centre the hyacinth, and in each corner a cluster of crocus or snowdrop bulbs can be placed, with here and there, nearest the window, a jonquil or tulip. The soil is to be rich, but with a mixture of sand, and the bulbs are merely covered. After watering freely, it is well to place for a while in a dark, cool place about a week or two, to encourage a development of roots. When these are fully formed the plant will stand a great deal of bad treatment, preferring a cool atmosphere for long continued flowering, but doing fairly even with a high temperature. But some may say the perfume would be too strong if many flowered at once. Yet, I reply, how pleasant to have them in midwinter to give to a friend, or to gather to place in another room. Besides, the box gathers many a little treasure. A slip of some vine, a piece of moss, or a shell, finds place therein; some little cutting takes root, and we find our winter garden an object of interest. In order to avoid this, too, the bulbs are classed as "early" and "late," needing only a judicious mixing, while the enterprising seedsmen of McGill street are always glad to impart information; and, after years of experience, I can say that their Holland bulbs show good taste in selection, and have flowered more surely than some procured at a distance.

ANNIE L. JACK.

## A MUSICAL INSTRUMENT.

What was he doing, the great god Pan,
  Down in the reeds by the river?
Spreading ruin and scattering ban,
  Splashing and paddling with hoofs of a goat,
  And breaking the golden lilies afloat,
    With the dragon-fly on the river.

He tore out a reed did the great god Pan,
  From the deep, cool bed of the river:
The limpid water turbidly ran,
  And the broken lilies a-dying lay,
  And the dragon-fly had fled away
    Ere he brought it out of the river.

High on the shore sate the great god Pan,
  While turbidly flowed the river;
And hacked and hewed as a great god can,
  With his hard, bleak steel at the patient reed,
  Till there was not the sign of a leaf, indeed,
    To prove it fresh from the river.

He cut it short, did the great god Pan,
  (How tall it stood in the river!)
Then drew the pith, like the heart of a man,
  Steadily from the outside ring,
  And notched the poor, dry empty thing
    In holes, as he sate by the river.

"This is the way," laughed the great god Pan,
  (Laughed while he sate by the river,)
"The only way, since gods began
  To make sweet music, they could succeed."
  Then, dropping his mouth to a hole in the reed,
    He blew in power by the river.

Sweet, sweet, sweet, oh Pan!
  Piercing sweet by the river!
Blinding sweet, oh great god Pan!
  The sun on the hill forgot to die,
  And the lilies revived, and the dragon-fly
    Came back to dream on the river.

Yet half a beast is the great god Pan,
  To laugh as he sits by the river,
Making a poet out of a man:
  The true gods sigh for the cost and pain,
  For the reed which grows nevermore again
    As a reed with the reeds by the river.

—*E. B. Browning.*

## SCIENTIFIC—SANITARY ENGINEERING.

**Lectures by Professor H. T. Bovey, of McGill College.**

### ANSWERS TO QUESTIONS IN LECTURE No. III.

1.) What influence has the physical outline of a district on the ventilation of sewers?

*Ans.* The physical outline of the district has a great effect on the ventilation of sewers, as sewers are always, if it be at all possible, inclined to a certain extent, which will depend upon the necessity of the case in question, and as it is natural for the gases and vapours formed from sewage matter to rise and seek an outlet in an upward direction, where the fall of the sewer is very great they will rush up to seek a vent at the top of the sewer in much the same way that smoke rises out of a chimney. Montreal itself may be taken as a very good example of the effect which the outline of the district has on the ventilation of the sewers and some of the inhabitants of the upper parts of the town have at times been able to testify to the fact in question. This operation will be very much accelerated by any obstruction in the sewers, or in the case of towns on the sea-side, or on tidal rivers where the outlets require to be closed during the times of high tide, and also by the rise in the level of the sewage which, by the increased pressure on the impure air, causes it to rush out. Generally this difficulty is overcome by placing a series of ventilations, usually at regular intervals, which distributes the foul air more evenly, and it will then not have the same effect on any one locality, or if considered necessary it may, in its passage into the atmosphere, be deodorized by charcoal, chlorine gas, lime and other disinfectants and filterers. T. DRUMMOND (2nd year.)

2. State the volume of sewage for which provision should be made, when laying down a system of sewers?

*Ans.* The engineer ought to provide for 5 cubic feet of sewage per head per day, in addition to the rainfall and subsoil water to be admitted, one-half flowing off in six hours and the remainder in 18 hours.

