(No Model.) 2 Sheets—Sheet 1.

T. D. HOLLICK & W. E. RICKARD.

APPARATUS FOR THE TRANSMISSION OF POWER.

No. 381,138. Patented Apr. 17, 1888.

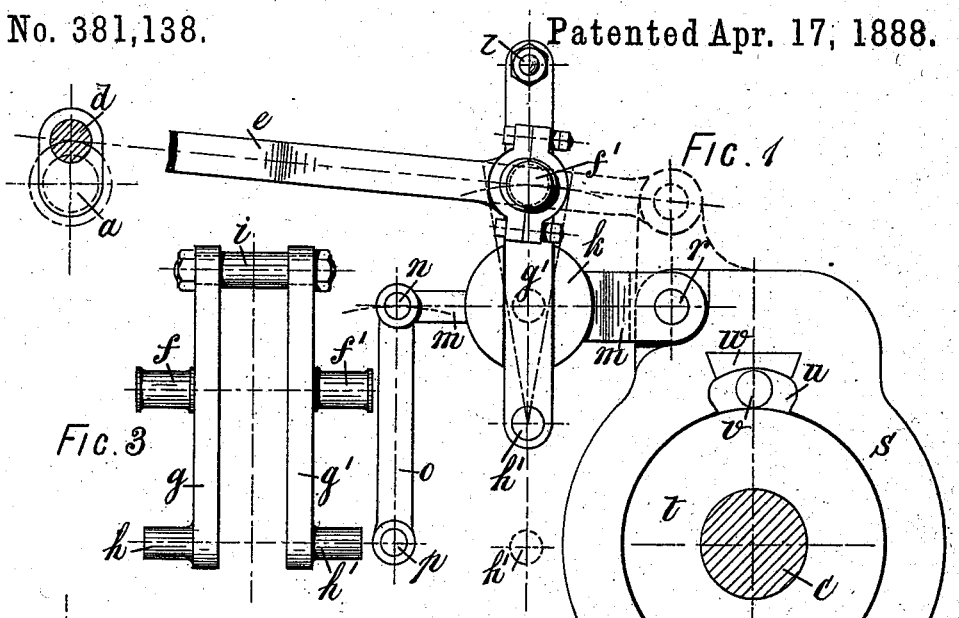

FIG. 1

FIG. 3

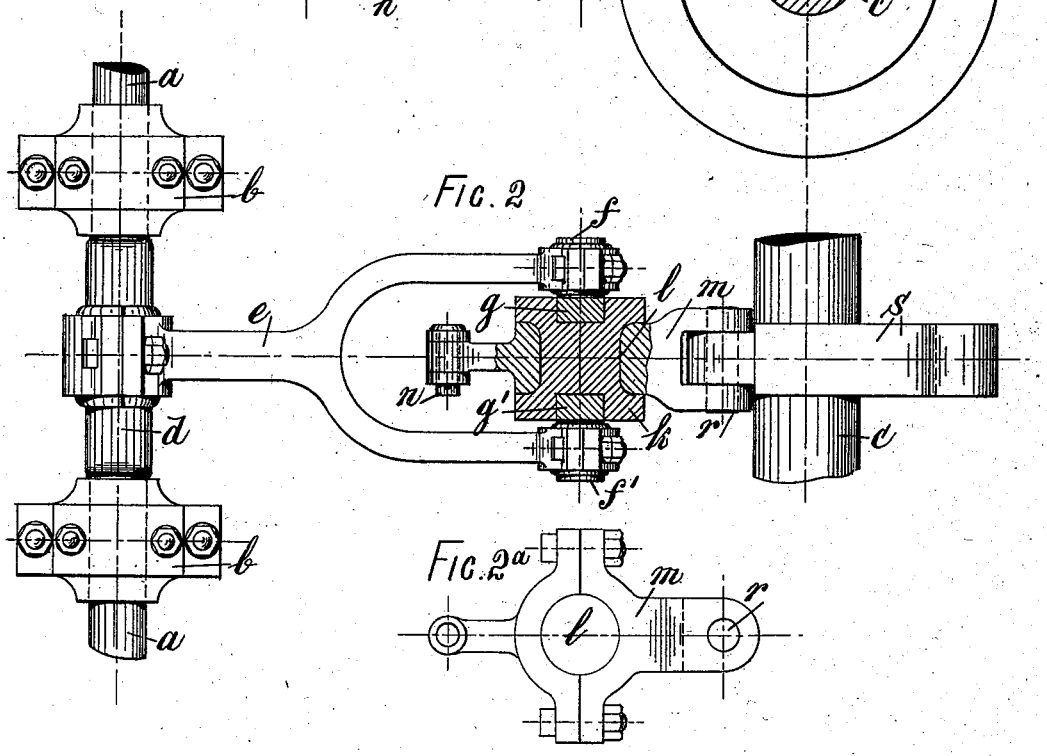

FIG. 2

FIG. 2a

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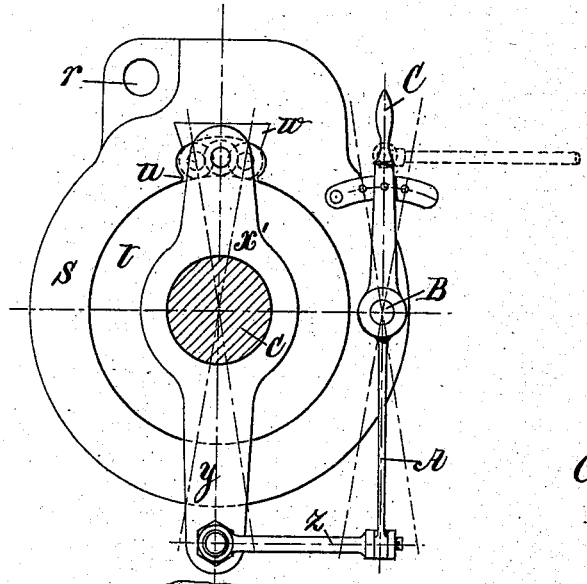
FIG. 4



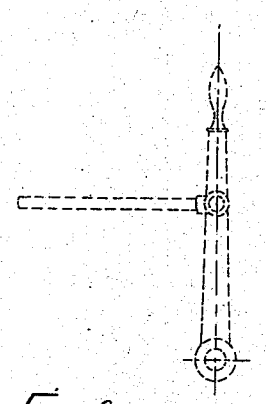


FIG. 5

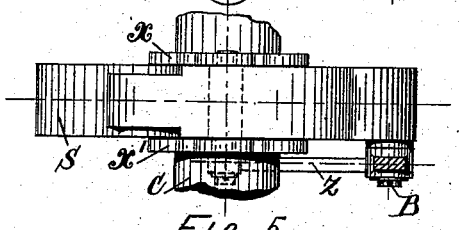
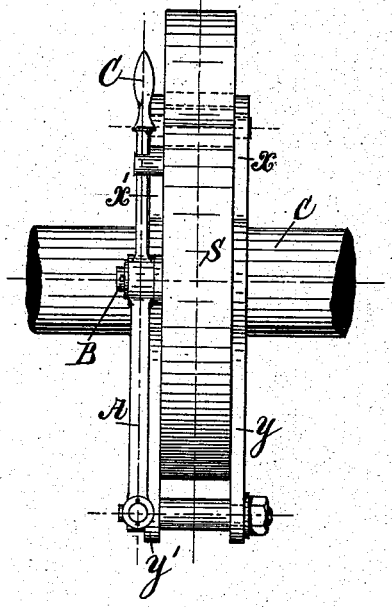


FIG. 6



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UNITED STATES PATENT OFFICE.

THOMAS DRAKE HOLLICK AND WILLIAM EDWARD RICKARD, OF LONDON, COUNTY OF MIDDLESEX, ENGLAND.

APPARATUS FOR THE TRANSMISSION OF POWER.

SPECIFICATION forming part of Letters Patent No. 381,138, dated April 17, 1888.

Application filed August 8, 1887. Serial No. 246,380. (No model.)

To all whom it may concern:

Be it known that we, THOMAS DRAKE HOLLICK and WILLIAM EDWARD RICKARD, engineers, subjects of the Queen of Great Britain, residing in London, in the county of Middlesex, England, have invented certain new and useful Improvements in Apparatus for the Transmission of Power; and we do hereby declare the following to be a full, clear, and exact description of the invention, reference being had to the accompanying drawings, which form part of this specification.

Our invention relates to improvements in machinery or apparatus for transmitting power from a driving-shaft revolving at a greater speed to another shaft which is to be driven at a reduced speed—as for instance, from the shaft of an electric motor to the driving-axle of a tram-carriage which it is desired to propel by such electric motor.

