WELDED STEEL PIPES.

During recent years welded pipes have come into general use for pipe lines in water-power plant to the exclusion of riveted pipes in cases where the latter cannot be constructed of sufficient strength to resist the high pressures employed, and welded mains, of large diameter, 2 ft. to 8 ft. and over for gas and sewage are rapidly taking the place of cast-iron mains. The chief reason for this change in engineering practice is the mechanical superiority of the welded pipe, coupled with its cheaper cost of production.

In a recent issue of the Engineering Supplement to the London "Times" the advantages of welded steel pipes and their manufacture are noted.

The tough steel of which these pipes are constructed gives greater tensile strength and ductility, conferring greater resistive power to internal and external pressures and reducing the chances of fracture to a minimum. Pipe sections can be made of any desired dimensions, and thus there are fewer joints, the risks of leakage are lessened, and the costs of laying are reduced. More secure joints can be made, giving greater elasticity. Manufacturing costs decrease with increase of pipe diameters, while the finished pipe is lighter than the hard and brittle cast-iron rigid-jointed pipes, which increase in price and weight with diameter.

The development of the welded steel pipe industry starts from the successful application of water-gas heating to plates and the improvement of welding machinery and other appliances. Previously, cast-iron pipes were in general use, though riveted pipes were adopted in the case of heavier pressures. Later lock-bar pipes followed. Riveted pipes with long seams have the inherent disadvantage of liability to start leaks in course of transport and handling, while their weight is increased by overlaps and rivets, which also increase their tendency to succumb to the corrosive action of air, water, and soil. Again, it is impossible to nest the pipes for long-distance transport except when the diameters are widely different. The joints are difficult to make, and the strength of a double-riveted seam is never more than 75 per cent. of that of the plate, which means that a thicker plate is necessary to ensure the required strength. Lock-bars entail increase of weight in addition to the disadvantages of long seams. When shipped the pipes cannot be adequately tarred and asphalted to prevent corrosion, and special machinery is needed for assembling the sections.

Welded pipes, being smooth and uniform in surface and without seams, are free from these disadvantages. The plate is the only additional weight, and the pipes can be completely finished at the works with adequate protection against possible corrosive influences. With relatively small differences of diameter they can be conveniently nested for shipment, and joints can be easily made by rolling the ends into sockets and flanges. It may be argued that cast-iron pipes are less susceptible to rust or corrosion. This is not so actually; though by reason of the thicker material used in their construction they resist corrosion for a longer period. Steel pipes are much less susceptible to electrolysis. Moreover, it is a cardinal principle in the manufacturing processes of welded steel pipes likely to be exposed to air, moisture, or soil that they are treated with a protective coating specially designed to resist corrosive influence.

The frequent bursting of water, gas, and drainage mains, entailing damage to property, danger to human life, and pollution to the surrounding soil, has decided the Berlin municipality to adopt welded steel pipes in place of cast-iron pipes. In cases where such mains are subjected to extraordinary strains, where, through subsidences due to undermining by coal working, &c., they are continually bursting and developing new leaks, or where heavy traffic is constant and increasing, welded pipes, by their srength and ductility offer a means of constructing mains capable of withstanding the severe strains encountered, since they have an elongation value of at least 30 per cent. They will buckle without fracturing, and only breaking of the joint can cause leakage. The tensile strength of the weld is at least 90 per cent. of the strength of the pipe material.

Modern hydraulic engineering, utilizing falls of several thousand feet, requires pipes of at least 1¼ in. thickness, but whether the pressure is very high or relatively low, welded steel pipes offer such advantages of strength, tightness, and convenient jointing that their claims to employment have been recognized in all cases other than those where very light pressures permit the use of thin plates with the cheaper kinds of single-riveted cast-iron pipes. The European demand for large welded steel gas, water, steam, and drainage mains, water-power conduits, digesters, boilers, tanks, shipmasts, &c., exceeds 120,000 tons annually, and a larger demand is yet to come. Despite the duty of 45 per cent., large quantities have been imported into the United States during the past three years.

Being a relatively new industry the manufacture of welded-steel pipes is at present just outside the range of general engineering concerns, and is practically in the hands of a select band of specialists, who manufacture but do not design new works. A German firm leads the way in practical manufacturing experience in this class of pipe, while a Swedish firm established in London and Toronto has largely pioneered the use of these pipes in the United Kingdom wherein at the moment no fully-equipped concern exists for the purpose of manufacture.

The plant required includes a welding machine with gas fires, for diameters ranging from 24 in. to 96 in., able to weld lengths of 30 ft. from one end without turning the pipe end for end. For hand welding, necessary in cases of irregular shaped objects such as pipe fittings and branches, ends, tanks, and receivers, special portable hand fires are needed. Specially adapted machine tools, charging machinery, gas fires for flanging and socketing pipe ends, asphalting and anti-corrosion plant, &c., are also necessary.

Assuming plate at $30 per ton, lock-bars at $30 per ton and rivets at $45 per ton, the actual costs of producing a pipe 20 ft. by 3 ft. in diameter made of ½-in. plate will be:

Welded-steel pipe—

Finished pipe, 3,980 lb., at $28.80 per ton	$51.16
Weld-waste of plate, 15 lb., at $28.80 per ton	.19
Cost of 20 ft. weld at 8c. per ft.	1.60
Total cost of production	$52.95

Riveted pipe—

Weight of plate in plain pipe, 3,980 lb., at $28.80 per ton	$51.16
Weight of 20 ft. double riveted longitudinal seam, rivets, and overlap, 204 lb., at $28.80, and at $43.20 per ton	3.06
Total cost of materials	$54.22

Ferguson lock-bar pipe—

Weight of plate 3,940 lb., at $28.80 per ton	$50.66
480 lb. of lock-bars at $28.80 per ton	6.14
Total cost of materials	$56.70

It will be noted from these comparative figures that the total cost of production of welded-steel pipes is less than the cost of material for other types, and it should be understood that in the cases of larger diameters requiring several plates there are even greater differences in their favor. As