

N<sup>o</sup> 20,220



A.D. 1910

Date of Application, 30th Aug., 1910

Complete Specification Left, 24th Mar., 1911—Accepted, 30th Aug., 1911

PROVISIONAL SPECIFICATION.

**Improved Means for Converting Reciprocating into Rotary Motion and vice versa.**

I, FREDERICK LAMPLOUGH, of Albany Works, Cumberland Park, Willesden Junction, in the County of Middlesex, Managing Director, do hereby declare the nature of this invention to be as follows:—

5 The invention has for its object improved means for converting reciprocating into rotary motion and *vice versa*, whereby simplicity of construction and improved action are obtained.

10 In carrying my invention into effect, I employ a ring or gymbal provided with trunnions diametrically opposite each other around which it can oscillate. This ring or gymbal is provided on a line at right angles to a line passing through the above trunnions, with ball bearings to receive the trunnions of a ring of cup shape fitted with a flat race ring forming half a ball race. An inclined disc suitably balanced is mounted on a shaft to be rotated and is keyed thereon with capability of being slidden for adjustment. This disc is fitted with a second ball bearing flat race ring of such diameter as to enable it to pass into the aforesaid cup shaped ring where it will bear against balls placed in a cage between the two flat race rings. These two flat race rings are formed with slightly sunk paths for the balls.

15 The inclined disc is formed with a boss fitting the shaft and with a split socket to receive an adjusting sleeve which is screwed onto a screw threaded part of the shaft. When the inclined disc is properly adjusted against the balls it is locked in position on the shaft by a screw screwing towards each other the lugs of the split socket, such latter screw at the same time fitting within a circular groove formed around the adjusting sleeve. By these means the inclined disc and the adjusting sleeve are firmly locked together. The inclined disc and sleeve are locked firmly on the shaft by a locking ring having projections fitting recesses in the end of the adjusting sleeve in combination with a nut and a nut locking washer preferably such as that described in Specification No. 27,870 of the year 1908.

20 By these means the bearing balls are caused to receive and transmit the thrust from and to the flat race rings on exactly opposite sides of the balls thereby avoiding any tendency for the balls to roll outwards and inwards according to the thrust.

30 An oscillating motion is given to the gymbal ring by connecting rods, pin-jointed to lugs on opposite sides of and at equal distances from an axial line passing through the trunnions

35 By applying motive power to the shaft the apparatus above described may be used to communicate by means of the said connecting rods a rectilinear motion to any desired part of machinery.

Dated this 30th day of August, 1910.

40

HARRIS & MILLS,  
Agents.

[Price 8d.]



*Improved Means for Converting Reciprocating into Rotary Motion and vice versa.*

## COMPLETE SPECIFICATION.

**Improved Means for Converting Reciprocating into Rotary Motion and  
Vice versa.**

I, **FREDERICK LAMPLOUGH**, of Albany Works, Cumberland Park, Willesden Junction, in the County of Middlesex, Managing Director, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in, and by the following statement:—

The invention has for its object improved means for converting reciprocating into rotary motion and *vice versa*, whereby simplicity of construction and improved action are obtained, such means being of that type in which an inclined disc is keyed on a shaft and is surrounded by a ball bearing ring provided with trunnions which are mounted in bearings in a frame or yoke, this yoke being pivoted in fixed trunnions at right angles to the first mentioned trunnions, and in which devices it has previously been proposed to arrange ball bearings running in annular grooves between parallel flat races formed respectively on the inclined disk and the trunnioned ring rotatably mounted thereon.

I will describe my invention by the aid of the accompanying drawings, in which:—

Fig. 1 is a plan showing the improved apparatus applied to one end of a shaft.

Fig. 2 is a horizontal section of the same applied to the opposite end of a shaft, and

Fig. 3 is an end elevation.

Figs. 4 and 5 are respectively an elevation and a cross section of the cup-shaped ring.

