(No Model.)

A. JAROLIMEK.

Device for Transmitting Power.

No. 241,494. **Patented May 17, 1881.**

Fig. 1

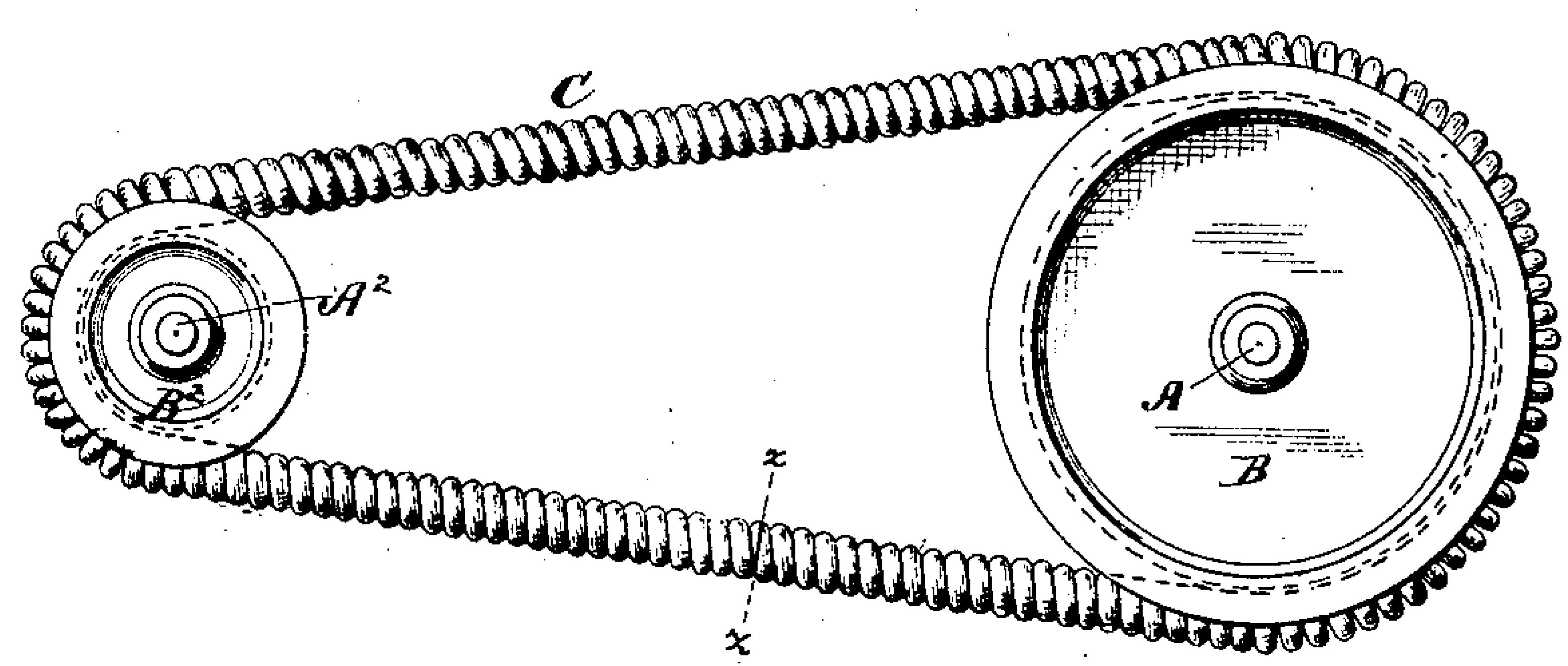
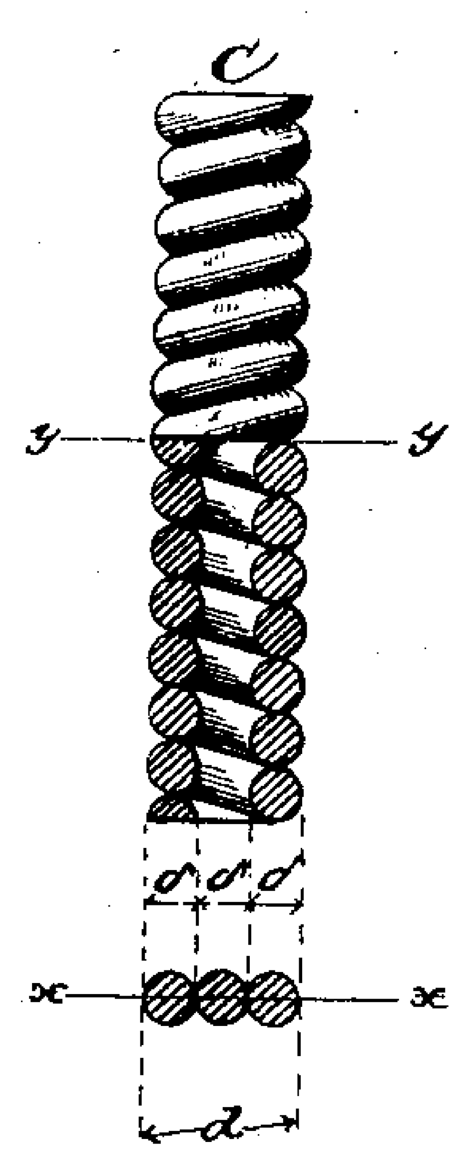


