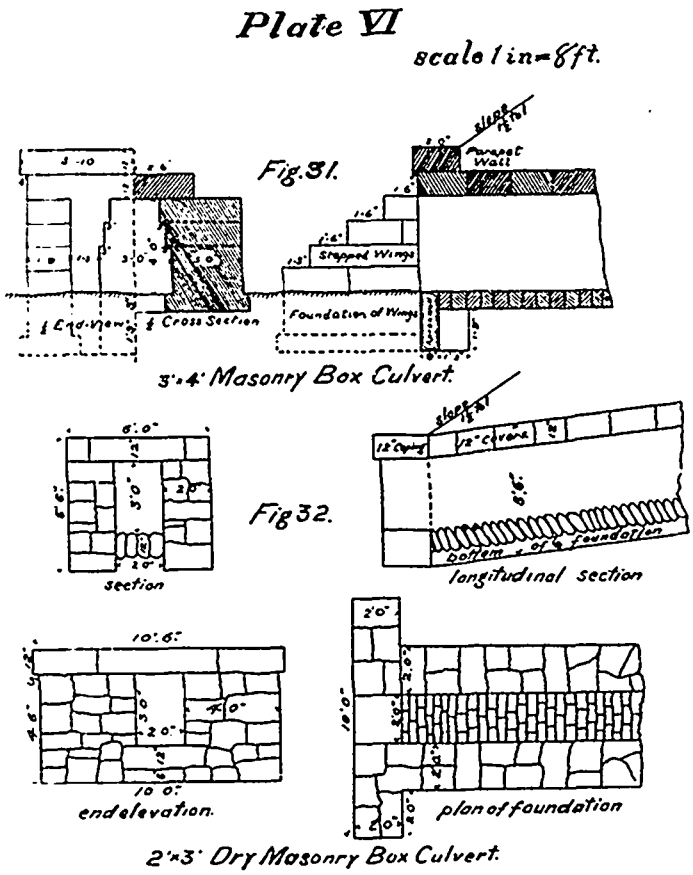
area of bed, nor less than eight inches thick, and must be hammer-dressed so as to give good beds with half-inch joints or less. Headers shall be built in the wall from front to back, alternately, at least one in every five feet of wall and frequently in the rise of the wall. The least width of bed for stretchers shall be twelve inches. In larger structures, all stones must be heavier in proportion, every attention must be paid to produce good bond, and to give the whole a strong, neat, workmanlike finish. All dimensions must be according to plans, but these may be varied if the engineer so requires."

"The paving shall be of stone set on edge, twelve inches deep, packed solid, of an even face, and inclined in direction of the stream."

"The mortar shall consist of one part good quality Portland cement to three parts of clean sharp sand, and all joints, beds and interstices shall be carefully filled with mortar and packed solid—the exterior faces and interior of barrel shall have all joints raked and pointed with mortar, consisting of one part cement to one part sand."



Cost of Box Culverts.—Taking timber in place, including iron and foundations at $25 per M.B.M., culvert masonry at $6 per cubic yard, and paving at $3 per cubic yard, including foundations The cost of box culverts according to figures (28) timber, and (29) masonry, are given in table XIV.

TABLE XIV.

APPROXIMATE COST OF BOX CULVERTS (16 FOOT EMBANKMENTS)

Structure.	Waterway.	Total cost for depth of top of paving below subgrade. 10 ft.	20 ft.	30 ft.	40 ft.	50 ft.	60 ft.
		$	$	$	$	$	$
Timber Box..... Fig. 28.	2' x 3' high	183	306	429	552	675	798
"	3' x 3' "	213	356	500	643	787	931
"	3' x 4' "	234	397	560	723	886	1,049
"	4' x 4' "	263	446	629	812	995	1,178
"	4' x 5' "	281	483	686	888	1,091	1,294
Stone Box ..... Fig. 29.	2' x 3' "	254	420	587	754	920	1,086
"	3' x 3' "	267	444	620	797	974	1,151
"	3' x 4' "	364	607	851	1,094	1,338	1,582
"	4' x 4' "	385	645	905	1,165	1,425	1,685
"	4' x 5' "	501	848	1,195	1,542	1,889	2,236

From which table it is evident that the stone culverts increase in cost much more rapidly than the timber ones, owing to the necessary increase in the thickness of the stone walls, being estimated at 2 feet, 2½ feet and 3 feet thick for culverts 3 feet, 4 feet and 5 feet high (in the clear) respectively. It does not pay, evidently, to build small timber culverts, other things being equal.

For THE CANADIAN ENGINEER.

THE DISPOSAL OF TOWNS' REFUSE.

BY W. M. WATSON, TORONTO.

An efficient refuse destructor is a desirable adjunct to the sanitary equipment of towns, and it is cheering to observe that the science of designing and the methods of constructing refuse furnaces has lately made rapid improvements, with the result that any kind of towns' refuse, including excrement, can be quickly and thoroughly burnt without the assistance of fuel. However foul and loathsome the material that is consumed may be, the fumes and smoke will be totally burnt up, instead of being discharged into the atmosphere, which was formerly the rule. A large amount of heat at a temperature of about 2,000° F. is created, which may be used to raise steam for generating electricity for pumping sewage, grinding mortar, crushing stone and clinkers, or any other useful or profitable purpose. Thus ensuring a saving of public health and money.

Some years since Professor Kennedy jokingly asked "How much steam could be raised from a pound of muck," meaning wet filthy refuse, street sweepings, excrements, etc. Geo. Watson, engineer, Leeds, England, and many others have during the past ten years clearly demonstrated that a furnace can be built that will raise one pound of steam for every pound of refuse destroyed, and maintain pressure of 140 pounds.

By studying the laws of creation we find that everything must be active to be useful, and that when activity ceases vitality ceases also, and whether the substance be a living body, or a volume of water, air or gas, when activity stops it becomes offensive and useless. Moreover, every thing created, however mean, small, or repulsive it may appear to us, is for some specific purpose. This is just what is done by gathering up the rejected refuse and filth of towns, and handling them in such a way that the poisonous gases they generate are destroyed and the unhealthy material turned to profitable account.

There are several kinds of refuse. In many towns there are privy pits, or the pail system of water closets, the contents of which have to be disposed of. The scrapings of macadamized roads are suitable only to mix with earth on productive land. Broken glass and crockery can be crushed small and used in place of marble or granite chips for mixing with concrete or asphalt work. Old tin after passing through the fire and the solder has been melted off, can be sold to manufacturing chemists or iron works along with the scrap iron picked out. The brass, copper, lead, and other valuable metals can find a ready and profitable market. Old paper and cotton rags can be easily made into common brown paper by erecting a small mill adjoining the destructor plant, as in Chelsea, Eng., without creating a nuisance, or jeopardizing the public health. The woolen rags may be steamed and afterwards