flowing over ice already formed. This ice could well be named layer ice.

8. An accumulation of increments of frazil, float or sponge ice upon the underside of surface ice. This could well be named canker ice.

Nos. 5 and 6 are easily controlled, since they are prone to float near the surface, and can be trained past an intake by glance booms.

No. 4 is in the usual instance of a water-fall or precipitous rapids, only controllable by elimination of the sudden changes in fall or sudden changes of course of the water.

No. 7 is hard to control, but an extremely wide raceway, with vertical sides, or an extremely narrow one, are an aid. In the one case the ice cannot hang, but drops up and down, floating with each change in elevation of the surface of the water. In the other case it arches.

No. 8 gives trouble in the St. Lawrence river and such places, where surface ice and strong currents and rapids are present.

No. 2. This is the ice that gives the trouble. It cannot be kept away from a screen, because it may be only water before it touches the screen. The water that gets past the bars of intake screen without sufficient change (lowering) of motion to turn it into ice will strike the wheel, and turn to ice at that point.

With two kinds of water and eight kinds of ice, the peck of troubles of a water-power user should be full. I have added nothing to his troubles, however, and if they can be simmered down to frazil ice, and the conditions governing frazil ice can be agreed upon, then the way to a remedy will be found. The best way in my view is to seek hub marks upon which agreement may be found.

Prof. Barnes disagrees with the definition that "frazil ice is water just ready to freeze, but prevented from so doing by motion, the action of freezing taking place when the rate of motion is lowered," and says it is contrary to all the known laws of ice formation. The only criticism I would make to this statement is that the laws of ice formation are not known. When a pail of water is placed out doors on a cold day, and after a certain period of time one should suddenly shock that water by a blow, then ice crystals will form. According to Prof. Barnes, it is the motion imparted to the water that caused the formation of the crystals.

According to the view developed at the meeting of the Engineers' Club it would be the circulation of the water, which we know must be taking place in a liquid that has one surface exposed to a low temperature, being suddenly stopped by shock, that caused the formation of the crystals. In a similar manner the frazil ice will form from frazil water when the degree of motion to correspond with the prevailing temperature of the frazil water is not maintained. As an aid to plant hubs or milestones on this question I would propose the following for adoption or rejection, viz.:

a. That night-time is more often the time when trouble with frazil ice occurs.

b. That cloudy days are also conducive to trouble.

c. That with an unclouded sun no trouble ever occurs.

d. That frazil ice will not cause trouble when the reservoir or river is frozen over, excepting in the case of very rapid streams.

e. That piers in the reservoir, extending to the surface of the water booms or other devices tending to assist the formation of surface ice are an advantage.

f. That frazil ice will form in slight currents when the water is at a half degree below freezing point.

g. That frazil ice will form in strong currents at any temperature.

h. That the degree of frost at which frazil ice forms is proportioned to the velocity of the current.

i. That frazil ice never forms in quiescent water.

j. That agitation of a lake or pond by winds is analogous to the flow of the stream, and will cause the formation of frazil ice.

k. That the thickness of the particles or crystals is in some proportion to the temperature of the water at which it formed, which temperature is again determined by the velocity of the stream.

l. That the greater the depth of intake the greater assurance of freedom from frazil ice, forty feet being considered a safe depth.

m. That in a strong current the temperature of the water at all depths is practically uniform, and frazil ice will form as readily at one portion of that depth as at another.

n. That in a lake or pond the frazil ice will form only in the upper layers, where agitation occurs from wind, and the greater the degree of cold at which frazil ice forms the thicker will be the particles, and the stronger will be a necessary suction to draw them to a given depth; thus, an intake crib with a strong suction will suffer from frazil ice at any degree of temperature below freezing and any degree of agitation of the water, while a weak suction will suffer only at moderate or slight degrees of frost, with slight agitation of the water.

o. The stronger the suction the greater should be the depth of the intake below the surface to insure freedom from frazil ice.

p. In a river the greater the velocity of the current the greater should be the depth of the intake below the surface to ensure freedom from frazil ice.

q. Is more trouble encountered early in the season before cold weather has become settled, or vice versa?

r. Is the trouble which is often encountered after a thaw, caused by frazil ice or by freed anchor ice?

s. The ice that forms on intake bars is frazil ice.

t. The ice that sticks to wheels is frazil ice.

u. The ice that sticks to any obstruction below surface of water is frazil ice, an accumulation of which is called anchor ice.

JOHN S. FIELDING.

Toronto, Feb. 22, 1905.

MOTOR BOATS.

Editor Canadian Engineer:

Sir,—We notice in the February number of the Canadian Engineer an item stating that the Canada Launch and Engine Works is the only firm in Canada which builds complete motor boats. We beg to say that we are building complete outfits, and are prepared to design and build motor boats of any kind in either wood or steel, for any purpose, to run at any speed that any other firm can, and we will equip them with either two or four-cycle gasoline engines of from one to four cylinders. We build these engines and boats ourselves, so that you will see that there is more than one firm in Canada building complete motor boats.

GEORGIAN BAY ENGINEERING WORKS,
G. W. Thexton, Manager.

Midland, 18th Feb., 1905.

THE METRIC SYSTEM OF MEASURES.

Editor Canadian Engineer:

Sir,—In a recent issue of the Canadian Engineer there appeared a letter by F. A. Halsey attacking the metric system, but containing so many errors that they should not be allowed to pass without correction.

The first point regards the number of countries which have up to date adopted the metric system. The extravagant language used by Mr. Halsey in this connection may be passed over without notice, but the criticisms, while neither new nor true, deserve answer, lest the uninformed might be misled to think the metric system had not been adopted in the larger portion of the world. It is of little consequence to know the exact number of countries which have adopted this system, but the fact remains that upwards of forty countries have done so, comprising a population of over 480,000,000. This statement may be verified by consulting the "Reports of Her Majesty's Representatives Abroad," made upon the official request of the Prime Minister of Great Britain "for information as to the actual experience of nations which have adopted the metric system." These reports were presented to both Houses of Parliament