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G. N. SCHOENBERG.

FRICTION CLUTCH.

No. 277,066. Patented May 8, 1883.

Fig: 8.

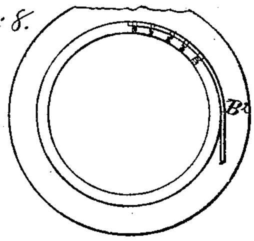


Fig: 5.

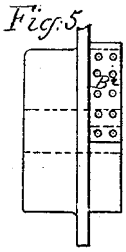


Fig: 6.

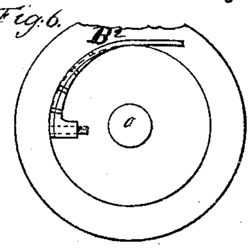


Fig: 7

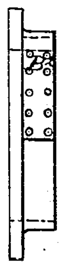


Fig: 1.

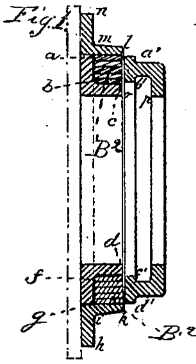


Fig. 2

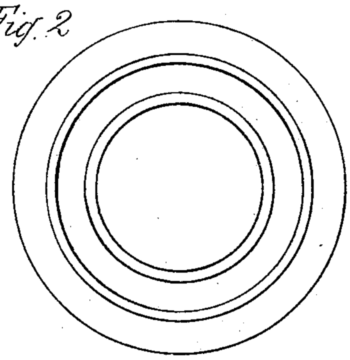


Fig: 3.

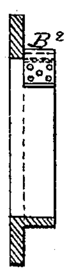


Fig. 4.

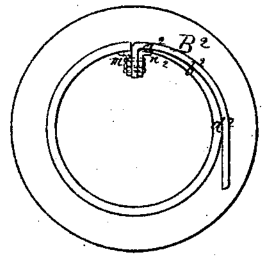


Fig: 15

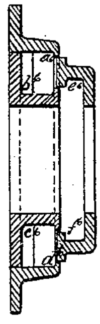
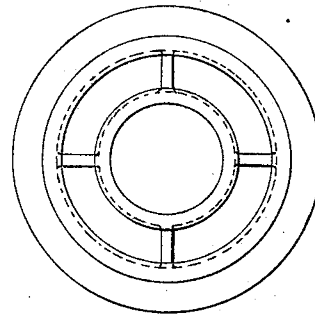


Fig: 16.



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G. N. SCHOENBERG.

