Montreal. Dr. Barnes is inclined to neglect Mr. Bell's highest result, thereby securing more consistent values, ranging from 358 to 783 pounds per square inch. Mr. Bell himself states that he considers 400 pounds a fair estimate of the crushing strength of ice from all his tests.

Dr. Barnes describes experiments performed by himself to determine the crushing strength of perfectly clear ice on somewhat larger blocks. The ice was cut from the river and tested in a hydraulic press. One large piece 6 in. x 28 in. x 40 in., furnished the largest number of individual blocks. The direction of the crystalline axis was determined by knowing the plane of freezing, and the various blocks were cut by a hand-saw accordingly. The ends of the blocks were melted smooth on a hot plate to fit the plates of the press. When the pressure was applied, considerable melting resulted on the ends. The blocks were kept outside at a temperature ranging from —8° C. to 0° C. and were brought into the laboratory for the tests. One interesting fact was noted, that the blocks were heard to crack at a pressure, approximately one-half the ultimate crushing force. It was repeatedly observed that as soon as the pressure was increased sufficiently to cause the first audible crack, the block appeared to stiffen, and the pressure ran up much quicker, with much less melting. In some cases the melting appeared to cease altogether. Dr. Barnes concluded that the giving way of the ice under pressure allowed the melted ice to run into cracks, where it must have frozen and cemented the block more firmly, being unable to see any of the cracks which could be distinctly heard at half the crushing pressure.

The only effect of varying the position of the axis of the ice with respect to the direction of the pressure, appeared to be the way the block burst. When the axis was parallel to the applied pressure, the ice burst sideways into innumerable long needles, resembling a cake of ice which has all but fallen to pieces in the sun. The cake fell to pieces on being removed from the press. When the axis was at right angles to the applied force, the block cracked lengthwise and transversely without shattering.

Table II. gives the results of the tests performed by Dr. Barnes. It will be seen that the mean value for all the tests for parallel axis is a little higher than the mean for perpendicular axis, but the difference is too small to make it possible to draw any definite conclusions. The results show considerable variation, which may be purely accidental or may have some bearing on the character of the initial distribution of the pressure.

The relation between the first cracking of the ice and the final crushing force is one which, the experimenter states, must be further investigated.

In closing he remarks: "The question of the relation of temperature to the crushing strength is one of importance. It has been assumed that ice becomes stronger at low temperature. The hardness of ice increases considerably as the temperature falls to 0° F. but I am inclined to think that the ice also becomes more brittle. In the neighborhood of the freezing point, ice is much more plastic than it is at lower temperatures. The plastic effect is, however, masked by the regulation effect, and it is a question whether the ice mass is not really firmer near the freezing point than when cooled much below. This can, however, only be settled by further experiment."

A number of samples of radium-bearing ore from British Columbia have been received by the mines branch, Department of Mines, Ottawa, for investigation.

THE SUCCESSFUL BURNING OF LIGNITE.

In *The Canadian Engineer* for December 3rd, 1914, the investigations of the Saskatchewan government into the coal resources of the province were referred to, and an analysis was given to illustrate its serviceability as fuel for power and domestic purposes.

Following it we present herewith some notes respecting the burning of lignite in the State of Texas, in which state there is an estimated area of over 60,000 square miles, containing what is roughly concluded to be 30 billion tons of lignite. In many centres its use in manufacturing plants has been extensively adopted. The lignite resources of the state have been recently investigated by Professor Wm. B. Philips, of the University of Texas, who has made a study of its commercial use. In a recent report he alludes to the introduction of a grate specially adapted to burn lignite screenings, a grade that is sold at from 50 to 60 cents per ton. This grate is similar to the ordinary grate, being rectangular in cross-section, but slightly wider at the top than at the base. On its top face are marginal and transverse ribs or partitions, forming fuel pockets adapted to retain fine fuel. On its bottom face are recesses forming air pockets. These fuel pockets are from one-half to five-eighths of an inch deep and are connected with the air pockets by tapered ventilating holes, largest at their lower ends, being about three-eighths of an inch in diameter at the top and 50% larger at the bottom. The tapering form of the ventilating holes tends to cause a discharge of the air in jets into the fuel.

In ordinary grates, especially where a forced or induced draft is used, the air rushes through the weakest places in the fire. With this grate the individual air pockets underneath prevent the air from rushing past some of the ventilating holes and overcharging others. These air pockets form sources of supply to the separate groups of ventilating holes and cause an even distribution of the air to the fuel pockets in the top of the bar throughout the grate surface. A steam blower is used with these grates.

Much lignite is now fired by hand, and while this method unquestionably gives good results when proper care is taken, the stoker seems to be necessary for large establishments. There are no difficult obstacles to be overcome. The main points to consider are that lignite is a fuel which parts with its volatile combustible matter more quickly than does ordinary bituminous coal and that the fixed carbon is not of a coking nature. This means that a large quantity of air must be supplied within a short time after the fuel begins to part with its volatile combustible matter and is supplied at the requisite points. The smoke must be prevented from forming, for it is difficult to handle it afterwards. The fixed carbon will take care of itself, if prevented from falling through the interstices of the grate; it is the volatile combustible matter that has to be cared for.

It does not appear that there are greater variations in the composition of lignites than in the coals with which they are to compete, so that a stoker installation successful with one lignite should be capable of burning any other under comparable conditions.

It has been stated in Ottawa that the value of minerals produced in Canada this year will be considerably less than that of 1913, because of the scarcity of capital for mining development and also because of the low prices which have existed for silver and other minerals.