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PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

An Improved Method and Means for Transmitting Power from Prime Movers such as Internal Combustion Engines to Driven Shafts, particularly for Locomotives or other Vehicles Driven by Internal Combustion Engines.

I, GEORGE CONSTANTINESCO, of "Carmen Sylva", Beechwood Avenue, Oatlands Park, Weybridge, in the County of Surrey, a subject of the King of Great Britain and Ireland, do hereby declare the nature of this invention to be as follows:—

The present invention relates to an improved method and apparatus for transmitting power from internal combustion engines or other prime movers developing constant torque to driven shafts, and is particularly applicable to locomotives or other vehicles driven by internal combustion engines.

The invention is also of general application where the prime mover is an internal combustion engine or other engine giving substantially constant torque and the torque to be overcome at the driven shaft is variable.

The object of the invention is to transmit power from the engine to the driven shaft in such a manner that increased resisting torque at the driven shaft may result in an increase of engine speed, so that the power developed by the engine does not decrease with increased resistance.

The invention consists broadly in a method and means for transmitting power from such a prime mover for example an internal combustion engine, utilising the inertia of suitably arranged masses in such a manner that the engine speed is not unduly decreased with increase of the resisting torque.

The invention also consists in a power unit comprising in combination an internal combustion engine whose shaft is connected to one point in an oscillating member, which at another point carries or is connected to a heavy mass, such oscillating member being connected to a device converting the oscillating motion to rotary motion in one direction.

The invention also consists in a variable resistance power unit comprising an internal combustion engine whose shaft is connected by an eccentric and strap to a link, the link being pivoted to a flywheel capable of oscillation, and also connected by two connecting rods with two opposed oscillating ratchet devices driving a rotor in one direction, such rotor being connected to the driven shaft.

The invention further consists in the improved method and means for transmitting power from internal combustion engines hereinafter described.

In a simple form of the invention there may be provided a lever one end of which is caused to move by an eccentric on a rotating driving shaft and which carries at its other end a mass. An intermediate point of the lever is connected to a driven shaft through two connecting rods actuating ratchet devices by which the oscillating movement of the lever is converted to a rotary movement in one direction the ratchet devices operating at each half revolution of the driving shaft.

With such an arrangement it will be seen that if the resistance to rotation of the driven shaft is small the mass on the lever will not move far on each side of its mean position at each oscillation, and the length of travel of the ratchets will be a maximum when the resistance to rotation of the driven shaft is zero.

As the resistance to rotation of the driven shaft increases, the travel of the mass increases, and that of the ratchets decreases; consequently at each revolution of the driving shaft, owing to the smaller angular movement of the ratchets when the resistance is high, the torque required from the prime mover does not increase. Consequently with such an arrangement, if the prime mover is an internal combustion engine; for example, a petrol engine, a constant or increased speed of revolution of the engine can be maintained, although the torque on the driven shaft is increased. In fact it can be shewn mathematically that the torque on the driven shaft is proportional to the square of the speed of the prime mover.

Many modifications of the arrangement are evidently possible.

According to another example as applied to a locomotive drive, an internal combustion engine which should have a rotating flywheel of considerable inertia is arranged with an eccentric on its driving shaft connected by a strap to the centre of a link one end of which is pivoted on a second oscillating flywheel, so that this end of the link oscillates with the flywheel. The other end of the link is connected by two connecting rods with two ratchet members acting alternately on a rotor so as to convert the oscillating motion of the lower end of the link to rotary motion, which is transmitted from the rotor to the road wheels of the vehicle by any suitable resilient drive.

The operation of this device is similar to that in the simple modification first described, and it will be readily seen that by this means a prime mover and transmission system is obtained in which the internal combustion engine may run at a constant speed, or if desired the speed of the engine may be increased to provide more power for overcoming high resisting torques.

Dated the 31st day of August, 1921.

W. GRYLLS ADAMS,
87, Victoria Street, London, S.W.,
Chartered Patent Agent.

COMPLETE SPECIFICATION.

An Improved Method and Means for Transmitting Power from Prime Movers such as Internal Combustion Engines to Driven Shafts, particularly for Locomotives or other Vehicles Driven by Internal Combustion Engines.

I, George Constantinesco, of "Carmen Sylva", Beechwood Avenue, Oatlands Park, Weybridge, in the County of Surrey, a subject of the King of Great Britain and Ireland, 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 present invention relates to an improved method and apparatus for transmitting power from internal combustion engines or other prime movers adapted to develop limited torque to driven shafts and is particularly applicable to locomotives or other vehicles, or to machinery driven by internal combustion engines, steam turbines, electromotors and the like.

The invention is of general application where the prime mover is an internal combustion engine or other engine adapted to develop limited torque and the torque to be overcome at the driven shaft is variable between wide limits.

The object of the invention is to transmit power from the engine to the driven shaft in such a manner that increased resisting torque at the driven shaft may result in an increase of engine speed, so that the power developed by the engine does not unduly decrease with increased resistance.

