ordinary temperatures and must have a moderate degree of resilience.

"As a test it is specified that 3 lengths of 8 in. pipe joined in this way and resting on supports 7 ft. apart shall carry a centre load of 200 lbs. without failure or excessive deflection, and that after such tests the joints shall show no leakage when subjected to a hydrostatic pressure of 5 lbs. per sq. in.

"Asphaltic joints have been used to a considerable extent in England and Germany, and the writer has long believed that a field would open for them in this country under conditions where cement work would be injured by washing or, later, by cracking.

"With larger sewers it is desirable to employ concrete in preference to brick if watertight work is desired. There is no question but that reasonably tight work can be secured by using correct proportions and a wet mixture, but additional safety may be had by the use of waterproofing compounds by the judicious admixture of lime or clay to the concrete or by the application of a layer of waterproofing material. The writer believes that the latter safeguards are rarely required in sewer work when good work can be relied on by contractor and inspector.

"In the construction of the west low level interceptor at Baltimore, waterproofing was applied to the interior surface of the concrete and a brick ring added inside to protect this. The diameter on sections 1 and 2, which lay along the waterfront with the invert from about 11 to 13 ft. below tide level, were from 74 to 84 ins. The invert was first swabbed with hot Trinidad asphalt upon which was placed a layer of 10 oz. burlap. This was then rubbed down and painted with hot asphalt, a second layer of burlap applied and this was then brushed down and saturated with a third coat of asphalt. The brick ring was then laid complete and the waterproofing carried over the brick arch. The concrete arch was finally laid on this.

"Some difficulty was experienced at first from the water which dripped on the tops of the side walls and found its way between the waterproofing and concrete of the invert, forming blisters 1 or 2 ins. in diameter. Where this occurred the blisters were pierced, emptied and patched. To prevent its recurrence channels were left in the tops of the side walls to cut the flow from outside and the lap of the burlap rolled up and covered with canvas to keep it as dry as possible.

"In forming the joint with the waterproofing of the arch the layers were lapped in pairs and an additional strip of burlap added outside, making the waterproofing at this most troublesome location 5-ply.

"To drain the channels left in the side walls 3 in. terra cotta drains were inserted, occasionally running down through the side walls to a quarter bend and thence to the gravel near the under drain.

"If the burlap got wet, as was sometimes inevitable, it was dried with a gasoline torch, although in extreme cases this was not practicable. To dry the invert before waterproofing, if too damp, gasoline was sprinkled on and lighted, but in sparing quantity to avoid injury to the concrete. At other times it was merely sprinkled with dry cement, which absorbed the moisture and was then brushed off.

"Estimates of the actual cost were made from time to time with the following results:—

	Per lin. ft.
Cost of waterproofing 84-in. sewer	$1.60
Cost of waterproofing 80-in. sewer	1.53
Cost of waterproofing 76-in. sewer	1.45
Cost of waterproofing 74-in. sewer	1.41

Cost per square yard:

Burlap at 6.9 cents per square yard	0.17
Asphalt at 25 cents per gallon	0.48
Labor	0.18
Total	$0.83

"The force employed usually consisted of a foreman, two laborers and two helpers.

"On section 3 the cost was reduced by the substitution of tar pitch for asphalt. Difficulty was experienced in securing a material that would neither be too soft at high temperature nor brittle at low temperature, but in other respects the results appeared satisfactory. The tar pitch cost $8 per 1,000 lbs., resulting in the cost for this material of but 15 cents per square yard of waterproofing.

"After the completion of the 3,590 lin. ft. of interceptor, about 100 ft. of which passed under the bed of a tidal stream, the leakage, including that from over 2,700 ft. of house connections and a considerable inflow around a bulkhead at the upper end of section 2, amounted to 11.16 gals. per min., or 0.223 gals. per sq. ft. of interior surface of interceptor (only) per day. The actual infiltration through the interceptor was practically nothing, as the water observed entered chiefly around the bulkhead mentioned, through the laterals or at the junctions with the interceptor. Probably 1/10 gal. of ground water per sq. ft. per day would be a liberal estimate in estimating on similar work. Considering the relative elevation of the ground water and the great difficulty in keeping the burlap at the spring-line dry while turning the brick arch, the final result was most satisfactory."

DRAFTING OF FORMS EFFECTS BIG SAVING EVEN ON SMALL, PLAIN JOB.

It is generally recognized that one of the prime reasons for the comparatively high first cost of reinforced concrete buildings is the cost of the material and labor put in the forms. Therefore continued efforts to reduce this item to a minimum are being made by many construction companies. A recent case of the Aberthaw Construction Company, of Boston, is illustrative of the possibilities of saving even on small jobs by designing the forms in the drafting room instead of putting the fitting up to the carpenter shop.

The job in question was a small structure costing about $26,000, and 50 ft. x 50 ft., four stories high. The design was of the beam and girder type, and was made as regular as possible in order to keep the cost down. In spite of this 115 different kinds of forms were required, making a total of about 500 forms in all, taking about 10,000 sq. ft. of stock. When it is considered that figures do not include any of the ledges, studs, or anything but the beam and column sides, it will be appreciated that 113 different kinds of forms is a large number for a plain, small job.

According to the company's former methods the carpenters not only made the beam sides but fitted them as they went along, and each one had to be sawed out. A large saving is therefore made by designing the forms for this small job in the drafting room, as the cost of drafting is very much less than the cost of making up the beams and fitting. It is very probable that the failure of new concrete contracting companies is often due to their ignorance of economical methods of handling form work, and the case above is an excellent illustration of how they might go astray on their estimate by not realizing the high cost of the many forms on such a small plain job.