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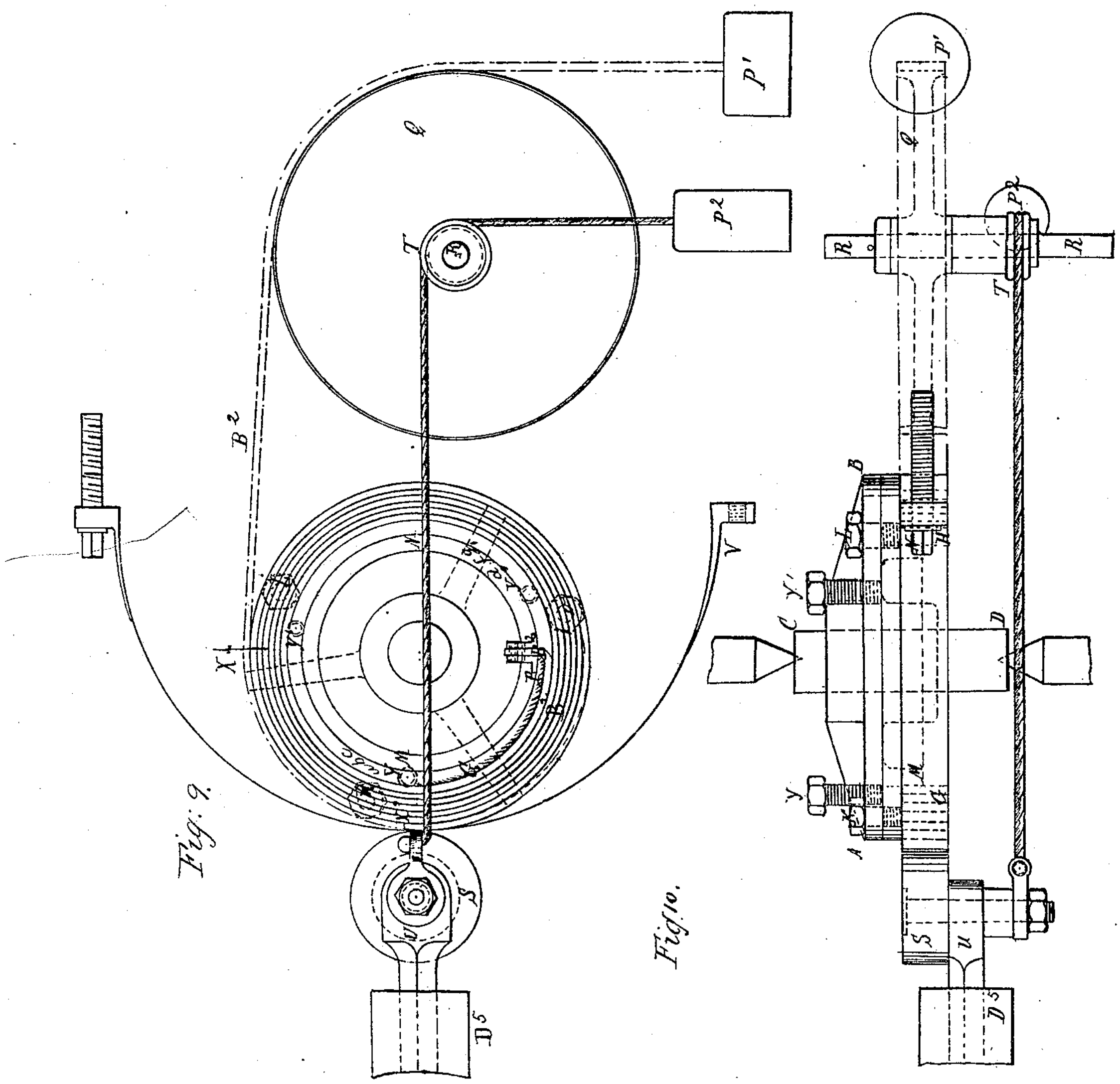

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N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.)

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G. N. SCHOENBERG.

FRICTION CLUTCH.

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Fig. 11.

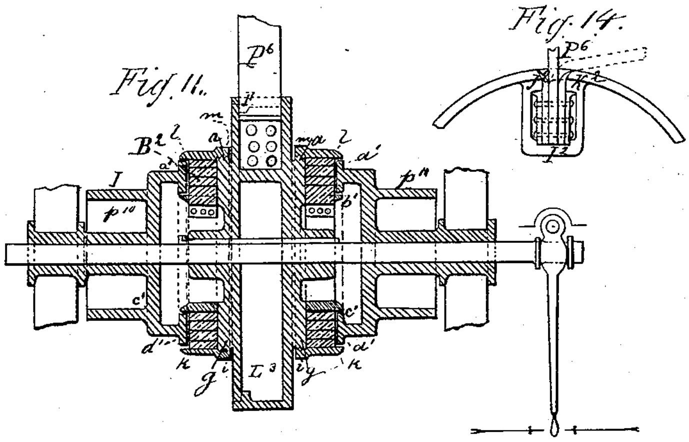


Fig. 14.

Fig. 12.