Fig. 2.



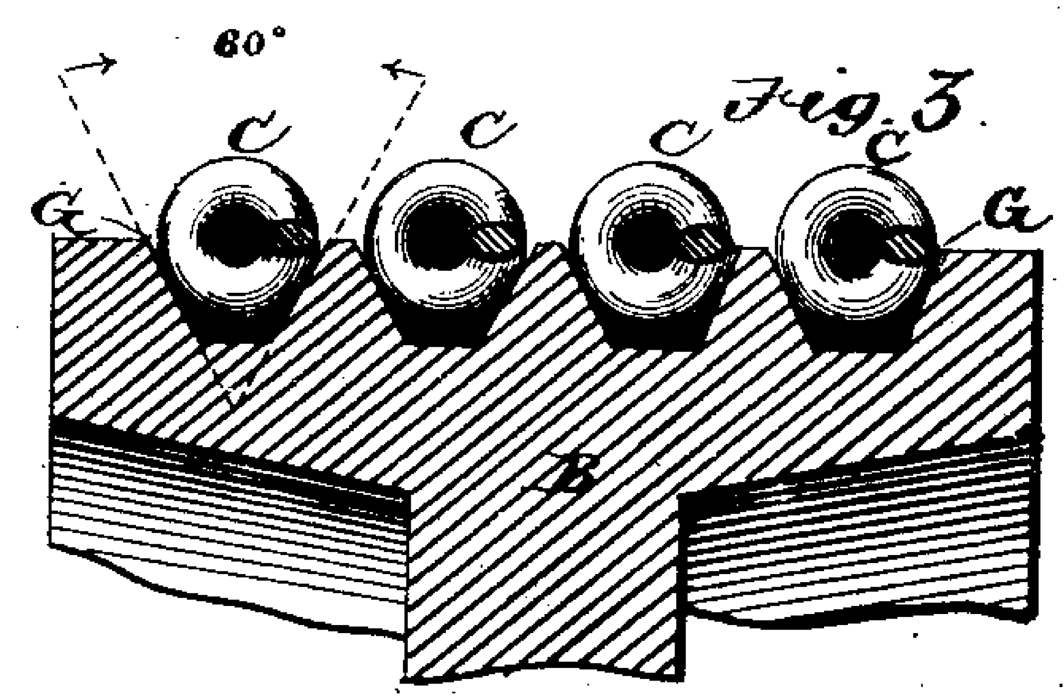


Fig. 4.