Figs. 6 and 7 are respectively a vertical section and an end view of the inclined disc.

Figs. 8 and 9 are respectively an end view and a longitudinal section of the adjusting sleeve, and

Figs. 10 to 16 are detail views of the various parts used in locking the inclined disc and sleeve in position on the shaft after they have been adjusted with relation to the cup-shaped ring.

In carrying my invention into effect, I employ a ring or gymbal  $a$ , provided with trunnions  $a^1$  diametrically opposite each other, on which it can oscillate in fixed bearings  $b$ . This ring or gymbal  $a$  is provided, on a diameter at right angles to a line passing through the trunnions  $a^1$ , with ball bearings  $a^2$  to receive the trunnions  $c^1$  of a ring  $c$ . According to the present invention this ring is formed cup shaped and is fitted on its disc-shaped part with a flat race ring  $c^2$  forming half a ball race. An inclined disc  $d$ , suitably balanced, is mounted on a shaft  $A$  required to be rotated, and is keyed thereon with capability of sliding longitudinally of the shaft for adjustment. This disc  $d$  is fitted on its side with a second ball bearing flat race ring  $d^1$ , which is in a plane parallel with the flat race ring  $c^2$ , and is of such diameter as to enable it to pass into the aforesaid cup-shaped ring  $c$ , where it will bear against balls  $e$  placed in a cage between the two parallel flat race rings  $c^2$ ,  $d^1$ . These two race rings are formed with slightly sunk paths for the balls  $e$ . The inclined disc  $d$  is formed with a boss  $d^2$  fitting the shaft  $A$ , and with a split socket  $d^3$  to receive an adjusting sleeve  $f$ , which is screwed onto a screw threaded part of the shaft  $A$ . When the inclined disc  $d$  is properly adjusted towards the balls  $e$ , it is locked in position on the sleeve  $f$  by a screw  $g$ , screwing towards each other the lugs  $d^3$  of the split socket  $d^3$ , such screw  $g$  at the same time fitting

[L.S. 2024]

Improved Means for Converting Reciprocating into Rotary Motion and vice versa.

within a groove  $f^1$  formed around the adjusting sleeve  $f$ . By these means the inclined disc  $d$  and the adjusting sleeve  $f$  are firmly locked together. The inclined disc  $d$  and sleeve  $f$  are locked firmly on the shaft A by a locking ring  $h$ , see Figs. 10 and 11, having projections  $h^1$  fitting recesses  $f^2$  in the end of the adjusting sleeve  $f$ , and projections  $h^2$  fitting keyways in the shaft A.

The locking ring  $h$  is used in combination with a lock nut  $i$  and a nut locking washer  $j$ , preferably such as those described in Specification No. 27,870 of the year 1908, and shown separately at Figs. 12 to 16. The lock nut  $i$  has recesses  $i^1$  on its outer face, and the nut locking washer  $j$  has integral there- with a tongue  $j^1$  which enters a groove on the shaft A, in which groove it is retained by the lock nut  $i$ , and such tongue is finally bent over into one of the recesses  $i^1$  in the lock nut  $i$ .

By the above described means the bearing balls  $e$  are caused to receive and transmit the thrust from and to the flat race rings  $e^2$ ,  $d^1$ , on exactly opposite sides of the balls, thereby avoiding any tendency for the balls to roll outwards or inwards according to the thrust.

An oscillating motion is given to the ring or gymbal  $a$  by connecting rods B pin-jointed to lugs  $a^3$  on opposite sides of and at equal distances from an axial line passing through the trunnions  $a^1$ .

