possible. It is also better if the lacing does not cross on itself.

Double belting, generally speaking, is not so good as single, since flexibility is what is required. It has been found, however, in certain cases, such as the belt for a return saw, that a double belt wears best, being better able to stand the alternate stretching and buckling.

RELULTS OF TESTS.

Tests of belting were made in McGill College testing laboratory in 1896-7 on the Emery testing machine. When pressure from the accumulator is admitted gradually the diagram curve of extensions is quite smooth and regular, but when the machine is fed rapidly the extensions are less; this becomes more noticeable in belt testing. It shows as a sharp change in the curve, but when the feed is again better regulated the curve resumes its former course. In some cases these sharp changes in the curve may be due to lack of uniformity in the material, particularly in the case of belting composed of cotton and hair. Extensions were read at every 200 pounds increase of load, except in some of the larger specimens, where readings were taken every 500 pounds increase.

Leather Belting.—Specimens were procured from a dealer in Montreal.

NO. 1.—ENGLISH OAK TAN LEATHER.

Width, 2 in. Sectional area, .453 square in.
Weight, .213 lb. per lineal foot.
Cost, 23 cents per ft.
Total stretch in 24 in. was 2.15 in.=9 per cent.
Permanent stretch, 0.2 per cent.
Maximum strength, 2,210 lbs. per square in.

This specimen contained a spliced cemented joint and laced in the same manner as first example described under "Joints." It broke straight across the middle of the joint.

No. 2.—(Same belt as No. 1, but without joint.)
Maximum strength, 4,640 lbs. per square in.

This shows that the strength of the joint is about one-half the strength of the solid belt.

NO. 3 —HEMLOCK TAN LEATHER.

Width, 3½ in.
Sectional area, .798 square in.
Weight, .206 lbs. per ft.
Cost, 43 cents per ft.
Total extension was 3.11 in. in 18 in.=18.3 per cent.

This specimen has a cement splice without lace or rivets. It failed at 3,300 pounds per square inch.

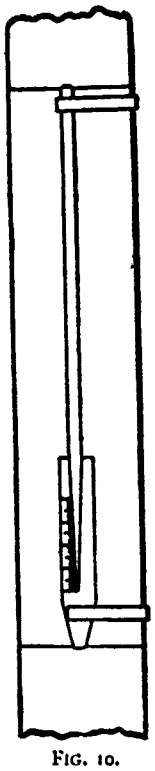

FIG. 10.

Fracture took place, not in joint, but immediately at its edge.

A solid piece of this belt stood 4,000 pounds per square inch.

An unlaced cemented joint is stronger than a laced one, but lacing is necessary where the belt is exposed to heat or moisture.

RUBBER BELTING.

The specimens tested were manufactured by a Canadian company.

The curve of extensions is almost a straight line with a slight tendency to turn upwards immediately before fracture. This straight line indicates that the extensions are about the same for each increment of load, and hence that the material is very uniform. Another fact that shows the uniformity of the material is that the fracture in each case was clear and straight across the belt. It was not a tear but a break.

The method of measuring the extensions is shown by Fig. 10. Two pencil lines are ruled square across the belt exactly thirty inches apart. A scale graduated to hundreths of an inch is clamped with one end at the lower mark.

A long steel pointer is clamped at the other mark. As the belt stretches this pointer moves along the scale, thus giving the amount of stretch, which can be read in hundredths.

Fig. 11 shows the method of holding the specimen. A piece of steel rod a is placed in the loop of the belt, to take up the pressure from the two rods bb, whose section is a semi-circle; bb are fitted into grooves and are free to move, so that the pressure from them is always directed towards the center of a. A separate piece of belting c is placed between the jaw and the specimen to protect the latter from being cut by the jaws. Four bolts d are used to tighten the jaws. When the belt stretches its thickness is diminished. The bolts are then tightened more to prevent slipping. The jaws are connected to the piston of the ram by a ball and socket joint. They can thus adjust themselves to any unevenness in tension.

SPECIMEN NO. 1.

Width, 4 in. Sectional area, .84 square in.
Weight, .4768 lb. per lineal ft.
Cost, 42 cents per ft.
Broke at 4,170 lbs. per square in.
Total extension in 30 in. = 3.00 in. = 10 per cent.
Permanent extension, 0.13 per cent.

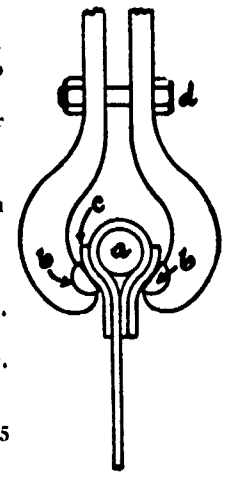

FIG. 11.

SPECIMEN NO. 2.

Width, 5 in. Sectional area, 1.1 square in.
Weight, .635 lb. per lineal ft.
Cost, 52 cents per ft.
Broke at 4,270 lbs. per square in.
Total extension, 14.9 per cent.
Permanent stretch, 3.0 per cent.

SPECIMEN NO. 3.

Width, 6 in. Section, 1.505 square in.
Weight, .844 lb. per lineal ft.
Cost, 62 cents per ft.
Broke at 3,790 lbs. per square in.
Total stretch, 16.4 per cent.
Permanent stretch, 3.0 per cent.

SPECIMEN NO. 4.

Width, 8 in. Section, 1.92 square in.
Weight, 1.032 lbs. per ft.
Cost, 84 cents per ft.
Broke at 3,700 lbs. per square in.
Total stretch, 17.0 per cent.
Permanent stretch, 1.9 per cent.

SPECIMEN NO. 5.