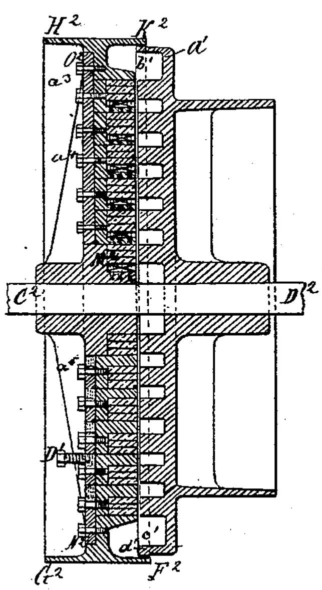
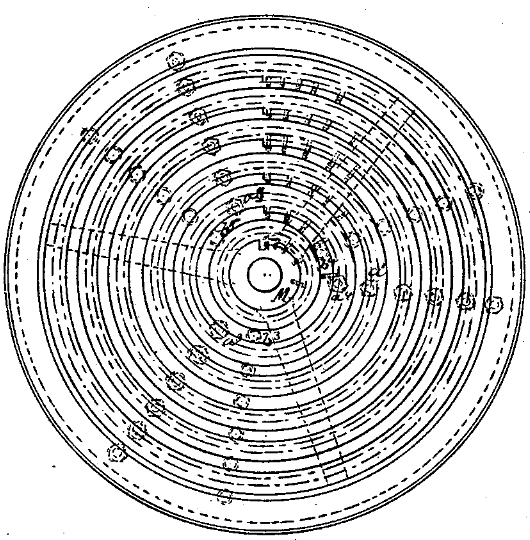


Fig. 13.



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UNITED STATES PATENT OFFICE.

GABRIEL NICOLAS SCHOENBERG, OF BOULOGNE, NEAR PARIS, FRANCE.

FRICTION-CLUTCH.

SPECIFICATION forming part of Letters Patent No. 277,066, dated May 8, 1883.

Application filed March 16, 1883. (No model.)

To all whom it may concern:

Be it known that I, GABRIEL NICOLAS SCHOENBERG, of Boulogne, near Paris, France, have invented Improvements in Friction-Clutches; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the annexed sheet of drawings, making a part of the same.

This invention relates to improved friction-clutches in which the adhesion or friction is produced between plane surfaces, and which embodies in a practical and simple way the principle of the total envelopment of a pulley by its belt, which yields, as regards the ratio of the weight raised to the pressure of contact, a result greater than unity.

In order that the invention may be more readily understood, I will proceed to describe it with reference to the accompanying drawings, which represent an example thereof, it being understood that the form and dimensions of the various parts are capable of variation, according to the nature of the application, without departing from the invention.

In the drawings, Figure 1 represents a vertical central section of my improved clutch; Fig. 2, a face view of the inner and outer rings thereof. Fig. 3 is a central section, and Fig. 4 a face view, of the inner ring; Fig. 5, a side view, and Fig. 6 a face view, of a modified form of such inner ring. Fig. 7 is an edge view of the inner ring; Fig. 8, a face view of a modified form thereof. Fig. 9 is a face view, and Fig. 10 a top view, of my improved clutch in position on a lathe for receiving the coiled band. Fig. 11 is a central section of a modified form of the clutch. Fig. 12 is a central section, and Fig. 13 a face view, of another modified form of the clutch. Fig. 14 is a detail face view, showing a mode of attaching a band to a pulley. Fig. 15 is a central section, and Fig. 16 a face view, of another modification of my improved clutch.

The invention consists, essentially, in fixing between two metal rings of suitable form—such as shown in cross-section at *a b c d f g h i k* and *l m n*, Fig. 1—a flat band of any kind of material used for such purposes, and in applying the friction to the edges of said band by means of a third ring, *a' b' c' d'*.

To avoid the frequent repetition of the letters of reference, the rings will be hereinafter referred to as follows: first, the metal ring *a b c d f g*, encircled by band, as the "inner" ring; second, the metal ring *h i k l m n*, enveloping the band, as the "outer" ring; third, the metal ring *a' b' c' d'* as the "friction-ring."

First. The inner ring has a cylindrical part, *b c f d*, equal to the width of the band, and a flange, *a b f g*, at right angles to the cylindrical part and equal to the thickness of the band when coiled on the said ring, as hereinafter described.

Second. The outer ring is made of slightly less internal diameter than that of the band when coiled on the inner ring and turned down, as hereinafter described, and it is also slightly coned internally, so as to increase its pressure upon the band when applied thereon. The flange of this ring may be made of any desired form, as will be hereinafter described.

