A. TOSCO & A. CAMINO.

ENGINE.

APPLICATION FILED SEPT. 25, 1911.

1,024,379.

Patented Apr. 23, 1912.

2 SHEETS—SHEET 1.

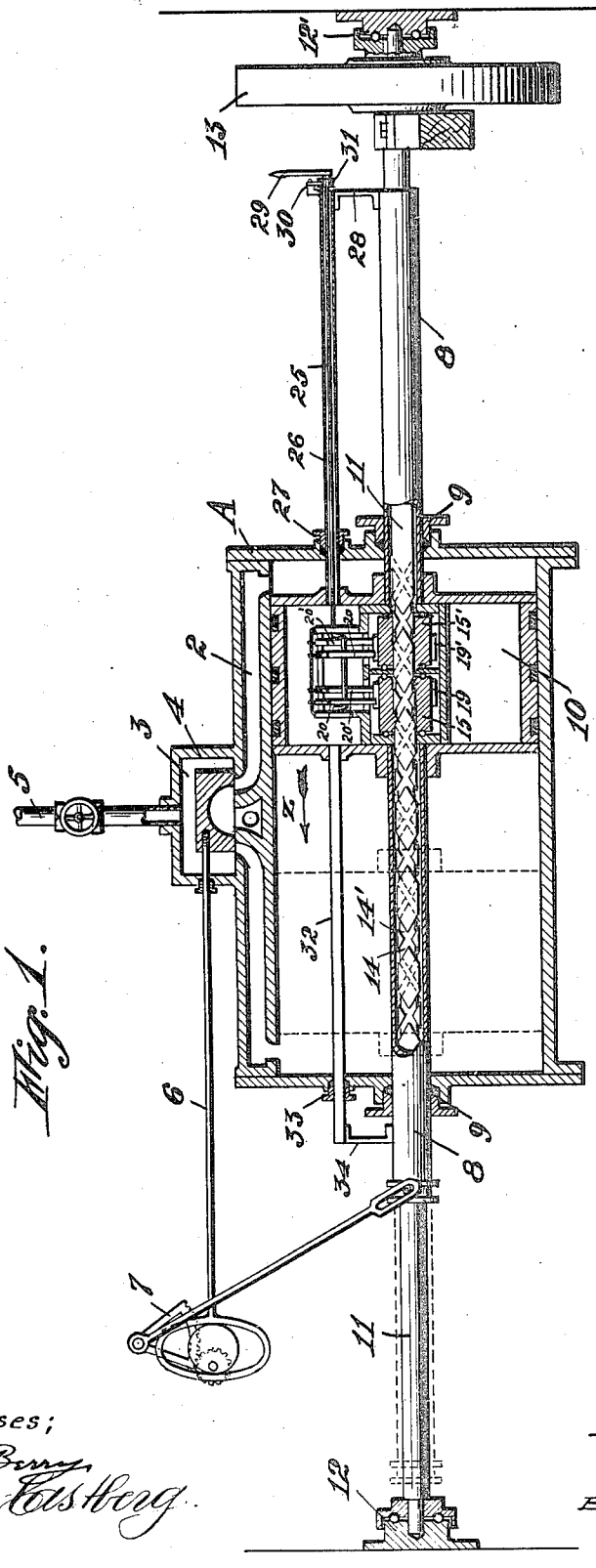

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 3.

