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J. MEYER
CONICAL BELTS
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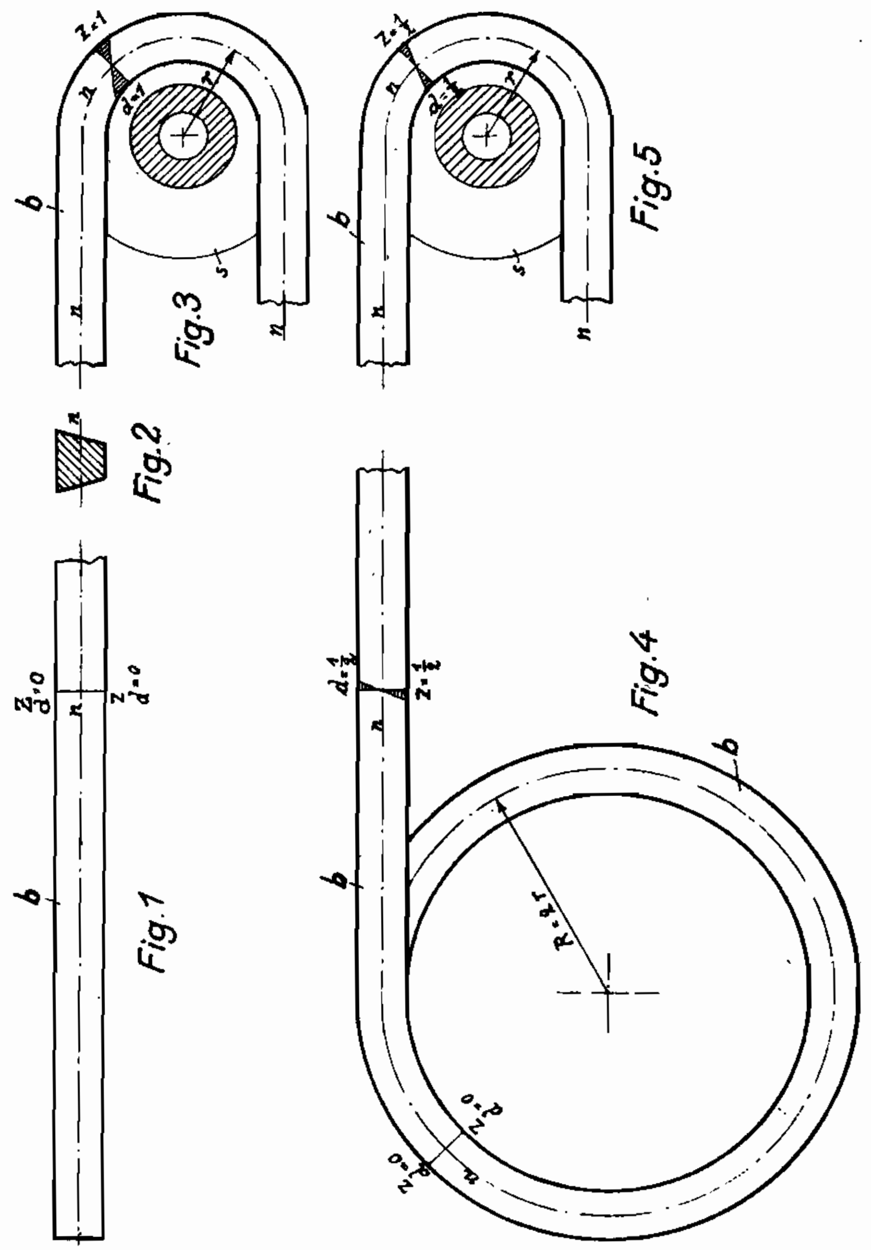