The invention consists in a method of transmitting power from a prime mover to a shaft which is to be rotated against a variable resisting torque by splitting alternating or sinusoidal motion derived from a steadily rotating shaft into component alternating motions of the same frequency; one component motion being caused to give alternating motion to a mass without absorbing energy, while another is caused to give alternating motion to a pair of unidirectional driving devices working in opposite phase and rotating a shaft.

The invention further consists in a method of transmitting power from a prime mover to a shaft which is to be rotated against a variable resisting torque, by splitting alternating or sinusoidal motion derived from a prime mover into component alternating motions of the same frequency; one component motion being caused to oscillate or reciprocate a mass about a mean position, while another is caused to oscillate a pair of unidirectional driving devices moving in opposite phase and rotating a shaft.

The invention also consists in a method of obtaining variable torque and speed at a driven shaft, consisting in utilising a fixed prime mover whose steady movement of rotation is converted into alternating motion imparted to a floating but non-revolvable lever, one part of which receives such alternating motion, a second part of which is connected to a mass oscillating about a fixed mean position, and a third part of which is connected to a pair of unidirectional driving devices converting positive and negative reactions into rotary impulses acting in one direction on a shaft.

The invention further consists in a method of transmitting power from a steadily rotating prime mover to a shaft which is to be rotated against a variable resisting torque, consisting in utilising a non-revolvable floating lever to split alternating motions given by the prime mover between a suitably arranged mass oscillating or reciprocating about a mean position and unidirectional driving devices rotating the driven shaft.

The invention further consists in a method of obtaining increased torque on a driven shaft from a limited torque prime mover having a steadily rotating crank, consisting in utilising a combination of oscillating but non-revolvable links and levers connected to and receiving negative and positive reactions due to the inertia of suitable non-revolvable masses oscillating or reciprocating about fixed mean positions, the levers and links being also suitably connected to two unidirectional oscillating driving mechanisms, and converting such reactions into rotary impulses in one direction in such a manner that the frequency of the links, levers, and mass is always equal to the number of complete revolutions of the crank of the prime mover, the amplitude of oscillations of the mass being variable and increasing with increase of the ratio between the speeds of the prime mover and the driven shafts, and also decreasing with decrease of such ratio.

The invention further consists in a method of transmitting power from a prime mover to a shaft which is to be rotated against a variable resisting torque, utilising a floating lever to divide alternating impulses given by the prime mover between suitably arranged oscillating or reciprocating mass and unidirectional driving devices rotating the driven shaft, in such a manner that increased resisting torque at the driven shaft may result in an increase of engine speed, and that the power developed by the prime mover does not decrease with increased resistance.

The invention further consists in the apparatus for transmitting power by the methods above set out as hereinafter described.

The invention further consists in the improved method and means for transmitting power from prime movers hereinafter described.

In a simple illustration of the principle of the invention there may be provided a floating lever one end of which is caused to move by an eccentric mounted on a rotating driving shaft and which carries at its other end a mass. An intermediate point of the lever is connected to two connecting rods actuating a driven shaft through two ratchet devices by which the oscillating movement of the floating lever is converted to a rotary movement the ratchet devices operating at each half revolution of the driving shaft.

With such an arrangement it will be seen that if the resistance to rotation of the driven shaft is small, the mass on the lever will not move far on each side of its mean position at each oscillation, and the length of travel of the ratchets will be a maximum when the resistance to rotation of the driven shaft is zero.

As the resistance to rotation of the driven shaft increases, the travel of the mass increases, and that of the ratchets decreases; consequently at each revolution of the driving shaft, owing to the smaller angular movement of the ratchets when the resistance is high, it can be shown that the torque required from the prime mover does not unduly increase. Consequently with such an arrangement, if the prime mover is an internal combustion engine, for example, a constant or increased speed of revolution of the engine can be maintained, although the torque on the driven shaft is increased. In fact it can be shown mathematically that taking into account the inertia opposed by the oscillating mass the torque on the driven shaft is proportional to the square of the speed of the prime mover.

Many modifications of the arrangement are evidently possible; but in order to effect the object of the invention, it is essential that the driving shaft and unidirectional driving connection should be connected to an oscillating or reciprocating member such as a floating lever, at two different points, the lever carrying or being connected to a mass capable of oscillation or reciprocation about a mean position.

In order to obtain stability without special means for maintaining a mean position of the various parts of the gear the forces acting on the oscillating mass should act in a direction away from and not towards its pivot or point of suspension.