By applying motive power to the shaft A, the apparatus above described may be used to communicate, by means of connecting rods B, a rectilinear motion to any desired machinery or apparatus.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. Means for converting reciprocating motion into rotary motion and *vice versa*, comprising a gymbal trunnioned in fixed bearings, a ring trunnioned in said gymbal, an inclined disk fixed on a shaft and surrounded by said trunnioned ring, and balls located between the trunnioned ring and inclined disk and acting to impart thrust from one to the other in a direction at right angles to the faces of such parts, characterized by the trunnioned ring being of cup form, a flat race ring fitted into the trunnioned ring, another flat race ring carried by the inclined disc and of such diameter that it will pass into the cup shaped ring, slightly sunk paths on said flat race rings, and balls located between such flat race rings, substantially as shown and described.

2. Means for converting reciprocating motion into rotary motion and *vice versa* as above claimed, characterized by the inclined disk being keyed on the shaft with capability of adjustment longitudinally thereon towards the balls between it and the trunnioned cup-shaped ring, a boss on said inclined disc fitting the shaft, a split socket on the inclined disc, an adjusting sleeve entering said socket and capable of being screwed along the shaft, a screw to draw the lugs of the split socket towards each other, and an annular groove around the adjusting sleeve in which such screw fits.

3. Means for converting reciprocating motion into rotary motion and *vice versa* as claimed in Claims 1 and 2, characterized by the adjusting sleeve having recesses on its outer end, a locking ring having lateral projections which enter said recesses and inner projections which enter grooves in the shaft, and a locking nut and nut locking washer, substantially as herein shown and described.

Dated this 24th day of March, 1911.

HARRIS & MILLS,  
23, Southampton Buildings, London, W.C., and at  
Sheffield and Llanelly,  
Agents.

SHEET 1

SHEET 2

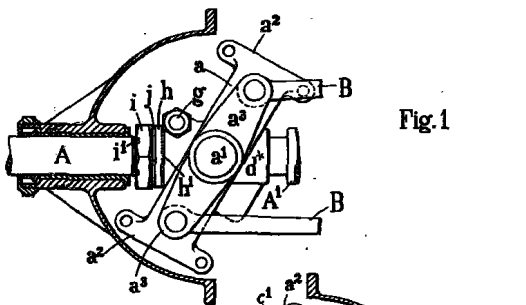


Fig. 1

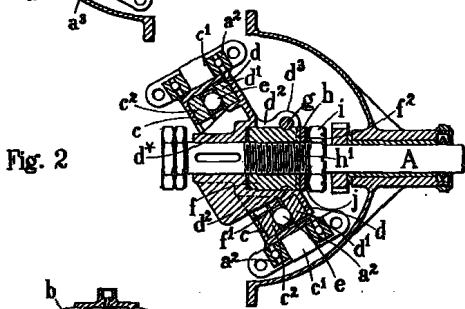


Fig. 2

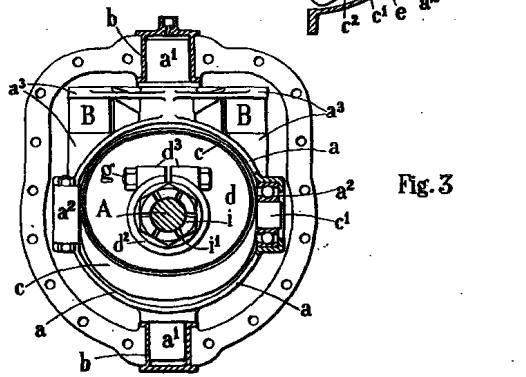


Fig. 3

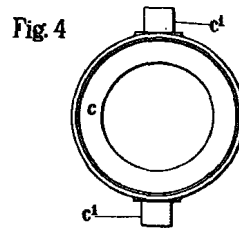


Fig. 4

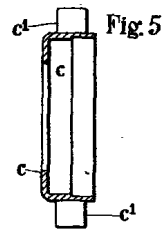


Fig. 5

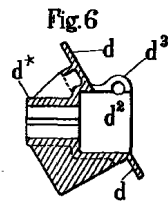


Fig. 6

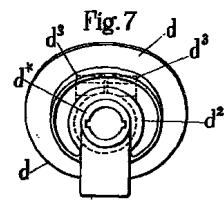


Fig. 7



Fig. 8

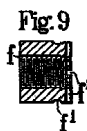


Fig. 9



Fig. 10

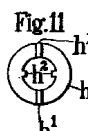


Fig. 11

Fig. 13



Fig. 12

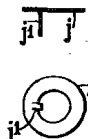


Fig. 14

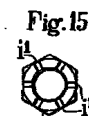


Fig. 15

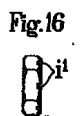


Fig. 16

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[This Drawing is a reproduction of the Original on a reduced scale.]