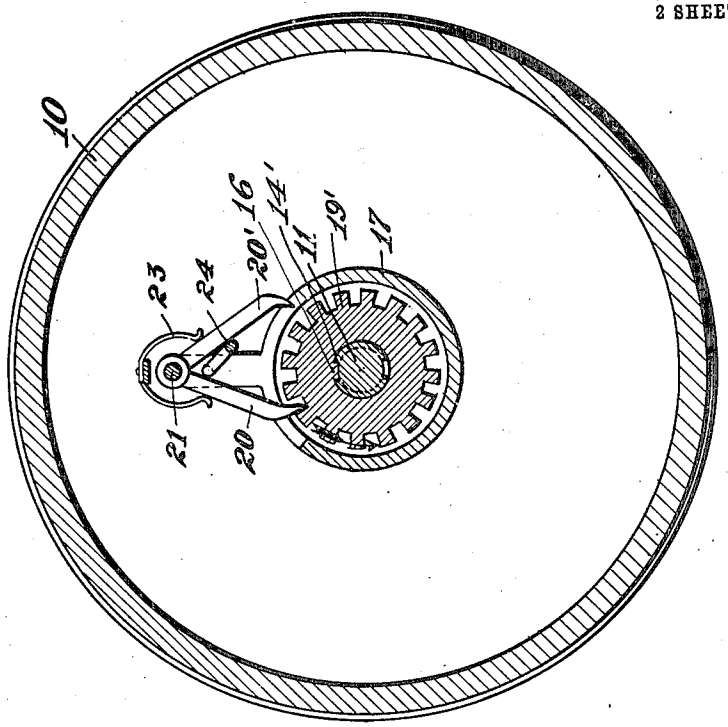
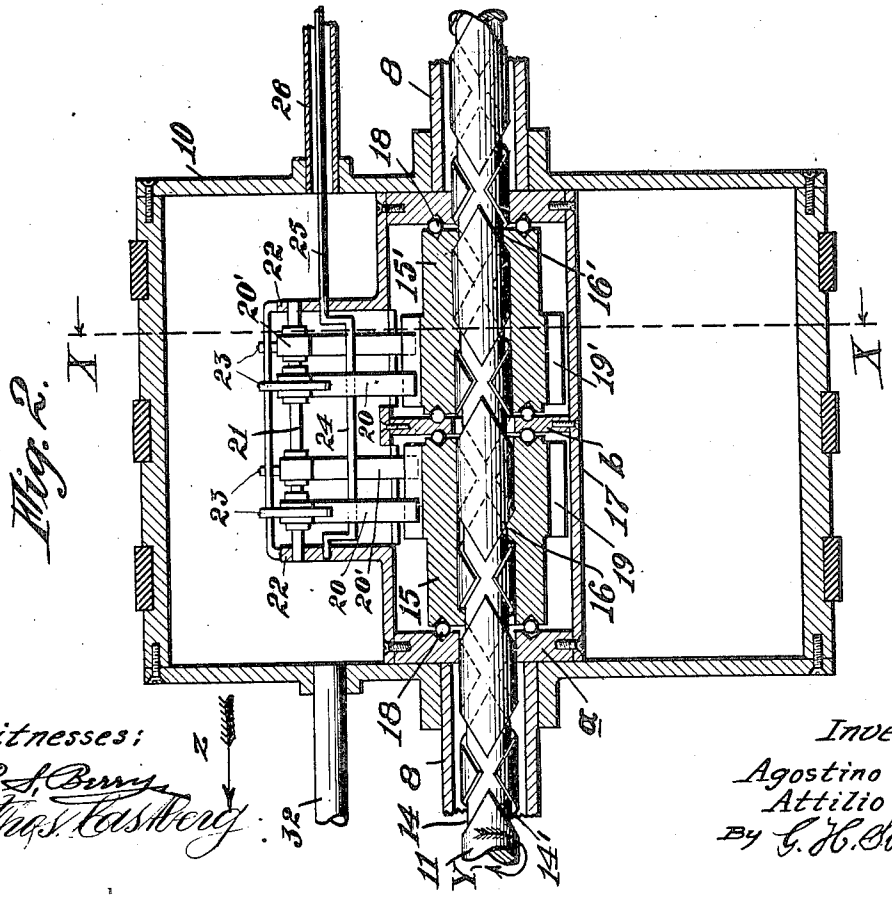


Fig. 2.



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UNITED STATES PATENT OFFICE.

AGOSTINO TOSCO AND ATTILIO CAMINO, OF SAN FRANCISCO, CALIFORNIA.

ENGINE.

1,024,379. Specification of Letters Patent. Patented Apr. 23, 1912.

Application filed September 25, 1911. Serial No. 651,034.

To all whom it may concern:

Be it known that we, AGOSTINO TOSCO and ATTILIO CAMINO, subjects of the King of Italy, and both residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Engines, of which the following is a specification.

This invention relates to a steam engine, and particularly pertains to a direct drive reciprocating engine.

It is the object of this invention to provide means in a reciprocating engine by which the alternate rectilinear motion of a piston produces a continuous rotary movement of a shaft, and which means is arranged within the engine cylinder so as to drive the shaft direct.

Another object is to provide a simple and efficient means whereby the direction of rotation of the shaft may be easily reversed.

Further objects of this invention will be disclosed in the following specification.

The invention consists of the parts and the construction and combination of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of the invention partly in elevation and partly in diagram. Fig. 2 is an enlarged section of the piston showing the mechanism for converting an alternate reciprocating motion of the piston into a continuous rotary motion of a shaft, and illustrating the device by means of which the direction of rotation of the shaft may be reversed. Fig. 3 is a section on the line X—X of Fig. 2.