Referring to the accompanying diagrammatic drawings:—

Figures 1 to 5 are diagrams showing various possible arrangements for carrying out the invention;

Figure 6 is a diagram showing the forces acting in one form of the mechanism;

Figure 7 is a diagram showing the relative values of the speed of the prime mover, torque on the driven shaft and speed of the driven shaft, when the torque of the prime mover is kept constant;

Figure 8 is a diagrammatic elevation showing one form of mechanism according to the invention;

Figure 9 is a sectional plan of the mechanism;

Figure 10 is a transverse section through the driven rotor;

Figure 11 is an axial section through the same;

Figure 12 is a section through another form of unidirectional driving device which may be employed;

Figure 13 is a section on the line 13—13, Figure 12;

Figure 14 is an end elevation with the ball race removed;

Figure 15 is a section through another form of the apparatus;

Figure 16 is a side elevation partly in section on the line 16—16, Figure 15;

Figure 17 is a section on the line 17—17, Figure 15;

Figure 18 is an axial section through another form of unidirectional drive;

Figure 19 is an elevation of another example of the invention;

Figure 20 is a plan of the same partly in section;

Figure 21 is a front elevation partly in section on the line 21—21, Figure 19.

In the diagram Figure 1 the crank 2 of the driving shaft 1 is directly connected to a floating lever 11 carrying a mass 12; and an intermediate point of the lever is connected by connecting rods 8, 9 to the two unidirectional driving members actuating the rotor 10.

It will be seen that in this case there will be a vertical oscillating movement of the mass as well as a horizontal movement, but this is immaterial if the amplitude of the oscillation of the mass 12 is considerable relative to the length of the crank 2. If desired, to balance the inertia forces, two or more systems as described may be mounted on the same driving and driven shafts, the phase angles between the cranks being suitably selected.

The form shown at Figure 2 is similar but in this case the driving crank 2 is connected to an intermediate point and the connecting rods 8, 9 to the upper end of the floating lever 11.

In the diagram Figure 3, the driving shaft 1 is connected by a crank 2 and connecting rod 3 to the centres of a floating lever 4 whose lower end is connected to a rod 5 carrying a mass 6 and pivoted and suspended at 7. The other end of the floating lever 4 is connected by two connecting rods 8, 9 to two unidirectional driving devices operating alternately to drive the rotor 10 in one direction.

In the form shown in Figure 4 the driving crank 2 is connected to one end of a floating lever 13 which near its centre is connected to a crank 14 on an oscillating flywheel 15 acting as a mass, the other end of the floating lever being connected through the connecting rods 8, 9 to the two unidirectional driving devices acting on the rotor.

In the form shown at Figure 5, the driving shaft 1 is at right angles to the driven shaft 16, the crank 2 being connected by the rod 3 to one end of the floating lever 13, which towards its centre is connected to a crank 14 on an oscillating flywheel 15, the other end of the floating lever 13 being connected by the rods 8, 9 to the two unidirectional driving devices.

In the diagram Figure 6 the driving crank 2 is connected by the rod 3 to the lower end of the floating lever 13 whose upper end is connected to a crank 14 moving with an oscillating flywheel 15. The lever 13 is connected towards its centre by the connecting rods 8, 9 to the unidirectional driving devices driving the rotor 10.

In all the diagrams the fixed pivots are indicated at 20.

It will be seen that in all the diagrammatic arrangements above described, neglecting the inertia of the oscillating mass, the motion of the driving parts is indeterminate; it is accordingly necessary to consider the stability of the system when in motion, as with incorrect positions of the fixed axes and moving pivots the amplitude of the oscillations of the flywheel or pivoted mass may tend to increase indefinitely, the whole system becoming unstable, with the result that jamming and consequent breakage of the linkage will occur.

To illustrate this, the forces acting in the various parts of the apparatus in one example of the invention, are shown in the diagram Figure 6. Considering the equilibrium of the oscillating flywheel 15 it can be shown that the average resultant of the compression forces which are transmitted through the connecting rod 8 will always be between the dotted lines indicated by the arrows a^1, a^4 and the average resultant of the tension forces which are transmitted through the connecting rods 9 will be between the dotted lines indicated by the arrows a^2, a^3. It should be noted that the reverse stresses in the connecting rods 8, 9 are due to inertia of reciprocating parts in the unidirectional drive and are very small in comparison with the driving forces referred to. Consequently in the arrangement shown in this figure the resultant forces acting on the oscillating flywheel 15 will be alternately to left and right and always in the direction away from the axis about which the flywheel oscillates, so that stability of the moving system is maintained.

In the diagram Figure 7, if we consider the speed v of driven shaft as abscissæ, the torque at driven shaft will be approximately represented by the ordinates of the curve z and the speed of the prime mover by the ordinates of the curve w, the torque of the driving shaft being kept constant.

From these curves it can be seen that as the speed of driven shaft gets beyond a certain speed, the torque at the driven shaft tends towards a constant value, and the speed of the prime mover varies in linear proportion with that of the driven shaft very much as in ordinary gear of constant ratio. On the other hand when the speed of the driven shaft diminishes below a certain value, the torque at the driven shaft increases very rapidly and similarly the speed of the prime mover also increases.

