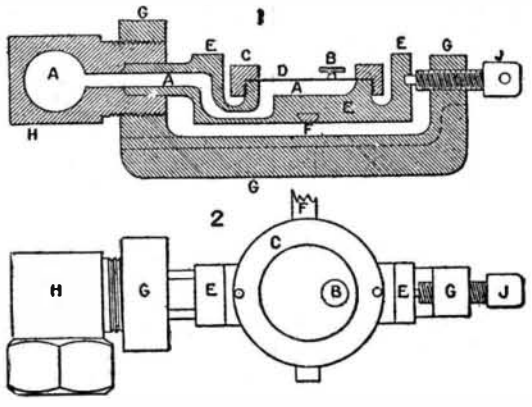

Fig. 1.—A GENERAL VIEW AND CROSS SECTION OF THE INDICATOR.

A, steam chamber; B, mirror; C, frame for holding disk D; E, oscillating frame; G, stationary frame; J, thumb screw; F, lever attachment for oscillating the frame E.

the registering cylinder and change the sheet of paper every time a diagram is made. Here the diagram is continually visible, and it is possible to follow every change of pressure, speed, or load. The permanent steam engine indicator of Perry is specially desirable for use on locomotives and on steam vessels, because it

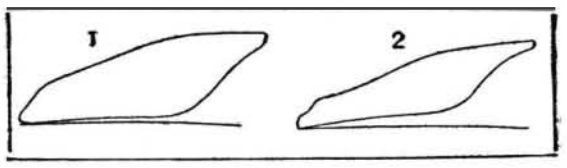

Fig. 3.—DIAGRAMS REPRODUCED FROM CRAYON DRAWINGS.

1, motor making 200 revolutions; 2, motor making 500 revolutions.

furnishes the engineer, at each instant, with a perfect indication of the pressure reached in his engine. It is equally desirable for use with pumps, and in various other machines in which fluids are used. Mr. Ayrton has already stated it would be possible to modify the apparatus in order to trace the form of the current produced by machines which have altenating currents. The principle of optics of Lissajous, which has not heretofore been applied in any other way than in the study of acoustics, can then render great service in the study of an industrial apparatus, as well as in other lines of scientific research. We owe many thanks to Mr. Perry for having produced the ingenious indicator which we have just described, after a communication made by the author to the Physical Society.—*E. Hospitalier, in La Nature.*

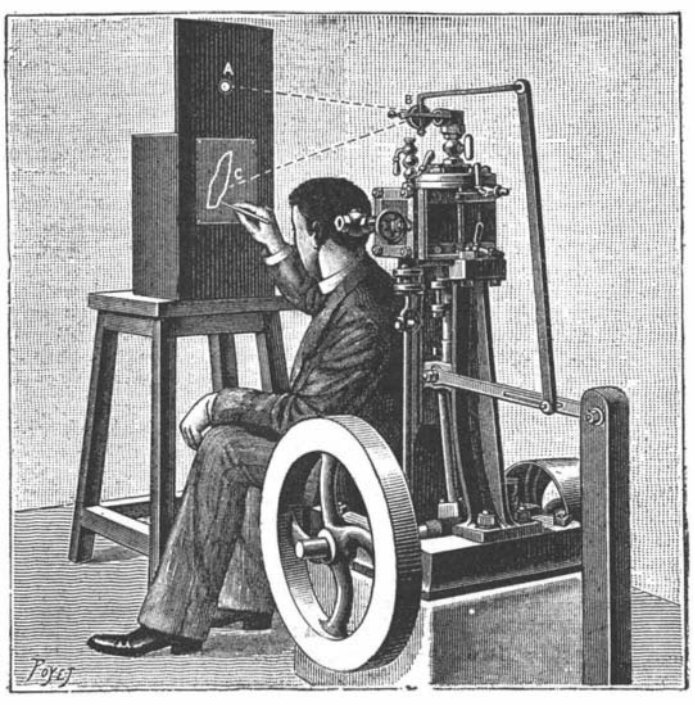

Fig. 2.—HIGH SPEED PERMANENT INDICATOR OF MR. J. PERRY.