In the drawings, A represents the engine cylinder, which is provided with the usual steam passages 2 opening at their outer ends into each end of the cylinder and terminating in a valve casing 3 at their inner ends. In the casing 3 is mounted a D-valve 4 to control the flow of steam from a supply pipe 5 to and from the passages 2 and the cylinder A, as is common in steam engine construction. The D-valve 4 is designed to be reciprocated by means of a rod 6 actuated by any suitable valve-gear, such for instance, as indicated in diagram at 7, which is controlled by the action of a reciprocating tubular piston-rod 8 which extends longitudinally through the cylinder A centrally thereof; the piston-rod 8 passing through stuffing-boxes 9 in the end plates of the cylinder A as shown in Fig. 1.

The piston-rod 8 is divided intermediate its ends and is attached to a hollow piston 10 arranged within the cylinder A and adapted to be reciprocated by the steam pressure admitted to the interior of the cylinder A through the passages 2 in the usual manner; the rods 8 being such length as to extend a short distance beyond the ends of the cylinder A at all times.

Extending lengthwise through the tubular piston-rod 8 and the hollow piston 10 and revoluble therein is a drive-shaft 11, the outer ends of which are supported in end-thrust bearings 12—12′. Mounted on the drive-shaft 11 adjacent the bearing 12′ is a fly-wheel 13.

The portion of the shaft 11 which lies within the cylinder A is provided with crossed spiral grooves 14—14′, as particularly shown in Fig. 2, and mounted within the piston 10 is a pair of sleeves 15—15′ which surround the shaft 11 and have spiral ribs 16—16′ on their inner walls which engage the spiral grooves 14—14′ respectively; the sleeve 15 thus being adapted to travel on the shaft 11 in engagement with the spiral groove 14, while the sleeve 15′ will travel on the shaft 11 in engagement with the spiral groove 14′.

The sleeves 15 and 15′ are inclosed within a cylinder 17, disposed within the piston 10, and which cylinder is closed at its ends by means of end plates *a* and is provided with a partition *b*, arranged between the adjacent ends of the sleeves 15—15′; the cylinder 17 being rigidly mounted within the piston 10 by attaching the end plates *a* of the cylinder 17 to the end plates of the piston 10.

The ends of the sleeves 15—15′ are provided with annular grooves, and corresponding grooves are formed on the adjacent faces of the end plate *a* and the partition *b;* these grooves forming runways for ball-bearings 18 which form anti-friction, end-thrust bearings for the sleeves 15—15′.

Means are provided for preventing rotation of the sleeves 15—15′ in either direction, and are here shown as consisting of square ratchet teeth 19—19′ formed on the sleeves 15—15′ respectively and two pairs of pawls 20—20′ which are pivotally mounted on a fixed shaft 21, supported on standards 22, mounted on the upper side of the cylinder 17. The pawls 20—20′ extend

through a slot formed in the cylinder 17; the pawls 20—20 engaging the ratchet teeth 19—19′ on one side of the vertical center of the sleeves 15—15′, while the pawls 20′—20′ are adapted to engage the ratchet teeth 19—19′ on the opposite side of the vertical diameter of the sleeves 15—15′, as shown in Fig. 3.

Plate springs 23 bear against the upper or outer faces of the pawls 20—20′ to normally retain them in engagement with the ratchet teeth 19—19′; it being obvious, however, that where the pawls are depended, as shown in the drawings, they would normally gravitate into their engaged position.

Mounted on the standards 22, below the shaft 21 and extending between the pawls 20—20′ is a crank 24, which crank is formed on the rod or shaft 25 extending through a tube or pipe 26 mounted on the end of the piston 10; and which pipe passes through a stuffing-box 27 in the end of the cylinder A, and paralleling the tubular piston rod 8, is attached to the outer end of the latter by means of a standard 28, as shown in Fig. 1, or other suitable fastening. The shaft 25 is designed to be rocked by means of a lever handle 29 mounted on its outer end adjacent to the end of the tube 26, so as to rock the crank 24 to raise either pawls 20 or the pawls 20′ out of engagement with the ratchet teeth 19—19′, as shown in Fig. 3; a pawl 30 on the sleeve 26 engaging a ratchet 31 on the rod 25 in such manner as to retain the latter in a fixed position and thus securely hold the pawls 20 or 20′ in their disengaged position.