In carrying the invention into effect as illustrated in Figures 8, 9, 10 and 11, the prime mover drives the shaft a which carries a flywheel b and is connected by the connecting rod c to the centre of a floating lever d. The upper end of this lever is pivoted at e to a swinging lever f pivoted at x which carries at its lower end a mass g. The lower end of the floating lever is connected by two pairs of connecting rods h k to two double arms l m oscillating about the axis of the rotor. On the oscillating arms at p^1, q^1 respectively are pivoted double circular frames p q carrying pivoted friction pads r s, Figure 10, bearing on the rotor on the side of its circumference remote from the pivots of the frames. The pads r s are adapted to bear on the circumference t of the rotor and grip the rotor in turn so as to drive it always in the direction in which the pads tend to approach the rotor owing to the fact that the pivot of each pad on its frame and the pivot of each frame on its driving arm are situated on a line which does not pass through the centre of the rotor. Further the angle between the diameters on which these pivots are situated is less than the angle of friction at starting with the particular materials used to form the surfaces of the pad and rotor. The lower connecting rods k are under tension and the upper rods h under compression. The pads are of substantial length occupying nearly a quarter of the circumference of the rotor. The springs u serve merely to keep the friction pads in light contact with the rotor on the idle stroke. Accurately placed pins might, however, be employed with or without springs for the same purpose, especially where a yielding material, such as the material known by the registered trade mark "Ferodo", or leather or rubber is used in the pads.

It is desirable in some cases to provide an elastic drive between the rotor and the shaft to be driven as in the two phase form illustrated the torque is intermittent. If considerable inertia on the driven shaft has to be overcome an elastic drive of some type is of importance.

It will be seen that with the apparatus above described, rotation of the driving shaft causes oscillation of the floating lever d and this oscillation can be split into two components and transmitted either to the mass g through the lever f or through the connecting rods h k to the unidirectional device on the rotor. As the speed of the driving shaft is increased, without much load on the driven shaft, the amplitude of oscillation of the mass g decreases and the stroke of the oscillating members driven by the rods h and k increases, thus increasing the speed of the rotor relative to the speed of the prime mover. If the apparatus is started with a heavy resisting torque acting on the driven shaft the swinging mass immediately starts oscillating at its maximum amplitude producing high alternating forces in the connecting rods *h k* the forces being proportional to the square of the speed of the prime mover; so that if the speed of the prime mover is sufficiently increased, the torque on the driven shaft is overcome by the unidirectional mechanism and the driven shaft commences to rotate; until rotation has started no energy is taken up except the amount absorbed by internal frictions. The driven shaft then rotates with corresponding diminution of the movement of the swinging lever, the torque to overcome the resistance at the driven shaft being directly produced by the forces set up in the connecting rods *h k* and proportional to the square of the speed of the prime mover. The relative values of speeds and torque produced by the mechanism are shown approximately in the diagram, Figure 7. It will be seen that many forms of the invention other than that above described are possible and many other forms of mechanism may be adopted in place of the unidirectional driving mechanism illustrated; for example, three mechanisms as described differing in phase from each other by 120 degrees may be provided acting on the same shaft and in this case almost continuous rotation instead of intermittent rotation would be obtained. The unidirectional drive mechanism employed may be of any suitable type. Further, instead of a swinging lever an oscillating flywheel or mass of any shape may be employed.

It will be seen that with a mechanism constructed as above described, vertical movement of either of the centres, that is either of the axis of the rotor, axis of the mass, or axis of the prime mover, will produce very little effect on the motion. Further, slight horizontal movement of these centres also is permissible. Alternating movement of the rotor centre in the horizontal direction will merely serve to slightly increase the speed of the rotor. It is possible, therefore, with such mechanism to allow small variations of the distances between any two of the supporting centres of driving shaft, mass, and driven shaft. This is of extreme convenience in motor vehicles, as parts of the apparatus may be mounted on springs and parts directly on the road wheels if desired.

In the form of unidirectional driving device shown at Figures 12, 13 and 14, the connecting rods from the prime mover are connected to the pins 21, 22 which are carried by sleeve members 2, 24 capable of oscillating about the shaft 25 on ball bearings 27. The friction pads 28, 29 are pivoted at 30, 31 on link members of plate form 32, 22 which are themselves pivoted to the roor members 34, 35 at 36 and 37, these rotor members being keyed to the rotor shaft 25.

In this form of the unidirectional drive the upper friction pad pivoted on the rotor is gripped and driven when the oscillating member 23 moves in the direction of the arrow, the lower pad on the other part of the rotor being gripped and rotated in the same direction during the return oscillation by the oscillating member 24.