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Fig. 6

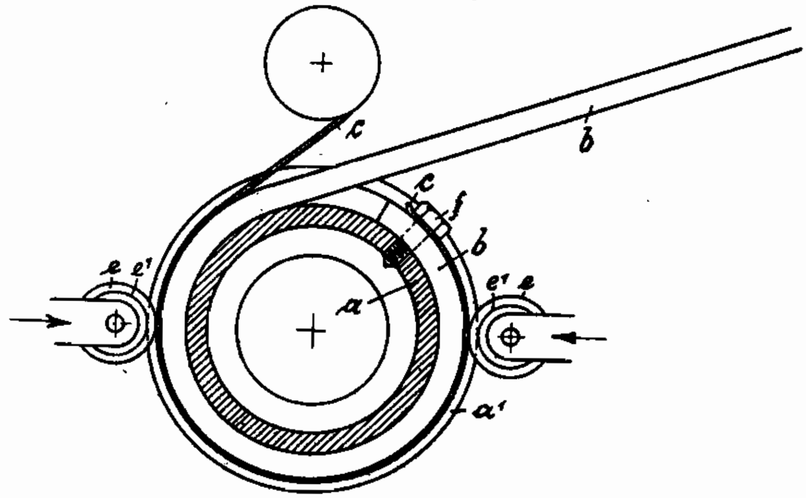

Fig. 8

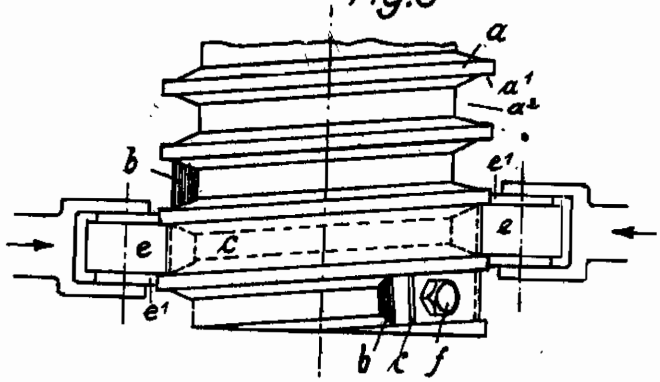

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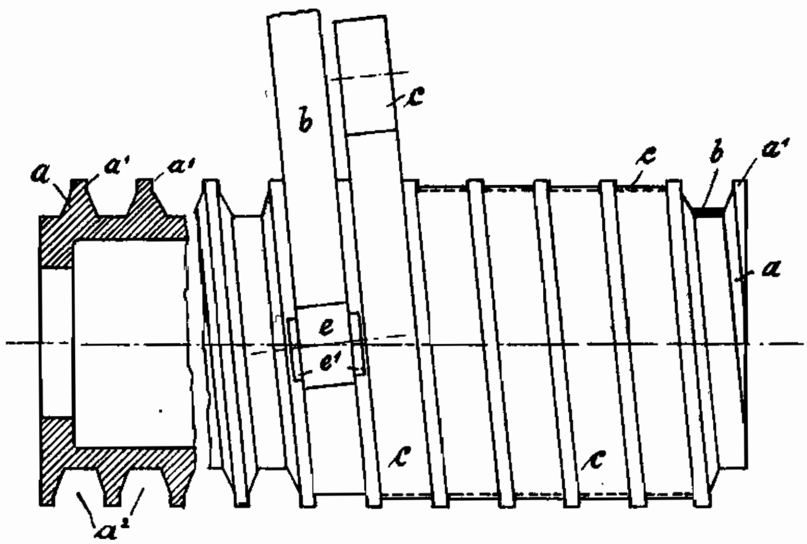
Fig. 7.