Third. The friction-ring is intended to transmit or receive the necessary pressure for the transmission of motion, and should be provided with one or more projecting flanges, *o p*, Fig. 1, of plane or angular form, but capable of entering easily the space between the two rings in which the band is coiled. The cylindrical part of the inner ring should be in one of the forms illustrated in Figs. 4, 6, and 8. One mode of attaching the band B^2 is as shown in Fig. 4. A slot is made in the cylindrical part of the ring for the passage of the band, and the cylindrical part at one side of this slot is reduced in thickness to an extent equal to the thickness of the band, as shown at a^2, the sunk surface a^2 b^2 d^2 gradually running out at the circumference of the ring a quarter or half way round the same.

The mode of attaching the band may vary. If the ring is large enough, the end of the band may be clamped between two angle-iron plates, m^2 n^2, roughened on their inner faces and riveted together. This done, the band is then inserted in the slot, as shown in Fig. 4, the plates m^2 n^2 forming stops. If the band is to be coiled upon the hub of a pulley or a solid core where no internal space is available, as in Fig. 6, a single clamp only is used, of the form shown, which is tapered and curved, so as to extend a quarter to half way round the hub, in which it is countersunk, as shown, the end of the band B^2 being attached thereto by rivets or screws, the clamp being further secured to the hub by a number of studs screwed into the bottom of the recess, in which it is countersunk, and projecting up through the band and riveted down thereon, or secured by nuts. When the power to be transmitted is small it is sufficient to screw a number of pins into the hub, as in Fig. 7, the said pins passing through the band and being riveted down thereon over their washers or secured by screw-nuts, which sink by their own pressure into the thickness of the band.

The mode of winding the band upon the ring is as follows: Suppose the mode of attachment Fig. 4 to be employed. I mount in a lathe a face-plate or chuck, A B, Figs. 9 and 10, keyed upon a shaft, C D, turning between centers or otherwise. The face-plate has a turned flange, M N, on it, upon which is fitted the inner ring, *a b c d f g*, said ring being fixed to the plate by means of three screws, K L O. The end of the band B^2, with the double clamp applied, is introduced into the slot in the ring, as shown. Supposing the band selected to be of leather, (although india-rubber, gutta-percha, canvas, or other fabric in flat form may be used,) of equal width to the cylindrical part of the ring, the band is first of all inserted in the slot and then stretched tightly over a pulley, Q, either by means of a weight, P′, or by direct traction. In the first case the pulley Q would be mounted loose upon the fixed shaft R, placed in proximity to the lathe. The chuck A B being then rotated, the band will be coiled upon the periphery of the ring. The band may or may not be cemented upon itself as it is coiled up, according to the nature of the leather and the number of the coils.

In order to regularize the tension in winding, after the preliminary stretching of the band, and, if necessary, to insure the adhesion of the coils together, a friction-roller, S, may be pressed against any suitable point of the ring by another weight, P^2, attached to the end of a cord which passes over a grooved tension-pulley, T, the other end of the cord being attached to the rod *u*, which carries the spindle of the pressing roller. This rod is of square section, and slides in a corresponding socket, D^5, which may be fixed on the tool-holder of the lathe without impeding the working of the guide or the rod *u*. The grooved tension-pulley may be mounted on the same shaft as the pulley Q, so as to enable the tensions to be applied simultaneously or separately, whether at the commencement to apply the band closely upon the cylindrical part of the ring, or at the end to stretch anew the end of the band while the pressure of the roller is relaxed, so as to be able without loss of tension to introduce between the leather band and the roller a binding-strap of sheet-iron, of such length as to tightly embrace the coil of leather, and provided at the ends with ears or lugs, of which one, V, is tapped to receive a coupling-screw which turns freely in the ear or lug at the other end. As soon as this binding-strap is introduced, as shown in Fig. 9, the pressure of roller S is reapplied, and the tension of the leather band B^2 is relaxed and the band is cut at about the point X, so that it shall overlap a little beyond the depression P G Y at the commencement of the coil, as shown at X′, beneath the roller, which, it will be seen, is a little higher than the original depression represented by cross-sectioning. If the band has not been cemented throughout its whole length, the two last coils must be glued carefully, especially toward the end. The severed end X is then brought round, as shown at X′, until the end is as nearly under the roller S as possible without passing beyond the point of contact. In this way the form of the band coiled up will be closely assimilated to that of the ring. The two ends of the metal strap are then brought together (the pressure of the roller being meanwhile maintained) and connected and tightened up by the screw V′. The ring may then be detached from the chuck A B by being forced off by means of the screws *y y′ y″*, or may remain on the chuck until the glue is set. The binding-strap being then removed, the coiled band, now become a solid ring, is turned truly round and of uniform diameter at all points.