In the form of the invention shown in Figures 15, 16 and 17 the prime mover is connected by a connecting rod 41 to one end of the floating lever 42, which for assembly should be made in two parts, pivoted at 43 to the oscillating flywheel 60 which oscillates about the axis 40. The lever is connected at its other end 44 to two connecting rods 45, 46 which oscillate respectively the two drum members 47, 48. The drum members are lined with friction surfaces as shown at 49 which may be of leather, each drum drives one of the two portions 56, 57 of the rotor situated within it; and each rotor carries a pair of friction pads 50, 51 pivoted at the ends of links 52, 53, these links being pivoted on the rotor at 54, 55 and passing through a suitable central space allowed in the rotor.

In this form the direction of movement in which the oscillating member 47 grips the rotor is shown by the arrow in Figure 15.

In another form of the unidirectional driving device, Figure 18, suitable for use in the transmission, the driving of the rotor is effected through face clutches. The connectng rods 61, 62 from the floating lever are pivoted to the oscillating members 63, 64 by pins 65, 66 and drive the rotor 67, 68 through friction plates 69, 70, which are mounted on the spherical members 71, 72. The locking of the device for driving the rotor in one direction is effected by pressure exerted through the slightly inclined rods 73, 74 which press through ball ends against the clutch members 69, 70 and the parts 67, 68 of the rotor which are keyed to the driven shaft by stout pins 75. Springs 76, 77 are provided adapted to keep the members 69, 70 in light contact with the oscillating members 63, 64 during the idle stroke. The actual friction surface may be provided by annular leather, metallic, rubber or like pads giving a considerable gripping surface.

In the form of the invention shown in Figures 19, 20 and 21, the shaft 81 of the prime mover carries a flywheel 82 and is connected by the connecting rod 83 with the floating lever 84. This lever 84 is connected at its other end to the almost vertically moving connecting rods 85, 86 which actuate the oscillating members 87, 88 which are adapted to drive the rotor 89, 90 through inclined rods 91, 92, as described above with reference to Figure 18. The lever 84 is pivoted at 93 to a crank 94 keyed rigidly to the vertical levers 95 pivoted at 96 in the fixed standards 97 and carrying at their lower ends masses 98. A certain freedom is permitted for angular movement at the various pivots at the ends of the connecting rods by making the bearings of curved form as illustrated in order to allow angular play.

It will be seen that in this modification the system is in indifferent dynamic equilibrium so that quite a small force is able to keep the oscillating mass in the mean position. As illustrated gravity effects this, and suitable buffers may be provided to prevent excessive shifting of the mean position of the oscillating mass to one side or the other.

The same object may be effected by arranging springs tending to hold the end of the floating lever connected to the oscillating members in a predetermined mean position.

Also with this form of the invention since all the connecting rods are substantially parallel a unidirectional driving device capable of driving in either direction could be employed.

The invention described above is suitable for traction purposes. The transmission gear, however, will be seen to be applicable to a large number of other purposes in which it is desired to overcome a torque at the driven shaft variable between very wide limits either with a constant torque prime mover, or a prime mover having other characteristics, for example, using the transmission gear for driving rolling mills by steam turbines, internal combustion engines or electric motors. Also, it can be applied to machine tools such as drilling machines, and as a mechanism for gearing down from high speed shafts for various purposes. Many other examples of transmission for which the gear is suitable will naturally present themselves.

Although in apparatus constructed as above described the movement of the oscillating members is approximately harmonic and the movement of the driven shaft is continuous, the shock which would be expected to take place at the instant of gripping will in many cases be sufficiently taken up by the natural give of the system.

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. A method of transmitting power from a prime mover to a shaft which is to be rotated against a variable resisting torque by splitting alternating or sinusoidal motion derived from a steadily rotating shaft into component alternating motions of the same frequency; one component motion being caused to give alternating motion to a mass without absorbing energy, while another is caused to give alternating motion to a pair of unidirectional driving devices working in opposite phase and rotating a shaft.

2. A method of transmitting power from a prime mover to a shaft which is to be rotated against a variable resisting torque, by splitting alternating or sinusoidal motion derived from a prime mover into component alternating motions of the same frequency; one component motion being caused to oscillate or reciprocate a mass about a mean position, while another is caused to oscillate a pair of unidirectional driving devices moving in opposite phase and rotating a shaft.

3. A method of obtaining variable torque and speed at a driven shaft, consisting in utilising a fixed prime mover whose steady movement of rotation is converted into alternating motion imparted to a floating but non-revolvable lever; one part of which receives such alternating motion, a second part of which is connected to a mass oscillating about a fixed mean position, and a third part of which is connected to a pair of unidirectional driving devices converting positive and negative reactions into rotary impulses acting in one direction on a shaft.

4. A method of transmitting power from a steadily rotating prime mover to a shaft which is to be rotated against a variable resisting torque, consisting in

utilising a non-revolvable floating lever to split alternating motions given by the prime mover between a suitably arranged mass oscillating or reciprocating about a mean position and unidirectional driving devices rotating the driven shaft.

