strands, each made with seven wires.

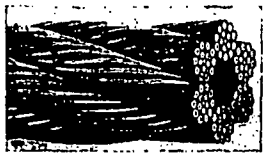
There are many other constructions of wire rope besides the ones shown, also several different constructions that fall under each of the standard classifications. For example, 6-strand ropes with 16 to 25 wires in each strand fall under the 6x19 classification. Three such ropes are shown on the bottom row, Fig. 8. The first one actually has 19 wires per strand while the other two have 21 and 25 wires respectively. Likewise, 6-strand ropes with 26 to 46 wires in each strand fall under the 6x37 classification, but only one of these is shown. Each construction is suited to a particular field, and for best economy by using the correct construction for a given job.

Fabricated of a few relatively large-diameter wires, the 6x7 rope has better resistance to corrosion than the more flexible ones. It is suitable for services where abrasion is severe but where bending is a minor consideration, as on some slopes and mine haulages, for traction ropes on tramways and for guys where corrosion may present a serious problem.

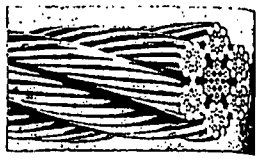
In 6x19 ropes, wires are of a size that have about equal resistance to abrasion and bending fatigue. The coarser 6x19 ropes are used on inclines and on scrapers and draglines where they are subject to considerable scrubbing along the ground, and for oil-well drilling. The intermediate 6x19 constructions serve for freight and passenger elevators, on mine-shaft hoists, on car dumpers and skip hoist. The more flexible are for general hoisting purposes, as on derricks, cranes and shovels.

Freight, Passenger Elevators. Because of its greater number of strands of slightly smaller diameter, 8x19 rope is more flexible than 6x19. But it has less metallic area and a slightly larger center core, and so does not have the strength and resistance to crushing and distortion that a 6x19 has. For these reasons the 8x19 constructions have fewer applications in industry, outside of some skip hoists and overhead traveling cranes. It is used extensively on freight and passenger elevators where its greater flexibility is an advantage under the fairly easy operating conditions.

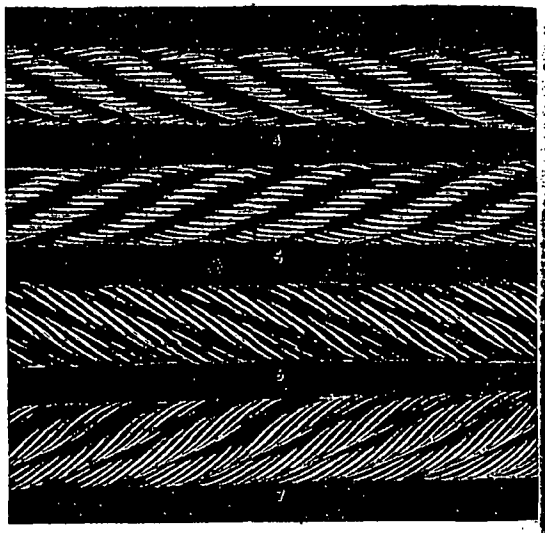
Of the 6-strand ropes the 6x37 is the most flexible, and so is adapted to small sheaves and drums, and where abrasion and corrosion are a minor factor. Therefore it is not often used outdoors unless rope size is fairly large. It is almost universally selected for overhead traveling cranes and, in the larger sizes, for dredges, stripping shovels and draglines in coal fields.



2 Wire rope may have 6 or 8 strands around a fiber core as in this 6x21



3 A wire-rope core increases rope's crushing resistance and strength



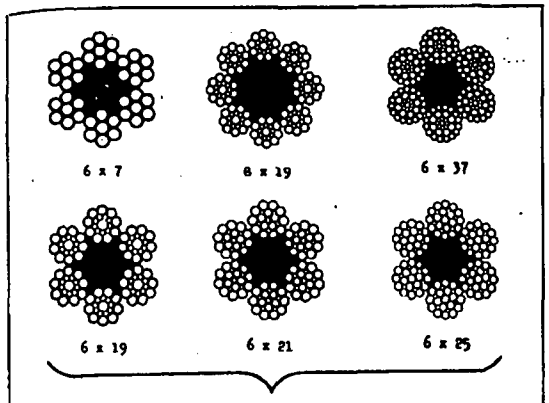
4-7 These four different rope lays are in common use: 4, regular lay, right lay; 5, regular lay, left lay; 6, lang lay, right lay; 7, lang lay, left lay