The operation of coiling as herein described, produces such an alteration of form which enables any desired dimensions, whether in width or thickness, of the coiled ring to be adopted, the homogeneity of the ring depending only on the pressure and cementing, and being rendered as perfect as may be desired by means of the apparatus described. The outer ring, *h i k l m n*, envelops the coiled mass of the band, and serves, first, to retain the form obtained in the lathe, and, second, to impart additional pressure by the slight conicity of the ring, which lightly compresses the circumference of the coiled band, and, third, prevents subsequent distortion under the pressure of the friction-ring. It consists of a cylindrical part, *i k m l*, Fig. 1, equal to or greater than the width of the coiled band, as in Fig. 11. In the latter the internal diameter of the ring is rather less than the external diameter of the coil, and slightly coned at the entering side. This outer ring is forced on until it is near enough to the plate to screw on the threaded part *a g*, Fig. 11, or to be screwed to the back plate, O^2 N^2, Figs. 12 and 13, by means of the bolts a^3 a^4 a^5, which are shown applied to each of the series of rings in Fig. 12. In the first case, Fig. 11, the outer ring is forced on until the threads engage, and then turned round in the direction of winding until screwed home. In the other arrangement (shown in Fig. 12) the covering-ring, it will be seen, incloses the entire coil with a pressure which may be as great as the winding-tension and transform, without possibility of alteration, the flattened coil into two surfaces of unlimited area, as of winding on a coil of any width desired, (and which in all cases represents the width of the band.) It will also be possible to obtain any desired amount of friction-surface for all kinds of material. If desired, the outer ring may also be heated and coated with glue on the inside and then forced upon the coil, wound and turned true, as above described. As regards the external form of covering-ring, it may be varied. Thus in Fig. 12, for example, it is the last of a series of concentric rings mounted upon the boss and plate fixed on the spindle C^2 D^2. Each of these rings is prepared to receive a coil in the manner before described, and in this particular case they act both as inner and outer rings. The first coil is attached to the boss M^2 in the manner shown in Fig. 6, and the other coils to the successive rings, as shown in Fig. 8, each ring being forced on the band (previously coiled and turned true, as described) until nearly close up to the plate M^2 N^2 O^2, and then drawn home by means of the screws a^3 a^4 a^5 upon each ring. This plate, which forms a pulley in this case, also has three other holes, b^3 b^4 b^5, opposite each ring, which are tapped to receive screws like that shown at D', whereby any one of the rings may be removed without difficulty or injury to this or to any other of the rings.

The outermost flange-ring, F^2 G^2 H^2 K^2, may either serve as a pulley, as in this example, or as a clutch-wheel, or otherwise. Its flange K^2 and F^2, together with the flange of the friction-ring a' b' c' d', hereinbefore referred to, serves to box in the friction-surfaces and prevent the introduction of foreign matters between them. The ring a' b' c' d' is cast in one with a pulley, and as many concentric circular ribs as there are coils, and nearly equal in height to the width of the coiled band.

The advantage of this system consists, essentially, in the possibility of utilizing by successively-increasing depth of penetration at least four-fifths of the coiled mass for the purposes of friction. This advantage is derived both from the mode of coiling and the means of fixing the end of the band. As the coiling commences in a depression or countersink in the inner ring or hub equal in depth to the thickness of the band, the latter remains intact in the neighborhood of the attachment during the whole duration of the band, and will continually help to maintain the remainder in position.