5. A method of obtaining increased torque on a driven shaft from a limited torque prime mover having a steadily rotating crank, consisting in utilising a combination of oscillating but non-revolvable links and levers connected to and receiving negative and positive reactions due to the inertia of suitable non-revolvable masses oscillating or reciprocating about fixed mean positions, the levers and links being also suitably connected to two unidirectional oscillating driving mechanisms, and converting such reactions into rotary impulses in one direction in such a manner that the frequency of the links, levers, and mass is always equal to the number of complete revolutions of the crank of the prime mover, the amplitude of oscillations of the mass being variable and increasing with increase of the ratio between the speeds of the prime mover and the driven shafts, and also decreasing with decrease of such ratio.

6. A method of transmitting power from a prime mover to a shaft which is to be rotated against a variable resisting torque, utilising a floating lever to divide alternating impulses given by the prime mover between suitably arranged oscillating or reciprocating mass and unidirectional driving devices rotating the driven shaft, in such a manner that increased resisting torque at the driven shaft may result in an increase of engine speed, and that the power developed by the prime mover does not decrease with increased resistance.

7. Means for transmitting power from a prime mover to a shaft which is to be rotated against a variable resisting torque by any of the methods claimed in the preceding claims.

8. Apparatus according to Claim 1 comprising a connection from a prime mover to an oscillating or reciprocating member having its effective mass at a point other than the point of connection to the prime mover and connections from one or two other points on said member to unidirectional driving devices converting the two oscillating impulses on each oscillation into two successive impulses acting on the driven shaft in the same direction.

9. Apparatus according to Claim 1 comprising a connection from a prime mover to a link which is connected at another point to a reciprocating or oscillating mass, the link being also connected at one or two other points to a pair of unidirectional driving devices oscillating in opposition to each other and rotating the shaft to be driven in one direction.

10. A power unit as claimed in Claim 1, comprising in combination a prime mover having a limited torque whose crank is connected to one point of a floating link which at another point carries or is connected to a heavy mass, such floating link being connected to a pair of devices converting both alternating forces due to the oscillations of the mass into pulsating torque in one direction.

11. A variable resistance power unit transmitting power according to the method claimed in Claim 1, comprising a prime mover having a limited torque, for example, an internal combustion engine whose crank is connected to a link which is pivoted to a mass capable of oscillation and which is also connected by two connecting rods with two opposed oscillating ratchet devices driving a rotor in one direction, such rotor being connected to the driven shaft.

12. Apparatus as claimed in any of the preceding claims, having two or more sets of driving devices with double unidirectional driving members operating with a phase difference of 90 degrees or corresponding angle on a single rotating shaft, substantially as described.

13. Apparatus transmitting power according to the method claimed in Claim 1 comprising a driving shaft having a crank connected to a point near the centre of a floating link, one end of such link being connected to a swinging lever pivoted at a fixed point and carrying an effective mass, while the other end of such link is connected by two connecting rods to a suitable double unidirectional driving device adapted to give the rotor two equal impulses per revolution in one direction, substantially as described.

14. Apparatus transmitting power according to the method claimed in Claim 1, in which the oscillating members of the unidirectional driving device are mounted within the driven rotor substantially as described.

15. Apparatus transmitting power according to the method claimed in Claim 1 comprising a driving shaft having a crank connected to a floating link, one point on which is pivoted to an oscillating flywheel which can oscillate about a fixed point, another point on such link

being connected by two connecting rods to oscillating members in opposite directions and adapted to drive a rotor situated within the oscillating members, the unidirectional driving devices being pivoted on the rotor, substantially as described.

16. Apparatus transmitting power according to the method claimed in Claim 1, comprising a driving shaft connected to one end of a floating link which is pivoted to a lever swinging about a fixed point and carrying a mass, the link being also pivoted at other points to two connecting rods driving two oscillating members, so arranged as to drive a rotor in one direction through suitable face clutches, giving two impulses per revolution of the driving shaft, substantially as described.

17. Apparatus transmitting power according to the method claimed in Claim 1, in which the swinging lever is in a state of indifferent dynamic equilibrium, so that a small force is sufficient to keep the swinging lever in a mean position, substantially as described.

18. Apparatus transmitting power according to the method claimed in Claim 1, having between the oscillating members and the rotor face clutches which are caused to engage in one direction only by suitable inclined connecting rods universally pivoted at their ends, with suitable means for keeping the face clutches in contact, substantially as described.

19. The improved apparatus for transmitting power from a driving shaft to a driven shaft hereinbefore described and illustrated at Figures 8 to 11, 12 to 14, 15 to 17 and 18 to 21 of the accompanying drawings.

Dated the 31st day of May, 1922.

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87, Victoria Street, London, S.W.,
Chartered Patent Agent.

Abingdon: Printed for His Majesty's Stationery Office, by Burgess & Son.
[Wt. 123A.—125/5/1931.]

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

Fig.1.