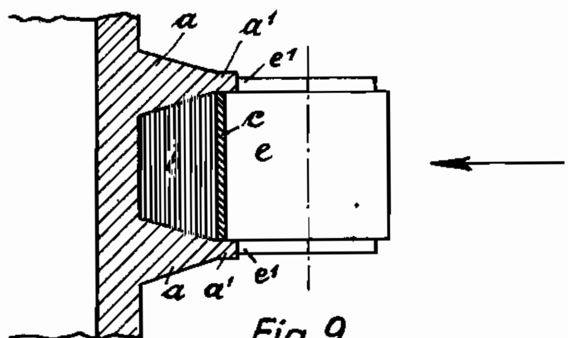


Fig. 9

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ALIEN PROPERTY CUSTODIAN

CONICAL BELTS

Johann Meyer, Berlin-Steglitz, Germany; vested in the Alien Property Custodian

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This invention relates to conical belts of the type consisting of a strip of material having free ends which are subsequently joined at their ends to form an endless belt, as distinct from conical belts which are directly produced in the form of closed rings. Conical belts, owing to their large transverse section, are exposed to high bending forces emanating from the bending around small pulleys. The highest amount of such detrimental bending forces is found in belts which, like conical belts with free ends made of rubber or rubberized texture, are manufactured or vulcanized in the form of straight rods or strips.

The detrimental bending forces are less pronounced in the case of endless conical belts of rubber or rubberized texture, which are mostly manufactured and vulcanized in circular moulds the circumference of which equals the evolved useful length of the belt. A conical belt thus vulcanized represents a self-enclosed circle the bending radius of which in its tension-free state of manufacture is always dependent upon the actual length of the belt. It follows that belts with equal cross section can yet show largely varied bends in their tension-free state, depending upon the respective length of the belt, although said belts of equal cross section are running around the same pulley of smallest diameter.

The greater the length of a belt thus manufactured or vulcanized, the more unfavourable will be its bending ratio from the tension-free state of manufacture relative to the bend which it must make around the smallest pulley. With its length increasing, the belt will approach the most unfavourable state of the straightened form and the maximum of the detrimental inner bending forces at the point where its runs over the respective smallest pulley.

It is an important object of the present invention to impart to the belt a preliminary bending feature by which the tension in the belt due to these conditions is reduced to a minimum.

Another object of the present invention is the provision of means and methods for producing belts having a bending feature as specified in accordance with the spirit of this invention.

With these and further objects in view, as may become apparent from the within disclosures, the invention consists not only in the structures herein pointed out and illustrated by the drawings, but includes further structures coming within the scope of what hereinafter may be claimed.

The character of the invention, however, may be best understood by reference to certain of its structural forms, as illustrated by the accompany-drawings in which:

Fig. 1 is a side elevation of a conventional conical belt manufactured in known manner in its stretched original state.

Fig. 2 is a cross section of the same belt.

Fig. 3 is a side elevation of the belt as it is bent around its associated smallest pulley.

Fig. 4 is a diagrammatic view for illustration of the invention.

Fig. 5 is a diagrammatic view indicating the tensions in a belt according to the invention.

Fig. 6 is a sectional view of a mould device for producing conical belts in accordance with the invention.

Fig. 7 is a plan view, partly in an axial section, of the same device.

Fig. 8 is a plan view of the mould and tools cooperating therewith.

Fig. 9 is a fragmentary sectional view illustrating the position of the belt in the mould device.

Similar characters of reference denote similar parts in the different views.

According to the present invention, the strip-shaped belt is produced with an inherent bend the curvature of which in tension-free state corresponds to a smaller circumference than the actual length of the belt in its closed ring-shaped form ready for use. Preferably, the belt strip is made with an inherent bent corresponding to a circle having twice the diameter of the smallest pulley over which the belt runs in operation. This bending has been found to be best from a standpoint of long life and small wear of the belt, which is probably due to the fact that the curvature of a circle with the diameter **2** is the exact mean value of the curvature of a circle with a diameter ∞ and the curvature of a circle with the diameter **1**. Assuming that the smallest pulley will have a diameter of approximately ten times the radial height of the belt cross section, which is a generally accepted figure, this would come down to a bend of a radius ten times the radial height of the belt.