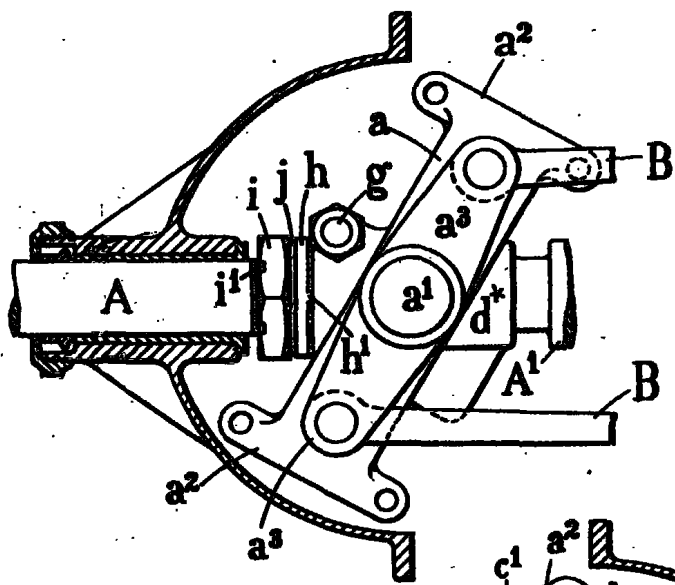


Fig. 1

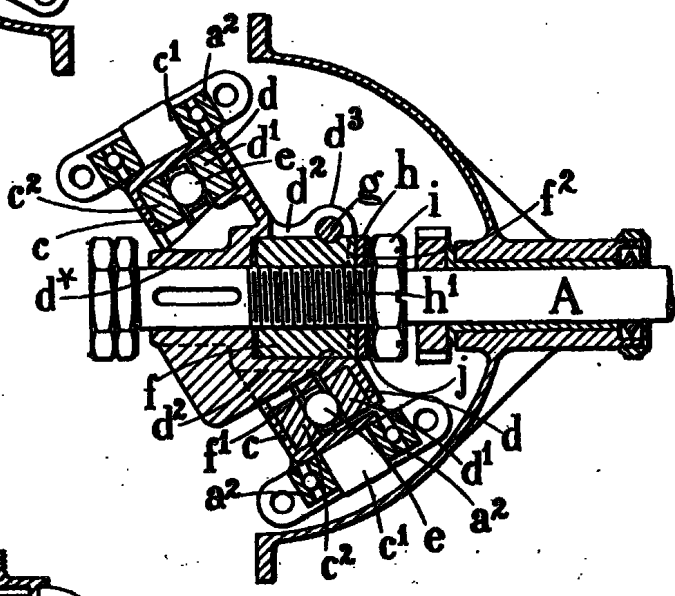


Fig. 2

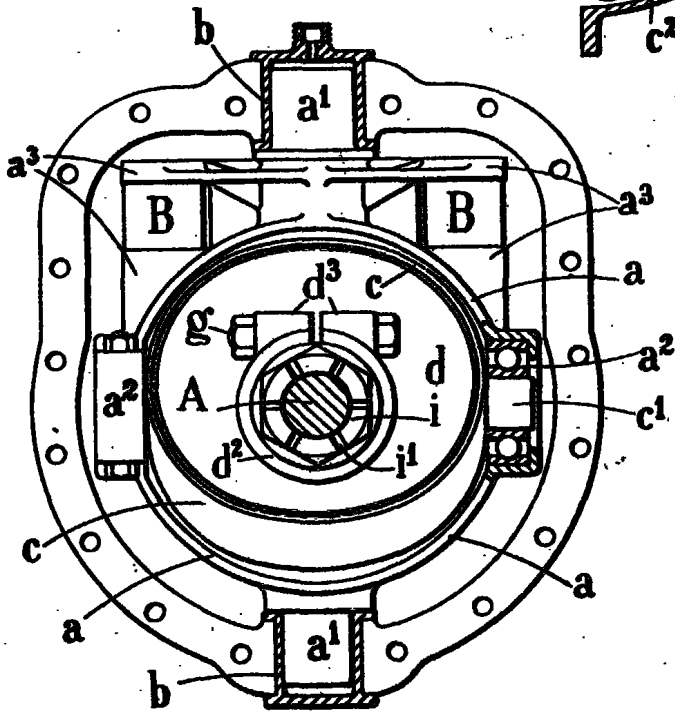


Fig. 3

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 4

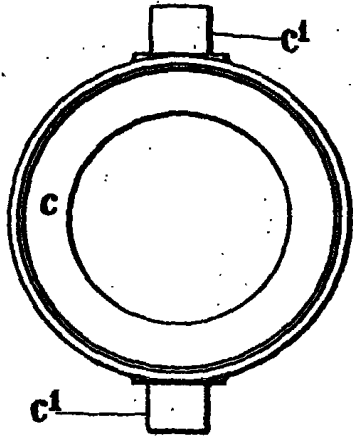


Fig. 5

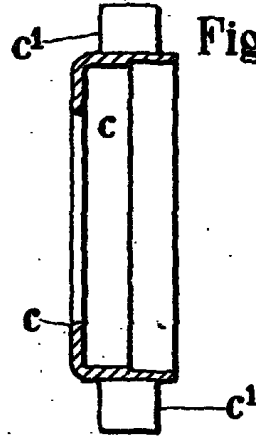


Fig. 6

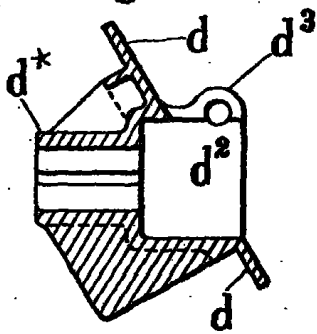


Fig. 7

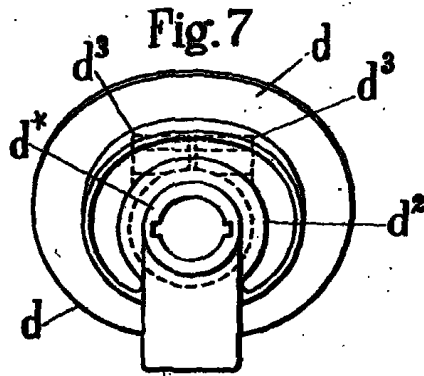


Fig. 8

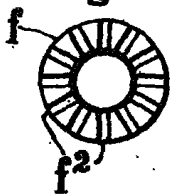


Fig. 9

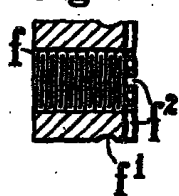


Fig. 10



Fig. 11

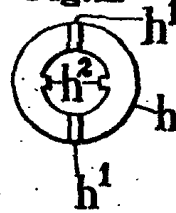


Fig. 13



Fig. 12

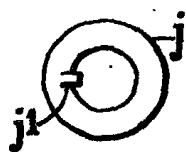


Fig. 14

Fig. 15

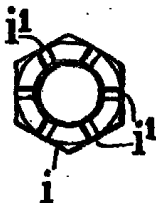
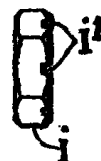


Fig. 16



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