with one end an inch larger in diameter than the other, and the small end of one pipe is laid inside the large end of the next, about 4″, as shown in Fig. 2.

About 18″ from the large end of the pipe a spud is placed with a lock nut on each side of the sheet iron shell; this spud is embedded in the concrete coatings sufficiently to cover the

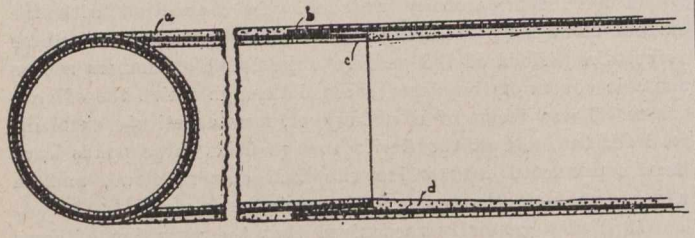


Fig. 2

lock nuts, and is filled with concrete also. A wooden block is put over it for its protection.

To make a tap it is only necessary to uncover the spud, drill out the concrete and attach the connection.

The usual pressure under which we operate is 40 to 45 pounds at the works, and, as the city is comparatively level, the pressure is nearly the same throughout.

The pipe can be made to stand any moderate pressure by the use of a shell of proper thickness. In this particular pipe the shell does not appear to have been coated before being lined.

Until the year 1906, pressure on the mains was direct from the pumps; since that time the water has been pumped into the standpipe which is close to the works and that furnishes the pressure to the city.

Cost of Concrete Mains.

Cost of mains originally laid, including trench, filling, restoring the surface of the street, etc., was as follows

12″ pipe per foot	$2.07
10″ " " "	1.62
8″ " " "	1.32
6″ " " "	1.07
4″ " " "	0.82

There was at this time, however, very little paved street. The cost of that laid the following year was 10 per cent. more.

For comparison, it may be stated that the contractors offered to lay cast iron pipe at the same figures.

The repairs to the mains from the time they were laid to the first of the year, 1910, including replacing about 500′ through low ground with iron pipe, cost $6,235.00, an average of about $164.00 per annum, or $13.00 per mile per annum.

The 12″ mains have needed scarcely any repairs, and experience has shown that where the pipe are properly laid, on good, firm ground, with the pressure used here, there is very little trouble. Where the ground is made, or marshy, the pipe are more likely to settle and if the outside concrete coating cracks, the air and moisture rust the sheet iron shell and eventually it breaks.

Strange as it may appear, sudden changes in the temperature of the water seems to have more influence on breaks than the change from direct pumpage into the mains to standpipe pressure has had.

Pipe Have No Encrustation.

When we have had to cut into the pipe, for any cause, we have found them absolutely without encrustation or deposit, and uniformly clean. The shell itself, with the exception of where the outside coating of concrete was cracked, has been as bright as it was when laid 38 years ago.

Had cast iron pipe been originally laid, we would now be experiencing more or less trouble for want of proper pipe capacity, while to-day, although they were guaranteed for 20 years only, there is no reason to believe there is any general deterioration in the mains.

THREE PHASE VERSUS SINGLE PHASE TRANSFORMERS.

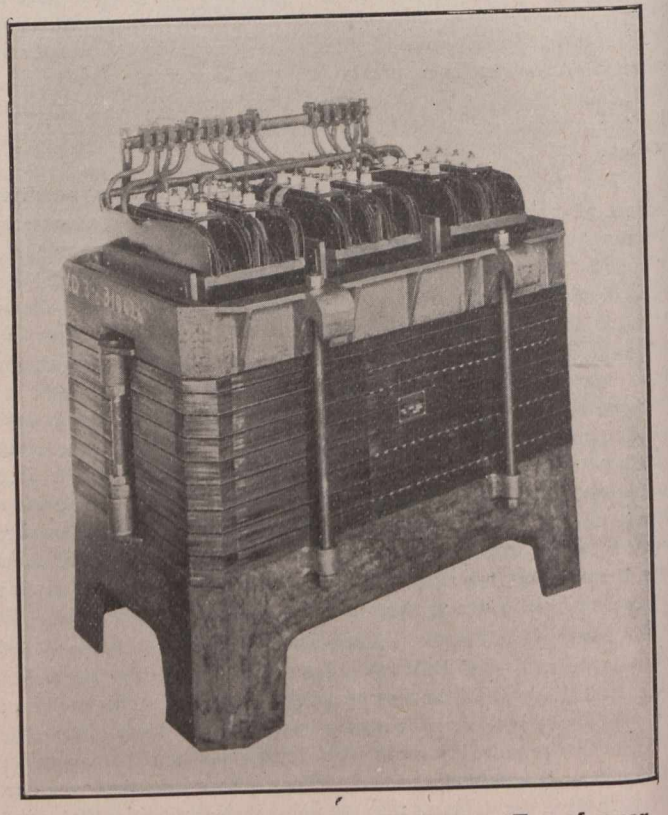
Gordon Kribs, S. P. S., '05.

Within the last year or so in Canada there has been an ever-increasing demand for three phase transformers, especially in the larger sizes for generating station and sub-station work. Heretofor single phase transformers have been used almost exclusively in the country, and there must be some reason for this change in recognized good practice.

It is the purpose of the writer of this article to investigate as far as possible in a limited space the relative merits and demerits of these two types of transformers.

Possibly one of the main reasons for the increasing use of the three phase type is the modern tendency to get electrical machinery as compact and self-contained as possible. The three phase transformer is undoubtedly more compact and lends itself to station design better than three single phase units of equal capacity, and the space occupied being much smaller, it tends to reduce the cost of the stations quite materially, besides giving a neat and compact layout.

However, one of the main reasons for the admission of the three phase transformer into popular favor has been the development of insulating materials. Within the last few years insulation in general and transformer insulation in par-



Working Parts of Three Phase Shell Type Transformer.

ticular has been brought to a high state of perfection and it is surprising how few modern transformers when given proper care and attention ever break down. It is this reliability of modern transformers that has done more, perhaps, than anything else to bring the three phase unit into favor. The engineer has found that it is unnecessary to use three single phase