A pipe or rod 32 is attached to the piston 10 on the side opposite that on which the tube 26 is mounted and extends through a stuffing box 33 in the end of the cylinder A, and is connected at its outer end to the tubular piston rod 8 by means of a standard 34. The tube 26 and tube 32 extending through the ends of the cylinder A, act to prevent rotation of the piston 10.

In the operation of the invention, steam is admitted to the cylinder A through the passages 2 so as to cause the piston 10 to reciprocate in the manner common to the ordinary and well known steam engine. The piston 10 in traveling in the forward direction indicated by the arrow Z in Figs. 1 and 2, causes the spiral rib 16 on the sleeve 15 to act in the spiral groove 14 on the shaft 11 on the principle of the inclined plane, in such manner as to cause the shaft 11 to revolve in the direction indicated by the arrow Y, Fig. 2; the sleeve 15 being blocked against movement in one direction by means of the pawl 20, to cause the shaft 11 to revolve, while the sleeve 15′ will rotate freely on the shaft 11 under the pawl 20 by reason of the spiral rib 16′ traveling in the spiral groove 14′ on the forward stroke of the piston. On the return stroke of the piston 10, the sleeve 15′ will be blocked against movement by the pawl 20 engaging the teeth 19′ so as to cause the spiral rib 16′ to act on the sides of the spiral groove 14′ in such manner as to continue the rotation of the shaft 14 in the same direction as was traversed by the shaft on the forward movement of the piston; the sleeve 15 then traveling freely beneath the pawl 20 as the spiral rib 16 travels back through the spiral groove 14.

It will be seen, when the pawls 20 are engaged with the ratchet teeth 19—19′, that as the piston 10 is reciprocated the shaft 11 will be rotated continuously in one direction by the alternate action of the spiral ribs 16—16′ in the sleeves 15—15′ on the grooves 14—14′ respectively. When it is desired to reverse the direction of rotation of the shaft 11, the crank 24 is thrown over by the operation of the lever handle 29 in such manner as to allow the pawls 20′ to drop and engage the ratchet teeth 19—19′ and to throw the pawls 20 out of engagement therewith. This blocks the rotation of the sleeve 15 on the rearward stroke of the piston 10 and allows it to move freely on the forward stroke while the sleeve 15′ is blocked against rotation on the forward stroke and is free to revolve on the rearward stroke.

The fly-wheel 13 acts in the usual manner to maintain a uniform and steady rotation of the drive shaft 11; it being employed as a belt pulley if desired to transmit power from the shaft 11. Any other means may be employed, however, for transmitting power from the drive shaft, not necessary to be here shown.

The use of the tubular piston rod 8 prevents the escape of steam from one side of the piston to the other through the spiral groove 14—14′, and the use of the end-thrust bearings 12 on the shaft 11 and end-thrust bearings on the sleeves 15—15′ acts in the usual manner to reduce friction at these points.

Having thus described our invention, what we claim and desire to secure by Letters Patent is—

1. A reciprocating engine, comprising a cylinder, a valve chamber, a slide valve and ports connecting with the cylinder ends, a hollow piston having tubular sleeves extending from its ends through the cylinder heads, a turnable shaft with oppositely crossed spiral grooves between the cylinder heads and exterior thrust bearing, a plurality of sleeves inclosing the shaft within the piston having spiral ribs engaging the spiral of the shaft, a cylinder fixed within the piston and anti-friction bearings between said cylinder and the sleeves, ratchets fixed to the sleeves, pawls suspended upon a shaft

above the center of the piston contained cylinder, and engaging the ratchets upon opposite sides of their centers, and means to disengage either of said pawls from its ratchet.

2. A reciprocating engine, comprising a cylinder, a valve chamber, a slide valve and ports connecting with the cylinder ends, a hollow piston having tubular sleeves extending from its ends through the cylinder heads, a turnable shaft with oppositely crossed spiral grooves between the cylinder heads and exterior thrust bearings, a plurality of sleeves inclosing the shaft within the piston having spiral ribs engaging the spirals of the shaft, a cylinder fixed within the piston and antifriction bearings between said cylinder and the sleeves, ratchets fixed to the sleeves, pawls suspended upon a shaft above the center of the piston contained cylinder, and engaging the ratchets upon opposite sides of their centers, means to disengage either of said pawls from its ratchet, said means including a crank-shaft extending through the piston and cylinder head, and an exterior lever by which the engagement of the pawls and the action of the engine may be reversed.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

AGOSTINO TOSCO.
ATTILIO CAMINO.

Witnesses:
JOHN H. HERRING,
CHARLES EDELMAN.