The objects of our improvements are to provide means by which the driving-shaft and the driven shaft or axle are readily connected together, so that the relative speed of the latter may be capable of easy and rapid variation and its direction of movement reversed or its revolution stopped without any interference with the movement of the driving-shaft. We attain these objects by means of mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical transverse section through a driving-shaft and through a parallel shaft which is to be driven by it. Fig. 2 is a plan of the same. Fig. 2ª is a detail view of a recessed connecting-rod, *m*, hereinafter described. Fig. 3 is an end view of part of the apparatus. Fig. 4 is a transverse vertical section through the driven shaft; Fig. 5, a plan, and Fig. 6 an end view, of the same, showing the apparatus by which we vary the speed and reverse the direction of rotation of the driven shaft when required without interfering with the driving-shaft or motor.

Similar letters refer to similar parts throughout the several views.

a is the driving-shaft of an electric or other motor, revolving continuously in either direction and at a high speed in suitable bearings, *b*, and *c* is the shaft (for instance, the driving-axle of a tram-car) which is to be driven at a reduced speed and its speed varied, as desired, or its rotation reversed or stopped, as desired; without interfering with the driving-shaft *a*.

The driving-shaft *a* is provided with a crank, *d*, or eccentric or other equivalent device, by which a short reciprocating movement backward and forward is given to the connecting-rod *e*, the other end of which is forked and jointed to pins *f f'* upon vertical bars *g g'*, which are provided at their lower ends with pins *h h'*, upon which the bars *g g'*, when the shaft *a* revolves, oscillate, their upper ends being connected and stayed by the bolt and stay *i*. The bars *g g'* fit in corresponding vertical grooves in the block *k*, the center of which is cylindrical and turns freely in a corresponding eye, *l*, in the connecting-rod *m*, (shown separately in Fig. 2ª,) one end of which is jointed at *n* to a radius rod, *o*, turning upon a fixed center, *p*, so that the point *n* is compelled to move in a path approaching a horizontal line. The other end of the connecting-rod *m* is jointed at *r* to the strong ring or hoop *s*, which fits freely upon the ring *t*, formed or fixed upon the shaft or axle *c* which is to be driven. The ring *s* is provided in its inner circumference with one or more recesses, *u*, of slightly greater height at the center than at the ends, as shown, into which is introduced a roller or friction-piece, *v*, which at the center of the recess, as shown in Fig. 1, is free, but near the ends of the recess becomes jammed between the edge of the ring *t* and the steel piece *w*, which forms the outer side of the recess, as indicated in Fig. 4. If, therefore, the roller *v* be forced toward either end of the recess *u*, while the ring or hoop *s* is made to oscillate backward and forward upon the ring *t* by the connecting-rod *m*, the movement of the latter in one direction will grip the roller *v* between the ring *s* and the ring *t*, and will cause the latter, together with the shaft *c*, to turn round with it, while in the other direction the roller will be released and the ring *s* will move back freely. The ring *t* and shaft *c* will therefore receive a succession of short impulses in the same direction and will re-

volve in that direction. If the roller *v* be forced toward the other end of the recess *u* instead of the one just described, it will be gripped against the ring *t* during the back-stroke of the ring *s* instead of its forward one, and the direction of rotation of the shaft *c* will be reversed, while if the roller *v* be kept in the central wider part of the recess it will not grip the ring *t*, and the latter, with the shaft *c*, will cease to be rotated in either direction, but is quite disconnected from the driving devices and can revolve perfectly freely.

In order to vary the stroke of the connecting-rod *m*, and consequently the speed of rotation in either direction of the shaft *c*, the joints *h h'*, upon which the vertical bars *g g'* turn, are raised or lowered, as desired, the bearings which carry them moving vertically in guides or being carried at the end of an adjustable lever.

If the joints *h h'* be raised until they are concentric with the center of the block *k*, the connecting-rod *m* will evidently cease to oscillate, while if they are lowered until the pins *f f'* are concentric with the block *k* the latter and the connecting-rod *m* will have a stroke equal to that of the connecting-rod *e*, and at any intermediate point the stroke of the connecting-rod *m* will be varied as may be desired.