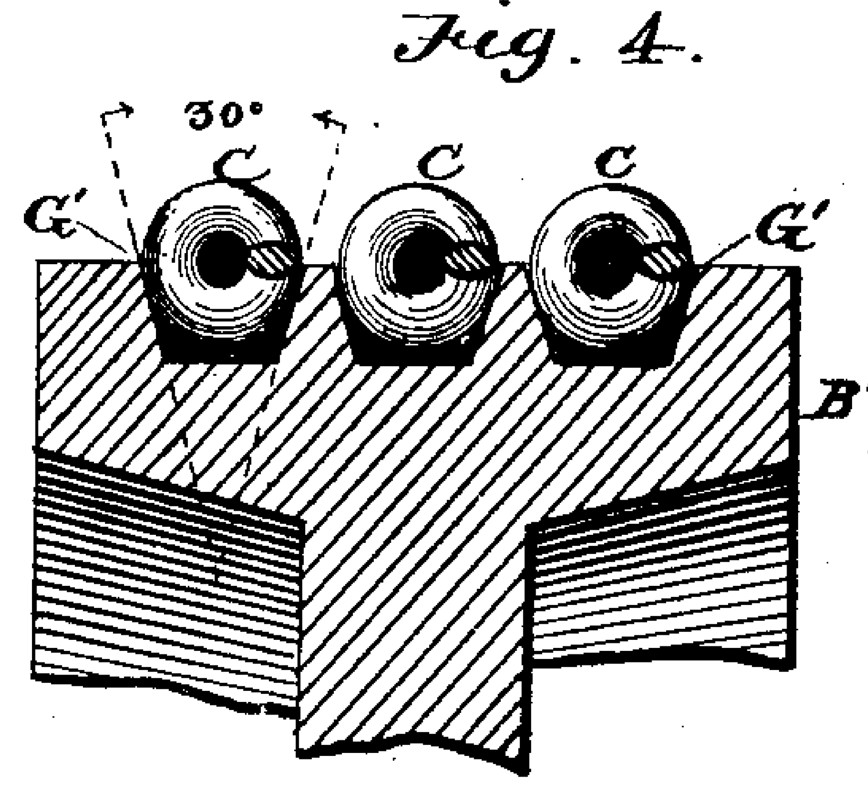
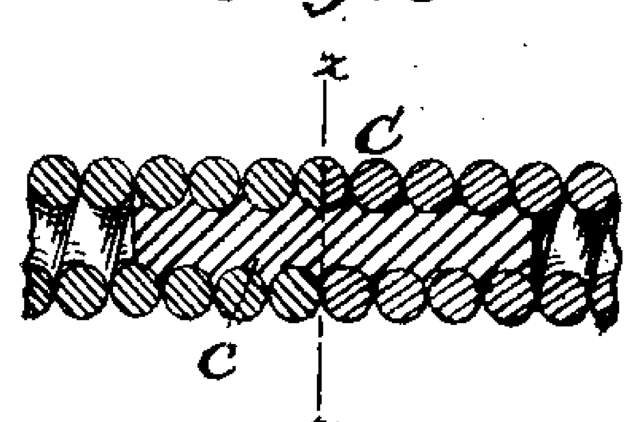


Fig. 5.



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UNITED STATES PATENT OFFICE.

ANTHONY JAROLIMEK, OF HAINBURG-ON-THE-DANUBE, AUSTRIA, ASSIGNOR OF ONE-HALF TO JOHN G. AVERY, OF SPENCER, MASSACHUSETTS.

DEVICE FOR TRANSMITTING POWER.

SPECIFICATION forming part of Letters Patent No. 241,494, dated May 17, 1881.

Application filed February 14, 1881. (No model.) Patented in France February 19, 1880, in Austria April 29, 1880, and in Belgium September 8, 1880.

To all whom it may concern:

Be it known that I, ANTHONY JAROLIMEK, a citizen of Austria, residing at Hainburg-on-the-Danube, in Austria, have invented a new and useful Improvement in Means for Transmitting Power, of which the following is a specification.

This invention has for its general object the economical employment of small elastic strings, or round bands of hardened-steel wire, or equivalent wire, in the form of peculiarly-constructed spiral springs, and metallic pulleys constructed with special reference to use therewith as substitutes for leather and rubber belts, cotton bands, and the like, and ordinary drums and pulleys for transmitting rotary motion as a vehicle of power.

In Letters Patent of the United States No. 227,163, dated May 4, 1880, the use of ordinary spiral springs as substitutes for leather belts is described and claimed.

The present invention is the result of numerous experiments and extensive scientific investigation growing out of the idea of so utilizing hardened-steel wire in the form of spiral springs, the prime object of said experiments and investigation being the discovery of a principle of construction which should enable me, by means of such steel strings or bands, to utilize the driving-power as fully—or, in other words, to transmit power with as little loss—as by means of ordinary leather or rubber belts and bands of other approved kinds. Ordinary spiral springs of hardened-steel wire do not possess this capacity, their considerable elongation under relatively light strains being opposed to it. Owing to this defective quality, a steel driving-band in the form of an ordinary spiral spring (such as shown in the drawings forming part of said Letters Patent No. 227,163, for example) stretches on the driving side and shortens in its loose part to such an extent, when running machinery, as to cause the driven pulley to run at a greatly-reduced surface speed, the band slipping continually on the pulleys, with excessive wear of the parts and serious loss of power as inevitable consequences. Only the smallest percentage of the strength of the spring can be utilized without developing this vital defect, while the size and weight of heavier springs, as well as their cost, preclude avoiding the difficulty by using springs made stronger in the ordinary way. My said experiments and investigation had reference also to means for reducing shaft-pressure, or strain on the bearings of the connected shafts, in obtaining the requisite traction, and to the best way of providing substitutes for the numerous sizes of belts and bands for transmitting different rates of power. My invention, as the result of said experiments and investigation, renders steel wire universally applicable as superior means for transmitting power of any rate; and to this end it consists in elastic steel bands (one or more) in the form of peculiarly-coiled spiral springs, and in peculiarly-grooved iron pulleys, in combination therewith, as hereinafter described and claimed.