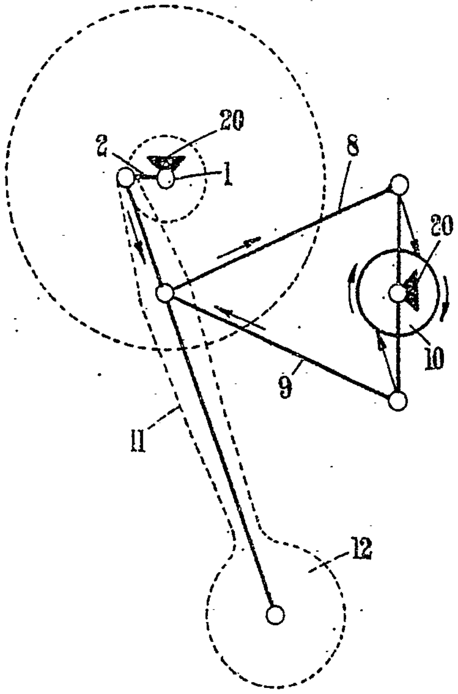


Fig.2.

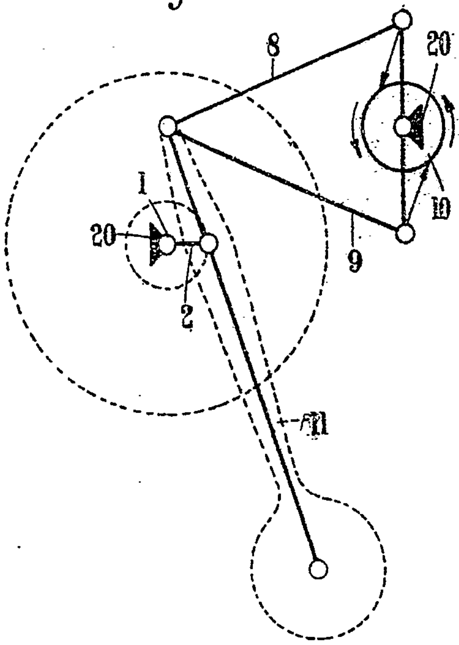


Fig. 3.

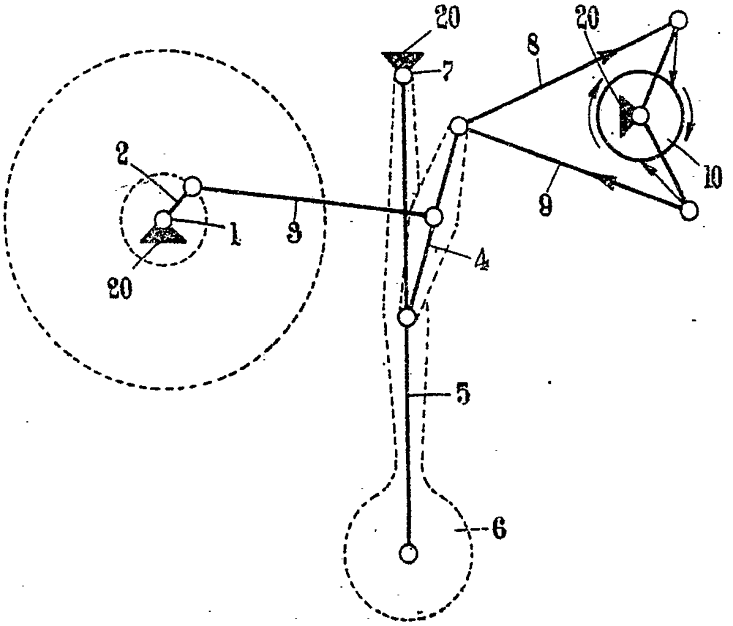


Fig. 5.

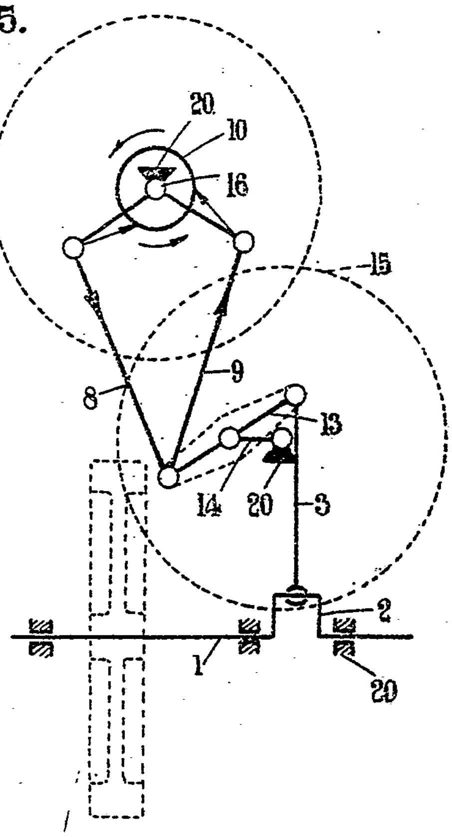
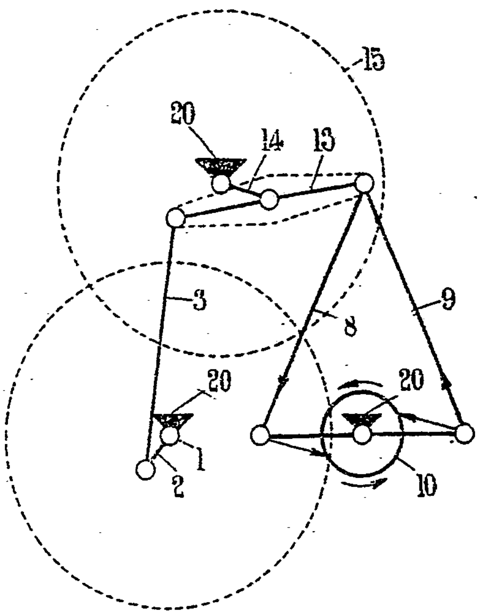