In order to adjust the position of the roller *v* in the recess *u* for the purpose of starting, reversing, or stopping the shaft *c*, it is provided with pivots at its ends turning in holes or bearings in plates *x x'*, which fit freely upon the axle *c* upon each side of the ring *t*, as shown in Figs. 4, 5, and 6. The plates *x x'* are provided with arms *y y'*, which are connected below by a connecting-rod, *z*, to a lever, A, which turns upon a center, B, carried by the oscillating ring *s*. By moving the handle C of the lever A in either direction, which can be readily done even when they are very rapidly oscillating backward and forward, the roller *v* can be brought toward either end of the recess *u*, the shaft *c* being caused to revolve in the corresponding direction, or it can be retained at the center of the recess, as shown in Fig. 4, and the transmission of motion to the shaft *c* then ceases.

The lower end of the lever A may be made somewhat flexible and elastic, and instead of the handle being formed upon the lever it may be arranged at any distance and connected to the lever by a connecting-rod, as shown in dotted lines in Fig. 4.

If it should not be required that the speed of rotation of the shaft *c* should be varied, but only that it should be started, stopped, or reversed when required, the connecting-rod *e* may be jointed directly to the ring *s*, as shown in dotted lines in Fig. 1, the bars *g g'*, block *k*, and connecting-rod *m* being omitted.

When the motor-shaft *a* is set in rapid rotation in either direction, it communicates a reciprocating movement to the connecting-rod *e* by means of the crank *d*, and this reciprocating movement is transmitted to the ring *s* by means of the bars *g g'* and the connecting-rod *m*.

The reciprocating movement of the ring *s* is converted into an intermittent rotating movement of the shaft *c* by means of the roller *v* and the curved recess *u* in the ring *s*, the direction of such rotating movement being determined by the position of the roller *v* near one or other end of the recess *u*.

Where the shaft *c* is provided with a fly-wheel or sets in movement a heavy weight—such, for instance, as a tram-car—its intermittent rotating movement becomes continuous, and to insure such continuous movement it is evident that two or more rings, *t*, and rings *s* may be used, actuated by a corresponding number of cranks, *d*, set at equal distances round the motor-shaft *a*.

In order to vary the speed of the shaft *c* without altering that of the motor-shaft *a*, the center *h* is raised or lowered, the length of reciprocating movement of the ring *s* being lessened or increased, as already described; and in order to reverse the direction of rotation of the shaft *c* without interfering with that of the motor-shaft *a* the roller *v* may be made to approximate to one or other end, as desired, of the recess *u* by means of the plates *x x'*, carrying the ends of the roller *v*, and the lever A, connecting-rod *z*, and handle C, as hereinbefore described.

Our invention is applicable to various purposes—as, for instance, the transmission and regulation of power for driving cranes by electric motors, steam, or other means, or, as already mentioned, for driving tram-cars by electromotors. The machinery to be driven may be connected to the shaft *c* by beveled or other toothed gear, or by pulleys and belts, if advisable.

We are aware that the use of a disk surrounded by a ring having a tapering recess containing a friction-piece, by which rotary motion is communicated to the disk by the reciprocating movement of the ring, is not new, but has already been used in what is known as "silent-feed" mechanism; but

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The combination of the reciprocating connecting-rod *e* with the ring *s*, having recess *u*, tapering at both ends, the roller *v* in said recess, the ring *t*, the shaft *c*, the plates *x x'*, which carry the journals of said roller, the connecting-rod *z*, and the lever A, substantially as set forth.

2. The combination of the reciprocating connecting-rod *e* with the ring *s*, having recess *u*, tapering at both ends, the roller *v* in said recess, the ring *t* within said ring *s*, the shaft *c*, and the plates *x x'*, in which said roller is journaled, the rocking of said plates in one direction or the other determining the position of said roller and the direction of rotation of shaft *c*, substantially as set forth.

3. The connecting-rods *e* and *m*, the block *k*, and the vertical bars *g g'*, having the pins *h h'*, on which said bars turn, in combination with a shaft, *c*, and intervening connections for transmitting motion, said block being journaled in connecting-rod *m*, and said bars *g g'* being adapted to be raised or lowered in recesses of said trunnion to regulate the amount of motion transmitted, substantially as set forth.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

THOMAS DRAKE HOLLICK.
WILLIAM EDWARD RICKARD.

Witnesses:
EDMUND EDWARDS,
ARTHUR E. EDWARDS.