the co-efficient of useful friction at six-tenths of that established for sliding friction. By their own experiments, as well as those of Morin, it was found that with equal areas of contact, the adhesion did not materially differ on pulleys of 12, 24, or 42 inches in diameter. Their experiments, as well as a number of examples cited, confirm their theoretical conclusions. The results are summarized in the following table, which gives for arcs of contact from  $\frac{1}{2}$  to  $\frac{3}{2}$  of the circumference, the net force which should be transmitted for each inch in width of single leather belt :—

Arc of Contact.	Lbs. per Inch.	Arc of Contact.	Lbs. per Inch.
90° 100°	32.33 34.80 27.07	150° 180° 210°	44.64 49.01 52.52
120° 135°	39.18 42.06	210° 240° 270°	55.33 57.58

For convenience of memory, these results may be approximated by the use of the following rule: To one-seventh of the number of degrees of contact, add 21; the result is the force in pounds per inch wide, which should be transmitted.

The single leather belt, laced, is in such general use that its strength must be taken as the basis in the arrangement of general machinery. Mr. Towne found the strength of rivetted belts to be about 80 per cent. greater than laced ones. A few have been known to last a long time under tensions twice as great as those indicated by the above table. But tensions one-third greater than those of the table are about as high as can be applied to single rivetted belts of average quality, without unequal stretching, and consequent loss of durability.

In our association meetings and our school meetings, we have often had lessons given on the strength of boiler plates and the strain or pressure they are safe to work at ; also what pressure would burst any boiler plate. I think an engineer may sometimes look at his belt and think to himself, what strain will that belt stand to burst or break it.

I propose to give you an idea how to work that out. The strength of the best hides used for belting has been calculated at about 3,086 lbs. per square inch of section. This is reduced at a rivetted joint to 1,747 lbs. and to 960 lbs. at a laced joint. One-third of these figures may be considered a safe working strain. As belts vary very much in thickness, the following table in lbs. per inch width of safe working strain may be of use :--

Thickness of Belt.			Working Tension.	
<b>3-16</b> i	inch	.05	60 lbs.	
7 - 32	"		••••• 70 "	
ł	"		••••• 80 "	
5-16	""		100 "	
a a	"		120 "	
7-16	**		140 "	
<del>1</del>	"		160 "	
9-16	"		180 "	
<u>f</u>	"		200 "	
11-16	"		220 "	
<b>Å</b>	"		••••• 240 **	

Another way of measuring the power of a belt, is to get an ordinary two-part clamp with a hook on the back, and fasten the clamps tight on the belt. To the hook fix a spring scale, and fasten the scale to the nearest wall or timber that will give a direct pull. Throw the belt over the driving pulley of the engine; hold the other end tight on the pulley, and set the engine off. The moment the belt slips, the reading of the scales is taken, and that is the actual resistance or tension of the belt on the pulley. This multiplied by the speed of the belt per minute gives the total foot pounds transmitted by it for the time reckoned.

In conclusion, I would like to give you a couple of recipes ---one for fastening your belts, and the other for making them pliable :---

CEMENT FOR LEATHER BELTING.—Common glue and isinglass, equal parts, soaked for ten hours in just enough water to cover them; bring gradually to a boiling heat, and add pure tannin until the whole becomes ropy, or appears like the white of eggs.

For making belts pliable, castor oil is good, besides making the belt vermin-proof. It should be mixed half and half with tallow or oil. Pyroligneous acid will preserve leather from meulding, and will remove the mouldy places by first rubbing with a cloth, then applying the acid.

A little advice on belting may not be out of place here. To those engineers who have full power to get their own supplies of everything round their engines, I would say, when the time comes that you require a belt, always buy the best that money can buy. The best is always the cheapest in the long run. To those engineers who do not enjoy the confidence of the firm they work for, and are not allowed to select their own supplies but must first consult a foreman (in many cases a man who never devoted five minutes of his life to studying these things), show him the benefits to be derived from getting a good belt. A cheap belt is always a poor one. I have seen them made, and have drawn my own conclusions a long time since.

When once you have a belt, take care of it. It will pay you for all the trouble you bestow on it. Keep it well dusted and free from moisture. If you see the least curling of a joint, if you can repair it, do so; if not, report it to somebody who can. I believe in the old saying, that "a stitch in time saves nine." I know it is true with regard to belts.—Dominion Mechanical and Milling News.

## NICKEL PLATING.

The following solution for electro-plating with nickel is used by several firms in Hainault: 500 grms. of nickel sulphate, 365 grms. of neutral ammonium tartrate, 2.5 grms. of tannin dissolved in ether, and 10 liters of water. One and one half liters of water are first added, and the mixture boiled for fifteen minutes. The remainder of the water is then added, and the whole filtered. The *Electrician* says—"Solution yields an even white deposit, which is not brittle, and the cost of which is hardly more than that of electro-plating with copper."

Nickel-plating is now effected at several works in Belgium with the following bath :—Sulphate of nickel, 1 kilog.=2.2 lb.; tartrate of ammonia, 0.725 kilog.; tannic acid with ether, 0.005 kilog.; water, 20 liters=4.4 gallons. With this formula a thick coat is deposited on all metals in a short space of time, and by a weak current.

White birch is the favored wood in the manufacture of toothpicks, the wood being delicately white as well as sweet to the taste, and there is a constant demand for the goods at a little less than \$2 a case of 150,000 picks. At Harbor Springs, Mich., the birch logs are sawed, steamed, and cut into ribbons three inches wide; these are run through the machinery, eight or ten at once, and fall in finished pieces into baskets placed for their reception. The packing is done principally by expert Indian women.