4 atmospheres pressure as a safe maximum, and then only for three or four hours for healthy men; with less pressure the period of labor may be lengthened, but on coming out to the open air the depressing effect of a lowered pressure must be counteracted by a strong stimulant like coffee, to prevent injurious consequences; and for reasons of safety the compressed air is taken from a receiver and not direct from the compressor. So that an accident to the machinery might not have an immediately disastrous effect by permitting an inrush of water before the men could escape.

The supply shafts marked are only used at the last, where concrete is passed in through them, to fill up the working chamber. The shafts themselves are also all filled with concrete, and the whole structure is a solid mass of timber, concrete and stone. Sinking foundations by compressed air has many advantages—the sinking can usually be quite accurately directed; it enables all the pier construction and excavation to proceed together; it enables all kinds of materials to be removed, and it permits of a careful examination and preparation of the bottom before concrete is put into place.

An example of such construction is detailed in Patton's "Foundations," at a cost of

$16.82	per cubic yard for the	caisson material;
$10.76	" "	crib "
$7.83	" "	sinking "

making an average of about $20 per cubic yard. This was for a depth of 68 feet below water and in 56 feet of mud—evidently the cost would vary with the depth and the materials encountered, in this case the sinking was at the rate of 1½ to 2 vertical feet per day.

Open Dredging.—This method has been long practiced in India, where circular brick wells are built with heavy walls, and gradually lowered through soft soils by excavating and undermining, the material being raised in some primitive manner. This is improved upon now by using steel cylinders and excavating by clam-shell or other dredges. There is usually difficulty in controlling the direction of movement, and large logs and boulders are troublesome. So that open dredging is usually used only where the depth is too great to admit of using compressed air and where the materials can be freely dredged (in India, submarine blasting of boulders, etc., tended to crack the cast iron cylinders, but would, probably, not have a bad effect on timber cribs). A striking example of this process is that of the foundations for the Poughkeepsie bridge, which were sunk through a depth of 50 to 60 feet of water and 75 to 80 feet of mud, clay, sand and gravel, or a total distance of 140 feet below high water. (See Fig. 75.) The cribs, 100 feet by 60 feet, had 31 gravel pockets, extending from top to bottom, which afforded enough load to sink the cribs when undermined; there were 14 dredging wells extending from top to bottom 10 feet by 12 feet, in cross section, through which the dredging was done by a clam-shell dredge. The walls were 2 feet thick of solid timbers, laid in alternate lapping courses, well drift-bolted together, and after the cribs arrived at good bottom the wells and pockets were filled with concrete, and a floating caisson similar to Fig. 69 was brought out into position and built into until it sank on to the top of the crib. The chief difficulties in carrying out this process, aside from anchoring such a huge mass of timber in a swift current, preparatory to dredging, are that it is difficult to guide the crib in direction as it settles down, and that logs, boulders, etc., under the cutting edges, cause delay and necessitate, often, sending down divers. A combination of compressed air and open dredging has been used in Europe, in which several working chambers surround an open well, the men force the material out under the inner edges of the working chambers from which it is removed by a clam-shell dredge; the process is cheaper in handling the material, but uses an enormous quantity of compressed air.

(To be continued.)

For The Canadian Engineer.

DISPOSAL OF TOWNS' REFUSE.

BY W. M. WATSON.

(Concluded from last issue.)

Lately the scientific journals of the United States have been reporting a process of garbage disposal invented by a person named Harris. I visited his experimenting room and examined the garbage gas manufacturing machine, consisting of an extra large wood burning box stove, covered by two iron tubes, which acted as retorts for carbonizing the garbage, with another tube on top of the two, which answered for a superheater or reburner of the gas after leaving the retorts. I saw four lights of gas burning, stated to be from the gas manufactured from the garbage in the retorts, but after reading the description published on page 170 of the October issue of The Canadian Engineer, I feel almost certain that the gas I saw burning was made from the coal oil, and, probably, chemicals that were mixed with the garbage when charging the retorts. I do not believe that Mr. Harris has found a chemical that can work what should be called a miracle, supposing that the reports should be true. A fuel gas can be made from vegetable or woody garbage that would add a great quantity of heat to a fire composed of wood or coal fuel, but would make a poor show if depended on to give heat or light alone. But even this kind of gas can scarcely be made with the little heat that can be generated with the experimental box stove, and I base my opinions on a two years' experience in the manufacturing of illuminating gas from sawdust, and the lessons I received, teaching me how to make water gas, and when I have explained the two methods, my readers will be able to judge the soundness of my views.

If ten pounds of melon skins and potato peelings be properly dried until all the moisture is extracted, it will be found that the vegetable substance left will weigh under 3½ pounds, proving that there was 6½ pounds of water in them, so that there is 3½ pounds of vegetable that can be made into fuel gas by a heat at a temperature of about 2,000° F., and 6½ pounds of water that can be made into a good heating gas, by first converting the moisture or water into a high pressure steam, then passing the steam through red-hot pipes which super-heats it, making the steam gaseous, then discharging it on to a fire heated to a temperature of about 3,000° F., in fine small jets, it is then turned into large volumes of gas, and by allowing drops of coal oil to drop on to the fierce fire along with the fine sprays of gaseous superheated high pressure steam, a passable illuminating gas is made at about the third of the price Harris declares he can make gas from garbage. In making gas from sawdust, we carbonized sawdust that was first dried well upon hot plates; if we needed illuminating gas we carbonized pine wood sawdust containing plenty of resin, which was probably the substance that gave out most of the gas needed. If we were well stocked with gas, we then carbonized dried hardwood sawdust that made large quantities of valuable acids; but we could not use wet sawdust to advantage, no more can Mr. Harris use wet garbage to make gas, for the two materials have a similarity. If we used sawdust in an undried state it condensed watery acids and threw off a