The 6x7, 6x19 and 6x37 ropes are often fabricated in the lang-lay construction. In the regular lay, Fig. 4 and 5, the wires are laid opposite to the direction the strands lie in the rope. As a result, individual wires on the rope's outside are nearly parallel to its axis. In the lang lay construction, Fig. 6 and 7, wires and strands lie in the same direction, which gives the wires a considerable angle with the rope's axis. Lang-lay rope has the same strength as regular lay but has the advantage of being slightly more flexible for the same size and strand construction. Also, lang-lay has greater resistance to abrasion than regular-lay. It is used for hoist and dragline ropes on excavating equipment, scraper wagons, carryalls, and other similar equipment.

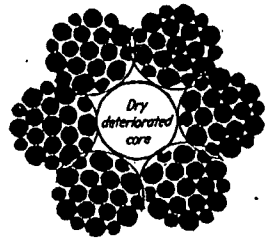
Independent Wire-Rope Cores. Any of the standard constructions are supplied with either a fiber or an independent wire-rope core. The all-metallic construction, however, is generally used in 6-strand ropes because conditions requiring its use can seldom be met satisfactorily with the 8x19 constructions. An independent wire-rope core adds about 7.5% to the rope's strength and reduces its stretch. On some applications increased strength and low stretch may justify using this class of rope but usually it serves where a firmer support for the strands is desirable.

Deteriorated Fiber Cores. It is advantageous to use rope with an independent wire-rope core where temperatures are high enough to char or burn a fiber core. The rope core in Fig. 9 has deteriorated in this manner and its cross section clearly shows how its diameter was reduced and how the core allowed the strands to pull toward the center and toward each other (overlap). But since overlapping could not occur, destructive nicking developed at the points of strand contact. This has reduced the rope's strength and its useful life.

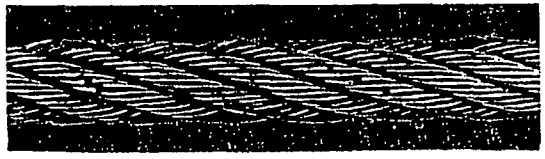
The same action occurs if a rope with fiber core is used where the pressures are high enough to cause the strands to crush the core. High pressures occur with heavy loads and where the rope operates over sheaves and drums of relatively small diameter. These conditions prevail on most shovels, cranes and draglines, and so on excavating equipment, ropes generally have an independent wire-rope core. These applications form one of the largest uses for this type of rope.



8 Here are the four classifications into which the commonly used wire ropes can be grouped: they are 6x7, 6x19, 8x19 and 6x37 constructions. All are shown of the same size to indicate the relative size of the wires which give various degrees of flexibility to the different constructions



9 This cross section shows that the fiber core has deteriorated because of the high temperature and thus has permitted the strands to bite into each other



10 When the wires in a nonpreformed wire rope break, their ends generally rise above the surface of the strand so that their locations are easily detected



11 Broken-wire ends in preformed rope generally remain closely in place in the strands but with some care these breaks are easily seen during inspections

Preformed Constructions. Because a preformed wire rope is made of the same material as the standard or nonpreformed, it can be supplied in any size, grade and construction, and in either regular or lang lay. It is made in the same way as non-preformed rope, except that during the final operation the wires and strands are formed to the spiral shapes they assume in the finished rope. Because of this difference the strands do not have a tendency to unlay when the rope is cut. This inert characteristic makes a preformed rope readily distinguishable from a standard or nonpreformed type.

This characteristic also makes preformed rope less susceptible to some forms of abuse and less likely to be damaged during installation. Because preformed rope is a little more flexible than nonpreformed of the same size and construction, it gives better service where bending and fatiguing conditions are severe.

Broken Wires. Another difference between the two types is that broken wires are not so easily detected in the preformed construction as in nonpreformed. Because the strands and wires are shaped to their spiral forms, ends of broken wires remain in their original positions and do not spring up from the surface as on nonpreformed ropes.

Fig. 10 shows how broken wires generally appear in a nonpreformed rope. The difference between these and the breaks in preformed rope is apparent, Fig. 11. Therefore it is generally a little more difficult to inspect a preformed rope for broken wires, but if proper care is taken these breaks can be seen easily.