Figure 1 of the accompanying drawings is an elevation of a pair of grooved pulleys connected by an elastic steel band, illustrating this invention. Fig. 2 is a view of a piece of the steel band, half in elevation and half in section, illustrating the principle upon which it is constructed. Figs. 3 and 4 represent radial sections through the peripheries of different-grooved pulleys, illustrating their construction and modifications thereof; and Fig. 5 represents an axial section of the band at its joint or coupling.

Like letters of reference indicate corresponding parts in the several figures.

A A^2, Fig. 1, represent parallel rotary shafts, B B^2 grooved pulleys thereon, and C a steel string or round steel band, or one of a series thereof, connecting said pulleys for the transmission of power, from B to B^2, for example.

The steel band C consists of steel wire coiled in the form of a peculiarly proportioned and substantially dense or close spiral spring of proper length, having its ends united, as at *z z*, by a suitable coupling. An internal coupling-piece, *c*, of elastic rubber or the like, is represented as a form of coupling which is preferred, while the construction of the band provides for its employment. This coupling-piece *c* is made to fit the interior of the band tightly, and is screwed into the ends after first turning them backward in the bands, so that when coupled the band will be free from torsion. A close, smooth, and amply strong joint is thus very readily formed, rendering the band not only free from laps, but of substantially the same thickness, weight, and elasticity at the joint as elsewhere. The ends of the band may in like manner be coupled by interscrewing the coils for a short distance after opening them sufficiently. A short metallic screw may be used in the same maner as the coupling-piece *c* as an inferior substitute, or a hook and eye may be formed at the respective extremities of the wire. The ends of the band may be prepared for coupling by means of an internal coupling-piece or screw by filing them square, as indicated in Figs. 1, 2, and 5; or the wire may be simply cut transversely or broken off.

The essential distinguishing characteristic of the steel band is a certain peculiarity of proportions or dimensions, which is illustrated more particularly by Fig. 2, and is the most important feature of my invention.

As a result of my said experiments and investigation I discovered that the wire must be coiled upon a very thin mandrel or spindle, very little, if any, thicker than the wire itself, in order to give the band the requisite resistance to elongation in proportion to its diameter and size of wire. I prefer to use a mandrel of the same diameter as the wire—a piece of the wire itself, for example—and the porportions of the piece of band shown in Fig. 2 are those which result from coiling the wire on a mandrel of this description—that is to say, the diameter of the band on the line *y y*, for example, is only equal to three times that of the wire of which it is composed, as represented at *x x*. In other words, if δ, Fig. 2, signify the thickness of the wire and d that of the band as a whole, then $d=3\delta$. These proportions are substantially invariable, and afford a reliable rule for making steel bands, whatever size of wire is employed. The relative length of diameter may be increased slightly without loss of usefulness, but with disadvantageous increase of elongation, or it may be decreased in some cases; but any material decrease would interfere with the use of an internal coupling-piece.

In producing the band I have used round steel wire, hardened uniformly throughout its length beforehand and tempered so as to be coiled cold; but any known process and apparatus for making spiral springs of hardened wire may be used. The band material is manufactured in lengths determined by that of the wire employed or by convenience, and with the coil perfectly close or dense. In testing the same to determine its load-bearing capacity, I prefer to load it slightly in excess of its limit of elasticity, so as to give it a permanent elongation of five per centum of the length. A coil open to this extent may be produced in the first place; and a more open coil may be used, if still more reduced elongation in a band of given diameter is desired, but at a sacrifice of flexibility. As manufactured by myself from hardened-steel wire, as aforesaid, the maximum stretch of the steel band within the limits of elasticity does not exceed twelve per cent., and using one-third of the load-bearing capacity, (which I find to be sufficient for ample economy in expense, while it affords threefold security against permanent stretch or breakage,) the stretch of the band in use does not exceed four per cent. in all. Of this I allow one per cent. for stretching by bending the band around the pulleys and three per cent. for stretch between the pulleys. A stretch of one per cent. by bending is the allowance for a tested band on pulleys having a diameter one hundred times that of the band, which proportions I prefer. The band is shown disproportionately large in Fig. 1 to exhibit its construction more clearly. In practice the band is extremely slender in size, corresponding in diameter with the thickness rather than with the width of an equivalent flat belt.