Width, 10 in.
Weight, 1.1434 lbs. per lineal ft.
Cost, $1.07 per ft.
Maximum load, 3,320 lbs. per square in.
Total stretch, 13.9 per cent.
Permanent stretch, 1.6 per cent.

SPECIMEN NO. 6.

Width, 12 in.
Weight, 1.2806 lbs. per lineal ft.
Cost, $1.30 per ft.
Maximum load, 3,540 lbs. per square in.
Total extension, 14.5 per cent.
Permanent extension, 2.4 per cent.

SPECIMEN NO. 7.

Width, 14 in.
Weight, 1.812 lbs. per ft.
Cost, $1.54 per ft.
Maximum load, 3,620 lbs. per square in.
Total extension, 15.8 per cent.
Permanent extension, 2.0 per cent.

CAMEL BELTING.

This belting is made partly of cotton and partly of coarse camel hair, said to be the combings of camels. The cotton is the material which forms the chief strength and therefore the longitudinal fibres are cotton. The hair yarn forms a woof, although in some of the specimens tested there were strands of hair running longitudinally as well as transversely. The two materials being interwoven in several plies, the belt is soaked in red paint and allowed to dry. The paint forms a good body coating, which protects the belt from moisture and makes it very durable. To prevent the belt from becoming stiff and hard an occasional coating of castor oil and tallow should be applied; but any resinous mixture is injurious. In making the lace holes a sharp awl should be used instead of a punch, as the latter cuts the threads and thus weakens the belt.

SPECIMEN NO. 1.

Sectional area, 4.35" × 29" = 1.262 square in.
Weight, .5717 lbs. per ft.
Cost, 33 cents per ft.
Total extension, 21.9 per cent.
Permanent extension, 11.6 per cent.
Maximum load, 5,960 lbs. per square inch.

SPECIMEN NO. 2.

Section, 5.07" × .24" = 1.22 square in.
Weight, .599 lb. per ft.
Cost, 39 cents per ft.
Total stretch, 35.1 per cent.
Permanent stretch, 4.45 per cent.
Maximum load, 5,570 lbs. per square in.

SPECIMEN NO. 3.

Section 6.1" × .28" = 1.71 square in.
Double or "Russian Brand."
Weight, .7995 lb. per ft.
Cost, $1.00 per ft.
Total extension, 24.5 per cent.
Permanent extension, 7.1 per cent.
Maximum load, 5,900 lbs. per square in.

SPECIMEN NO. 4.

Section, 5.95" × .22" = 1.31 square in.
Weight, .599 lb. per ft.
Cost, 48 cents per ft.
Total stretch, 27.6 per cent.
Permanent stretch, 12.9 per cent.
Maximum load, 5,650 lbs. per square in.

SPECIMEN NO. 5.

Section, 6.1" × 30" = 1.83 square in.
Weight, .781 lb. per ft.
Cost, 58 cents per ft.
Total stretch, 20.6 per cent.
Maximum load, 5,360 lbs. per square in.

SPECIMEN NO. 6.

Section, 12.20" × .31" = 3.78 square in.
Weight, 1.705 lbs. per ft.
Cost, $1.33 per ft.
Total stretch, 38.0 per cent.
Permanent stretch, 19.3 per cent.
Maximum load, 5,160 lbs. per square in.

A glance at the curves shows that for small loads the extensions are uniform and even have a tendency to decrease until a certain limit is reached. The elastic limit comes much sooner than in rubber and leather, and there is an enormous extension at the ultimate strength.

The ultimate strength is much greater than that of rubber and leather, etc., but the belt would never be used in such high tension.

PATENT "BALATA" BELTING.

This kind of belting already described seems to be very good. It is very strong, and the amount of stretch is small.

The gutta percha is said to bend over small pulleys with more ease than rubber, and it is also claimed it resists heat and moisture better. It has cheapness in its favor, and is likely to become a popular belt. Only one specimen was tested:

Section, 4.45" × .22" = .979 square in.
Weight, .433 lb. per ft.
Cost, 46 cents per ft.
Total stretch, 15.7 per cent.
Permanent stretch, 4.4 per cent.
Maximum load, 5,210 lbs. per square in.

Table showing comparative value of belts:

Kinds of Belts.	Ultimate strength. Per Square In.	Ultimate strength. Per Lb. per Ft.	Total Stretch.	Stretch at 400 Lbs. per Square Inch.	Permanent Set.
Leather.....	4,320	12,200	16.5 to 18.3	1.0%	0.5%
Rubber.....	3,773	7,290	14.6%	2.2%	2.0%
"Camel".....	5,860	12,150	29.6%	2.2%	13.1%
"Balata".....	5,210	11,750	15.7%	1.6%	4.4%

The column "Strength per lb. per ft.," gives a fair idea of the proportionate driving power that can be got out of the same weight of different kinds of belt.

The last two columns show the comparative values with regard to stretch.

PRICES.

Leather ..... 16 cents per ft. for 1" belt, to $12.00 per ft for 72"
Rubber ..... 21 cents per ft. for 2" belt, to $6.72 per ft. for 52"
"Camel"..... 12 cents per ft. for 2" belt, to $1.33 p r ft. for 12"
"Balata"..... 21 cents per ft. for 2" belt, to $1.50 per ft. for 12"

The "Camel" belting is by far the strongest, but its stretch is greatest. Where it can be used, the leather is probably the most economical, although it is very expensive in large widths. It is the lightest, and less power is lost by stretch.

The gutta percha comes next for lightness and driving power, and would therefore seem to be the most serviceable belt of all. But it is hardly fair to come to such a conclusion when only one specimen was tested.