A CORRESPONDENT places the address of a letter on the back thereof, the writing being across the folded parts of the envelope. He suggests this plan as an effective method of preventing the illicit opening of letters by steaming, etc. For the intended purpose the suggestion appears to be a good one.

New Class of Sugars.

The discovery by Tollens and his pupils of the existence of a class of sugars containing only five atoms of carbon in the molecule instead of six raises rather an important question as to our methods of food analysis. These *pentaglucoses* have not been shown to exist ready formed in any of our commonly used feeding stuffs; but they are produced in greater or less quantity when such stuffs are subjected to the action of dilute acids, the process always adopted for inverting cane sugar before its determination by Fehling's solution, and sometimes for a similar determination of starch. The proximate constituent of the plant which undergoes this change into a pentaglucose is probably a gum; for gum arabic is the best source yet discovered for one of the two members of the group at present known. This is *arabinose;* it sailed for some time under false colors, being generally regarded as a true glucose, or six carbon atom sugar, and it is only recently that its true character has been ascertained. The other pentaglucose is *xylose*, obtained most abundantly from the bran and other woody tissues. Both reduce Fehling's solution.

From what has been said it will be evident that the presence of these gums in a vegetable product used as a food must give rise to errors in the determination of the true sugar, and sometimes of the starch in that food. Now this error would be unimportant if it could be shown that these gums were of equal nutritive value with sugar or starch, but this has not been shown. On the contrary, all evidence is at present the other way, for it is probable that the splitting up of the gum into its pentaglucose would take place in the stomach, and there is no ground for the assumption that the pentaglucoses are of equal or similar nutritive value with the hexaglucoses. Neither of the pentaglucoses can be fermented with yeast.

Attention has recently been called to the wide-spread existence of the substances which give rise to the pentaglucoses by W. E. Stone. By taking advantage of the ease with which these bodies can be decomposed with the formation of an easily determinable substance called *furfurol*, he has found that after the gums, brewers' grains contain the largest quantity—about 12 per cent. The straws come high in the list, then Hungarian grass and "corn stover," as the Americans call their maize offal. Timothy hay and linseed meal are not far behind, while, on the other hand, corn meal (presumably maize) and cotton seed cake contained none.—*Chemical Trade Journal.*

The Weather Bureau.

The signal service corps of the army was relieved, on July 1, according to the provisions of an act of Congress, of the duty of furnishing the public with the daily weather reports, and this work was turned over to the Department of Agriculture. Gen. Greely is succeeded as chief of the bureau by Prof. Mark W. Harrington, professor of astronomy in the University of Michigan, at Ann Arbor, and editor of the *American Meteorological Journal.* He is about 43 years old, and is regarded as an accomplished student of meteorology and climatic problems. He has had considerable correspondence with the department about climatic matters in relation to agriculture, having prepared a bulletin on the subject, which is about to be published by the forestry division of the department. The intention of Congress in making the change was that the work of the weather bureau might be extended beyond its present scope in every way where such enlargement could possibly be of benefit to our agricultural interests. Secretary Rusk says the work of the meteorological service of the United States government must go far beyond the mere forecasting of the weather, and be so extended as to include a thorough systematic investigation into the climatic conditions of the various sections of the country, in order that a full knowledge of them and of their effects upon plant growth should be available for the farmers.

Whooping Cough.

Common thyme, which was recommended in whooping cough three or four years ago by Dr. S. B. Johnson, is regarded by Dr. Neovius, who writes a paper on the subject in a Finnish medical journal, as almost worthy the title of a specific. During an epidemic of whooping cough he had ample opportunities of observing its effects, and he came to the conclusion that if it is given early and constantly it invariably cuts short the disease in a fortnight, the symptoms generally vanishing in two or three days. They are, he finds, liable to return if the thyme is not regularly taken for at least two weeks. Regarding the dose, he advises that a larger quantity than Dr. Johnson prescribed be taken. He gives from one ounce and a half to six ounces per diem combined with a little marshmallow sirup. He never saw an undesirable effect produced, except slight diarrhœa. It is important that the drug should be used quite fresh.—*Lancet.*