20 ft. For the sake of facility in handling, however, the sections composing a line of pipe in a mine are usually not over 16 ft. in length.

Ordinary pipes, either lap or butt-welded, having screwed ends for connection by threaded flanges or couplings, are classified by manufacturers according to nominal inside diameter. The actual diameter is generally in excess of nominal diameter. Lap-welded tubes connected by other means than the regular coarser pipe threads, that is, by flanges shrunk or riveted on, or by leaded joints, or finely threaded sleeves or flanges, are known according to their exact outside diameter. Such pipe is generally called tubing; when connected by fine thread, it is known as casing.

The different sizes of lap-welded tubing can each be obtained of different thickness of material to suit different pressures. The following table of standard sizes and thickness may prove useful for reference:

TABLE I.

*Diamensions, etc., of Lap-Welded Tubes of a Prominent Manufacturer.*

| Outside Diameter of Pipe, in inches. | Inside Diameter of Pipe in inches. | Thickness of Metal. | | Weight per Foot, in pounds. | Bursting Pressure, lbs. per sq. inch. |
|---|---|---|---|---|---|
| | | Birmingham Wire Gauge. | Inches. | | |
| 3 | 2.73 | 10 | .135 | 4.05 | 5,900 |
| 4 | 3.70 | 9 | .150 | 6.00 | 4,800 |
| 5 | 4.67 | 8 | .165 | 8.40 | 4,200 |
| 6 | 5.64 | 7 | .180 | 11.00 | 3,800 |
| 7 | 6 64 | 7 | .180 | 13 00 | 3,200 |
| 8 | 7⅝ | .. | 3-16 | 15.65 | 2,900 |
| 9 | 8½ | .. | ¼ | 23.10 | 3,500 |
| 10 | 9½ | .. | ¼ | 25.75 | 3,100 |
| 12 | 11½ | . | ¼ | 31 00 | 2,600 |
| 13 | 12½ | . | ¼ | 33.40 | 2,400 |
| 14 | 13½ | .. | ¼ | 36 35 | 2,220 |
| 15 | 14½ | .. | ¼ | 39 00 | 2,070 |
| 16 | 15½ | .. | ¼ | 42 00 | 1,930 |
| 18 | 17¾ | .. | 5-16 | 58.40 | 2,150 |
| 20 | 19¾ | .. | 5-16 | 65.15 | 1,970 |
| 22 | 21¾ | .. | 5-16 | 85 00 | 1,750 |
| 24 | 23¼ | .. | ⅜ | 93.50 | 1,930 |

The thickness given in the table is known as standard. Pipe can be made one or two gauges lighter, but would not come any cheaper per foot. On special orders, the pipe can be made thicker to almost any extent. Numerous experiments have demonstrated that in properly welded pipes the weld is practically as strong as the rest of the metal.

*Heavy Riveted Pipes* used for pump-columns should, if possible, be made of mild steel, because then they can usually be made from a single sheet, requiring only one longitudinal joint. Steel admits of this method of construction, because, it has about the same restngth across the sheet as lengthwise. Iron, being fibrous in its nature, and having less strength across the sheet, should therefore be bent so that the fiber runs around the pipe, in order to secure the greatest strength. As the sheets are limited in width, this necessitates making a wrought iron riveted pipe section of several sheets riveted together by circular seams. Longitudinal seams should be double riveted.

Heavy riveted column pipe sections are usually connected by cast or wrought-iron flanges riveted to the sections. Where laid on the ground and not liable to be disturbed, they are often connected by lead-caulked joints, with cast or wrought iron rings to hold the lead.

Riveted sinking-columns, inside of which a pumprod works as in the Cornish system, should have the rivets countersunk on the inside, and the circular seams made as butt-joints with outside lap-strips, so that the lift-pump bucket can be drawn up and lowered through the column-pipe without catching on obstructions.