Referring now to the drawings in greater detail, and first to Fig. 1, the inner tensions z and d in the upper and lower layers of this belt of known type, made in straight condition, have the value zero in straight condition of the belt. Fig. 3 shows the same conical belt passed around the respective smallest pulley with the radius r. In this position the outer fibres above the neutral layer n are subjected to a pull, the amount of which in the most extreme layer is supposed to be $z=1$, whilst the fibres lying nearest to the axis of rotation are subjected to the pressure forces $d=1$. When passing into the straight line the forces z and d are zero again.

My novel conical belt on the other hand has been manufactured in such a way that with the bend of the belt having the radius $R=2r$, as shown in Fig. 4, the resulting bending forces z and d equal zero. When the belt is straightened out, the outer or upper side of the belt will be subjected to pressure whilst the inner or lower side will be subjected to pull. Since the bending radius R, with which the inside of the belt is free from tension, has been designated $2r$ and, since the forces emanating from the respective lengthening and shortening of the material are proportional with the bending radii, it follows that the bending forces which take effect during the stretching of the belt are: $d=\frac{1}{2}$ on the outside and $z=\frac{1}{2}$ on the inside.

If a conical belt which has been thus pre-bent is laid around a pulley s having the radius r, the tensions present in the straight line will reverse their signs beyond zero and, referring to Fig. 5, the outmost fibres will be subjected to a pull $z=\frac{1}{2}$ and the innermost fibres to a pressure $d=\frac{1}{2}$.

That part of the total stress of the conical belt emanating from its bend around the smallest respective pulley has therefore by this simple means been reduced to half the value of a belt which is tension-free in the straight line. Its life, other conditions being equal, has thereby been lengthened considerably or there is the possibility of running a belt of equal dimensions over a smaller pulley with the same efficiency and economy.

In order to produce conical belts having the intended bend in their tension-free state, I may vulcanize the conical belt in a suitable apparatus, such as a cylinder having a helical groove of trapezoid cross section. This helical groove is closed by a metal band protruding into it, the pressure of which upon the inserted conical belt is still raised by the expansion of the cylinder body and the enclosed belt due to the heat produced in the vulcanizing operation.

Figs. 6 to 8 show an embodiment of a suitable vulcanizing cylinder. Fig. 9 is a sectional view of the helical groove with inserted conical belt, metal band and pressure cylinder at an enlarged scale. Item a is the vulcanizing cylinder with the helical groove a^2 into which the conical belt b to be vulcanized is inserted. The conical belt b and the metal band c are jointly fastened to the cylinder at both ends by screw bolts f. Pressure rollers e force the conical belt surmounted by the metal band deep enough into the helical groove a^2 until the flanges of the pressure rollers e come in contact with the straight-line guiding tracks a^1 of the helical groove a^2, whereby the thickness and width of the conical belt are exactly determined.

The high pressure upon the conical belt required for vulcanizing is exerted during the vulcanizing process, according to the present invention, by utilizing the difference of the coefficient of thermal expansion of the materials used for the vulcanizing cylinder and the metal band. For this purpose the vulcanizing cylinder is made of a material with a very high coefficient of thermal expansion, for example, aluminium, whilst the metal band surrounding the belt is made of a material with a very low coefficient of thermal expansion, for example, steel.

Aluminium and caoutchouc have a very great heat expansion when subjected to the vulcanizing heat of about 140°, whilst the steel band behaves almost indifferent at this temperature and shows only negligible signs of expansion. Through the expanding tendency of the enclosed caoutchouc and through the expansion both in length and diameter of the aluminium cylinder during the vulcanizing process, a high pressure is exerted automatically below the steel band which is fastened at both ends to the cylinder. This pressure is evenly distributed upon the whole length of the worm or helical groove so that a product of highest uniformity and compactness is obtained, having the desired curvature.

The method and apparatus of the present invention have been described in detail with reference to specific embodiments. It is to be understood, however, that the invention is not limited by such specific reference but is broader in scope and capable of other embodiments than those specifically described and illustrated in the drawing.

JOHANN MEYER.