Another advantage is that the engagement and disengagement may be effected without sensible change of position of the contact-surfaces, (provided the two plates have been truly faced up and mounted on their spindles,) and as the distance to be moved is almost *nil* great power may be transmitted without much pressure being necessary, if a proper material has been selected for the coiled band. The outer ring may also be cast in one with its disk, instead of being screwed on, as in Fig. 11, which involves no change either in the mode of winding or encircling the coil with the outer ring, but simplifies the construction and enables this mode of attaching the band to be applied to the face or faces of a pulley, L^3, of this shape, as shown in the upper part of Fig. 11 and in Fig. 14. In the latter figure the box I^2 J^2 K^2, cast on the inside of the pulley, renders invariable the mode of attachment and enables the band P^6 to bend to right or left at will and not be in contact with the metal, but with two tapered pieces of leather riveted between the band and the clamps at either side, which pieces form an elastic cushion, preventing all injury to the band at this point when the latter is used for any purpose of traction.

In Fig. 11 the two friction-disks, whether driving or driven, are provided with their pulleys p^{10} and p^{11}, and their flanges a' b' c' d' are of sufficient depth to use up by wear four-fifths of the thickness of the coiled band. By means of the pulleys at their backs and an open and crossed band alternate circular motion may be imparted to the central pulley and the band P^6, attached thereto, or power may be conveyed by the pulley L^3 to the friction-disks. Instead of plane surfaces, angular or half-round surfaces may be employed by turning the face of the coiled mass to the shape best suited to the purpose.

Hitherto there has been a considerable loss in the transmission of motion by direct friction, as witness, for example, the very variable value of the work done by a belt on its pulley. This depends (the pressure being equal) upon the successive length of the arcs embraced by the band, and it is established by experiment that the latter will transmit the whole of the pressure exerted if the envelopment takes place under this same pressure over the whole circumference of the pulley. To obtain this result the inventor first envelops continuously the whole of circumference of the material selected and retains its circular form; second, establishes contact by pressure with another circular form of which no portion escapes contact. The inner and outer rings, with the friction-ring acting between them, answer the purpose perfectly, as the adhesion of the friction-ring on the total surface of the edge of the flat coiled band is exactly equal to that of a belt of equal width completely encircling a pulley of a diameter equal to the mean diameter of the coil. The diameter of the coil may be varied at will, and by fixing the rings to the arms of a clutch-wheel or fly-wheel I utilize advantageously space and material heretofore but partially made use of. By varying the configuration of the rings, as in Figs. 15 and 16, it is possible to utilize certain materials which have a favorable coefficient of friction, but cannot be prepared except in the form of segments, or by casting, or otherwise formed, and fixed in the space a^6 b^6 c^6 d^6, provided for their reception between the two rings, the edges of which are turned inward to retain the friction composition in position. The friction e^6 f^6 may, as above stated, have a plane, half-round, or angular surface, or be constructed of segments, or made of one piece of molded or agglomerated materials, so as to put into frictional contact so much as it is desired to utilize.

I claim—

1. In a friction-clutch, the combination of the inner ring, *a b c d f g*, and coiled band B^2 with the outer ring, *h i k l m n*, and friction-ring *a′ b′ c′ d′*, substantially as above described.

2. In a friction-clutch, the combination of the metal disk or inner ring, *a b c d f g*, with the outer ring, *h i j k l m n*, friction-ring *a′ b′ c′ d′*, and frictional body placed around the inner ring, within the outer ring, and in contact with the friction-ring, which is pressed upon the frictional body to operate in the transmission of power, substantially as described.

3. The inner ring made with angle-plates $m^2 n^2$, and with tapering portion $a^2 b^2 d^2$, in combination with the band B^2, substantially as herein shown and described.

4. The combination of the friction-clutch formed of inner ring, outer ring, friction-ring, and one or more bands, as above described, with the pulley L^3, substantially as herein shown and described.

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