*Light Riveted Pipes** are used principally for water supply for power or for hydraulic mining where the pressure is constant and where the pipe is not subject to being crowded out of line, as in a shaft. The sheets, rarely thicker than ⅛ in., are riveted up cold, often, on account of transportation, at the point where put in use. They are now almost universally made of steel. If made of iron, the sheets must, for reasons previously stated, be bent in the direction of the fiber. The longitudinal seams should be double-riveted. The lengths of pipe, except for very heavy pressure (when both internal and external sleeves caulked with lead are used), are generally joined by simply slipping the ends into each other like the sections of a stovepipe. The sections are made larger at one end for this purpose. These pipes will stand considerable pressure when it is constant, but they are not suitable for withstanding any water-ram. Iron pipes of this kind have been subjected continuously for many years to a constant fiber-stress of 17,000 lbs. per square inch on the section of the sheet. At the line of the rivets, where their insertion reduces the iron section of the sheets, the stress would in that case be about 22,000 lbs.

*Wooden Pipes*, made of staves like a continuous barrel, hooped with steel bands, as in Fig. 1, have been in use for a number of years in connection with irrigation and gravity water supplies for cities. They are economical, especially for light pressures, and may be used for pressurers of 200 ft., if steady, the spacing of the bands varying with the pressure. They are very smooth on the inside, and offer little resistance to the flow of water. They are not suitable for pump-columns, but there are cases in mining where this class of pipe can be used to advantage. The water does not come in contact with the steel bands, and cannot corrode them; and if the pipe is continuously filled with water, the wood will at all times be saturated and cannot decay. Where a pipe-line is required in a mountainous country, difficult of access, it is an advantage that the parts of which this pipe is composed are all light, can be closely packed, and easily transported. The entire pipe-line can be taken down without any injury to its parts, and be re-erected elsewhere.

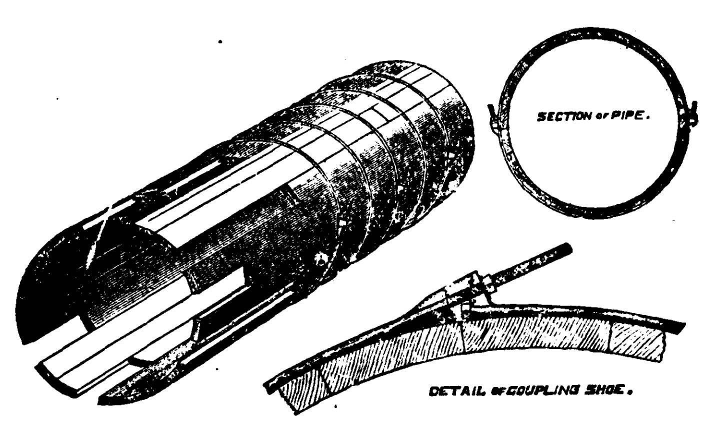

FIG. 1.

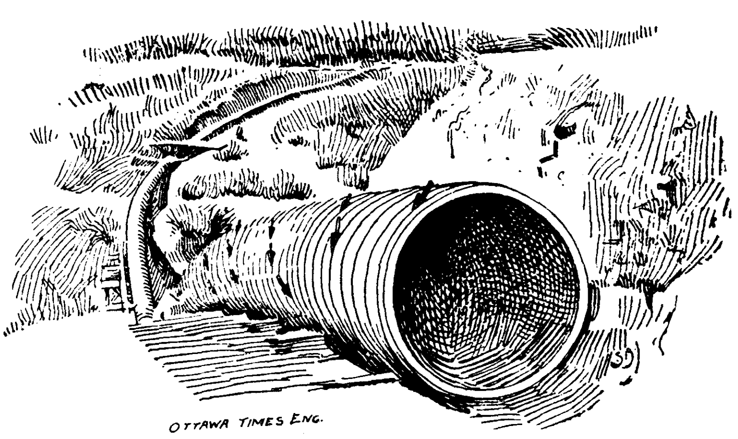

FIG. 2.

* This class of pipe has been ably discussed by Hamilton Smith in his "Hydraulics," and also by Aug. J. Bowie in his "Practical Treatise on Hydraulic Mining." Numerous examples of (completed) pipe-lines, with experiments on flow, leakage, and stress on material, are given in those two works.