When running on wooden pulleys a steel band, C, of the aforesaid description has the same traction as a leather belt under like tension, and by means of wedge-shaped grooves G, Fig. 3, having sides at an angle of sixty degrees to clamp the band, I obtain the same traction on iron pulleys. Under these circumstances the tension of the band between the pulleys on the driving side is twice as great as that of its loose part; and if the preliminary stretching for traction be one and one-half per cent., (I allow one and six-tenths per cent.,) if that of the driving side should reach three per cent., (the maximum,) the slip or loss of velocity would be only $3-1\frac{1}{2}=1\frac{1}{2}$ per cent., and consequently not more than that of a leather belt on a standard pulley. By cutting the grooves on a reduced angle the tension of the band may be reduced.

One of my steel bands C on an iron pulley, B′, Fig. 4, having a wedge-shaped groove, G′, with sides at an angle of thirty degrees, has the same traction as that of a leather belt on a standard pulley, with the tension of the former only half that of the latter. By rendering a light tension sufficient the strain on the bearings of the shafts, with the resultant friction and wear, is correspondingly reduced, and in this respect my improved bands and pulleys possess a highly important advantage over ordinary belts and pulleys in the transmission of high rates of power.

I provide the requisite variety of bands and pulleys for transmitting the various rates of power, from the lowest to the highest, chiefly by means of pulleys having series of grooves accommodating two or more bands of a given size, as illustrated by Figs. 3 and 4. I thus avoid the expense of carrying in stock the numerous sizes of bands which would otherwise be required, and at the same time provide for multiplying the capacity of a size of wire easily coiled up to the requirements of the heaviest machinery. I also thus obviate using very large drums and pulleys, while the great strength of my steel bands in proportion to their thickness insures narrow pulleys, and the requisite number of bands to transmit a given rate of power can be furnished considerably cheaper than an equivalent leather or rubber belt.

My elastic steel bands, employed in series, possess an important additional advantage in the facility they afford for repairs. Not more than one of the series will usually fail at one time, and this can be repaired or replaced by a new one without disturbing the remainder. Employed in series or singly, another additional advantage consists in their durability. Made of hardened steel, their wear is inappreciable. They are not affected, like leather, by the dryness or dampness of the air in which they are used, and they are not liable to be accidentally cut, nor to be thrown off the pulleys.

As substitutes for cotton bands in driving the fast-running spindles of spinning machinery and the like, my steel bands will be found to possess an important additional advantage in their freedom from dust.

Wire of phosphor-bronze or other known metals or alloys which may be found to possess in a good degree the strength, durability, and form-retaining quality of hardened-steel wire are considered equivalents of the latter, and elastic bands of such wire, constructed as herein described, are considered equivalents of my elastic steel bands.

I do not claim herein the use or employment of ordinary spiral springs as material for bands for transmitting power, nor the use of grooved pulleys, broadly considered; but

I claim as new and of my own invention—

1. As an improvement in means for transmitting power, the within-described elastic steel band, the same being composed of steel wire in the form of a substantially dense or close spiral coil having an outer diameter substantially three times that of said wire, as shown and specified, for the purposes set forth.

2. An elastic steel band composed of suitable wire in the form of a substantially dense or close spiral coil having an outer diameter substantially three times that of said wire, in combination with a pair of iron pulleys having wedge-shaped grooves with sides at an angle not exceeding sixty degrees, forming the bearings of said band, as improved means for transmitting power between rotary shafts without excessive slip and without excessive shaft-pressure, as herein set forth.

3. The combination of a series of independent elastic steel bands, substantially as herein specified, and a pair of pulleys, each constructed with a series of parallel circumferential grooves, of wedge shape, to receive said bands, as shown, for the purposes set forth.

ANTHONY JAROLIMEK.

In presence of—
WILLIAM HÜNING,
VERNER S. TINGLEY.