H. ARCHBALD (2nd year), and J. COLLINS (2nd year.)

The engineer when laying down a system of sewers must provide for 5 cubic feet of sewage per head per day, the half of which flows off in six hours; and, in addition to this, the sewers must be able to contain the subsoil drainage. It is found in ordinary dry weather that the subsoil drainage of a city almost equals the water used. In Liverpool the quantity supplied to the city was 12,750,000 gallons per day, and the amount of sewage that was discharged was 25,000,000 gallons per day. In another city the water used was 21,600,000 gallons per day and the sewage discharged 35,000,000 gallons per day. Extra space should be left in the sewers so that they will be able to contain the sewage that will arise from the increase of population. This is a material point, for in England the population has doubled itself in the last 50 years.

F. F. BUSTEED (2nd year.)

3. What precautions should be taken in obtaining "water supply" in the proximity of dwellings?

*Ans.* The supply is obtained in such cases either from streams which in towns are likely to be impure from admitting sewage, &c., or from springs and wells which may become very injurious from being mixed with impure subsoil water, caused by garbage, cess-pools, and nuisances of all kinds which find their way into the water. Such is especially the case in pervious soils, as sand and gravel, and in obtaining this supply the source should be thoroughly examined, and if found to be impure from such causes as are here mentioned, should be purified by their removal if possible; if not, should be excluded as a source of water supply. T. DRUMMOND (2nd year.)

4. What are the objections to the water-closet system? State your opinion as to these objections.

*Ans.* The introduction of water-closets has been opposed by the authorities in many towns, on the ground of the increased volume of water it would be necessary to procure if their use became general. Others have opposed their introduction on the ground that they are the sole cause of the pollution of the streams of the country. The result of investigation has shown that the sewage of those towns in which midden-steads are generally adopted, is, as a rule, quite as impure and nearly as great in volume as in districts where water-closets are universally used; while at the same time the sewage contains nearly as large an amount of putrescent organic matter as in water-closet towns. From a comparison of the composition of the sewage of these two different classes of towns, it appears that while the sewage of midden-stead towns contains 11.54 parts per 100,000 of chlorine, that of water-closet towns contains but 10.66. This excess of chlorine shows that there is a larger quantity of urine in a given volume of sewage of midden-stead towns than in a like volume of that of water-closet towns. It has been found that this increased consumption of water, where water-closets are used, is due chiefly to the imperfect fittings in connection with them, and that the introduction of the water-closet system with *perfect water-waste preventing fittings* will *not* materially increase the amount of sewage to be provided for, as the water used for this purpose forms but a small part of the whole of the water used for domestic and general purposes.

J. O'DWYER (3rd year).

5. What is the best method of disposing of the sewage in "Inland Towns?"

*Ans.* In towns and villages, where it is possible, land should be obtained to which sewage can be conveyed and spread over the ground. The sewage immediately sinks into the earth, and by this process, called "intermittent filtration," is quickly rendered innocuous. In villages and towns where it is difficult to contain good manure, such earth, saturated with sewage matters, would be invaluable as a fertilizer. In large towns where it would be impossible to procure such a plot of ground, the sewage should be treated chemically, and in all cases should be cleansed from all foul matter; but where it is impossible, such treatment should be supplemented by "intermittent filtration," or "irrigation works." H. ARCHBALD (2nd year.)

### LECTURE IV.

COURSE OF SEWERS.

Whenever it is proposed to lay down a system of sewers, it should be first of all ascertained what nature and art have done for the drainage of the district.

Generally speaking, the "main lines" of sewers will run along the natural drainage valleys, which valleys will also give the lines in which the "storm overflows" are to be constructed.

These "main lines" are not necessarily laid in straight lines, but curves may be introduced.

All common sewers should:—(1) Be laid in perfectly straight lines; (2) Have even and true gradients from point to point; (3) Be laid, if possible, in the middle of the streets; (4) Have an extra fall if curves be unavoidable.

{ *Man-holes—shafts down which a man can descend to the level of a sewer.*
*Lamp-holes—shafts down which a lamp can be suspended to the level of a sewer.* }

A *man-hole* or *lamp-hole* should be placed:—(1) At junctions of one common sewer with another; (2) At the point of concentration of several sewers; (3) At angle points; (4) At suitable intervals. *(The distances between the shafts should not exceed three hundred feet, and it is better to have too many than too few.)*

No shaft is necessary at the junction of a private communicating sewer with the common sewer, which is effected by a curve in the direction of the flow.

BACK SEWERAGE, &c.—Many authorities are of the opinion that "back