the tighter. Another reason is that it prevents the belt from cracking.

A tight belt should always be avoided. You may increase the power of the belt, but make sure if you tighten it too much, the constant strain will soon break it. If your belt is not powerful enough, it is far better to put on a wider one, and use the other for something else. A belt should not run faster than 30 feet per second, nor have tension of more than 300 lbs. per square inch of sections, and the machinery should be so planned that belts will not have to run in a vertical line; the direction of the belt should be from the top of the driver to the top of the driven.

In fastening belts on pulleys, there are several good ideas that I have seen in the way of hooks, staples, etc. I still use the old-fashioned plan of lacing, but no matter how you fasten a belt, you must do it so that it will run round the smallest pulley without jumping. I might say, that in lacing, you should lace from the centre, make the holes oval, and tie the knot in the centre and on the outside of the belt. For myself, I would never have a laced belt if I could so arrange it as to have an endless one, especially if it has to do very heavy work. I always consider that a laced joint is a great weakness, and I know it is a source of anxiety, for one never can tell when it will give out unless the practice is followed of looking at it daily. Some firms have an idea that they have saved a few dollars by getting a belt without a lap joint to make it endless; but the engineer does not think so. These hints that I have given on fastening belts, are for those engineers who are unfortunate enough to have to lace or fasten them.

Perhaps some of my engineer friends would like to make a lap joint when that irresistible desire to be working at something seizes them, so I propose to tell you how to go about it. In the first place, plane the two ends down level, until the lapped joint is the same thickness as the belt; scrape off all the uneven places left by planing until you have a level surface for joining; get some good cement and spread it quickly over the two ends; put the ends together and clamp them between two warm plates of stiff iron; if you have no clamps, put them in the vice, and in about an hour the belt will be ready for work. From the works of M. Powis Bale, I copied the following table of the different laps required for various sized belts:—

Width of belt in inches..	1"	2"	3"	3" to 6"	6" to 8"	Above 8"
Amount of lap in inches..	3"	4½"	5½"	6"	8"	10"

In most cases after a belt has been at work a short time, it stretches out considerably and begins to slip. Anybody could say that it wants tightening or drawing up, but just how to do it, and do it right, is the problem. To those engineers who make a practice of throwing the belt off and tightening it, then forcing it on again by hand, I would say, don't do it again, for you surely make one side longer than the other, and a loss of power is the result. Always shorten a belt when it is in its place with stretchers. They can be hired or borrowed from any belt shop, and if not, then make a stretcher of your own. Another question is: how much may it be taken up without injury to the belt? From the above mentioned work I give the following rule: When putting on a new belt, draw it up one inch for every five feet of its length, and in taking it up for the first time draw it up one inch for every 10 feet of its length; for the second time, one inch to every 20 feet, and so on.

An engineer may look at his driving belt, and wonder to himself what power his belt is developing or would develop under favorable circumstances. The following rule taken from the *Practical American*, says for leather belts, the product of the speed of a belt in feet per minute with its width in inches, is equal to 500 times the horse power transmitted. From these rules we may calculate: 1st, the horse power which a belt of given width and velocity can transmit; 2nd, the velocity with which a given belt has to be run to produce a given horse power; and 3rd, the width necessary for a belt to transmit a given horse power with the speed it is running the pulleys.

First Rule.—Multiply the speed of the belt in feet per minute with its width in inches, and divide by 500; the result will be the horse power. Example—suppose a belt is running with a velocity of 2,500 feet per minute with a 16 inch wide belt, what horse power will it develop?—$2,500 \times 16 \div 500 = 80$ horse power.

Second Rule.—Multiply the horse power by 500, and divide by the width of belt in inches; the result will be the velocity in feet necessary to transmit the power. Example—suppose you require 100 horse power with a 20 inch belt, what must the velocity be at which it must run?—$100 \times 500 \div 20 = 2,500$ feet per minute.

Third Rule.—Multiply the horse power by 500, and divide the product by the velocity of the belt in feet; the result will be the width in inches required to transmit the power without slipping. Example—what must be the width of a belt for a 150 horse power engine, the belt travelling at the rate of 2,500 feet per minute?—$150 \times 5,000 \div 2,500 = 30$ inches wide.

These rules hold for moderate sized belts. Very large belts need not be so wide, but may be 20 per cent. narrower than medium sized ones, while for very narrow ones the width must be taken more by some 20 or 30 per cent. We may deduce from this a rule easily remembered; it is that for every horse power, it takes one inch of belt if it runs at the rate of 500 feet per minute, and that the horse power increases in the ratio of this velocity. I may say these rules apply to single belts. Double belts are 3·5 stronger than single ones, therefore they need not travel so fast or be made so wide as the other belts to do the same work.

Rules laid down by some engineers make the diameter of the smallest pulley by a direct factor of the force which should be transmitted. Others make the length of belt in contact with the pulley such a factor. Others make the force transmitted as the arc of contact, or proportion of the circumference of the pulley enveloped by the belt.

Three forces are principally concerned in transmission of power by a belt: First, its tension on the driving side; secondly, its tension on the slack side; and thirdly, its adhesion to the pulley. The difference between the first and second is the net force transmitted, and cannot exceed the third. It is necessary first to inquire what tension can be continuously applied to the driving side without injury. The question then will be: What other, and less tension applied to the slack side will produce an adhesion at least equal to the difference between the two tensions?

The subject has been investigated mathematically by Rankine, and experimentally by Morin and others. A paper contributed to the *Journal of the Franklin Institute* by Mr. Robert Briggs, gives the result of some investigations made by himself and Mr. H. R. Towne, and is of great practical interest. The same paper is also published in Mr. J. H. Cooper's "Use of Belting." The greater or driving tensions were taken at 67 lbs. per inch wide, or one-third the ascertained breaking strength of the laced joinings of single leather belts, and