Fig. 4.



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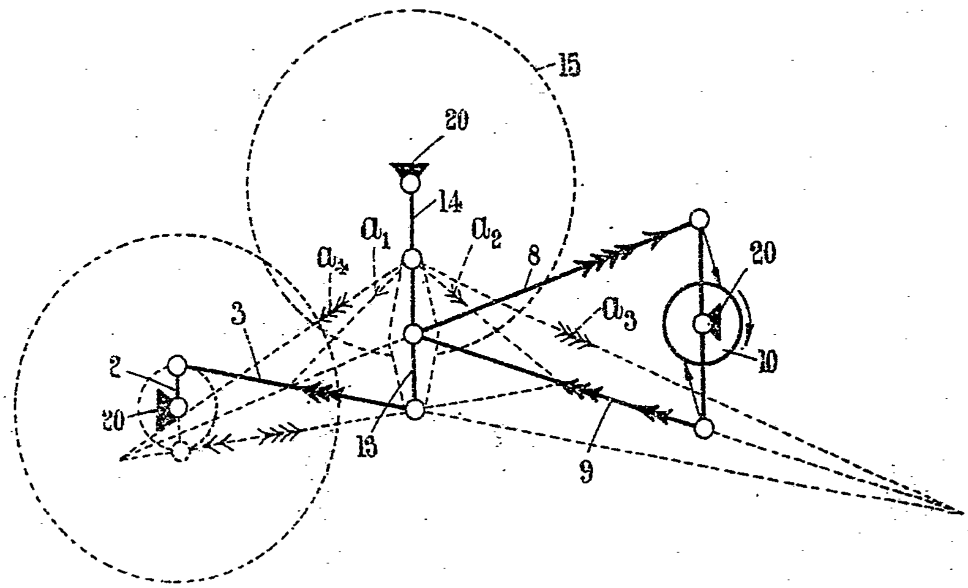

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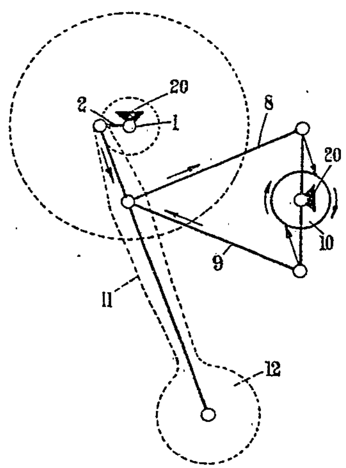
Fig.1.



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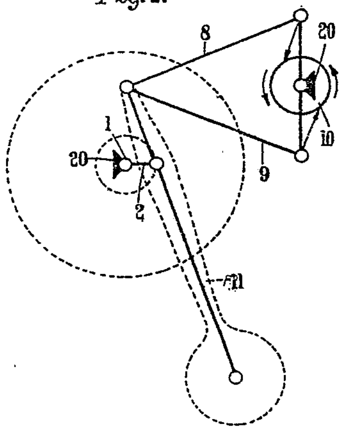

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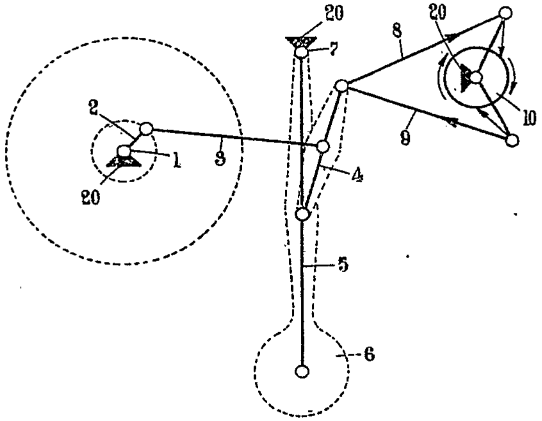

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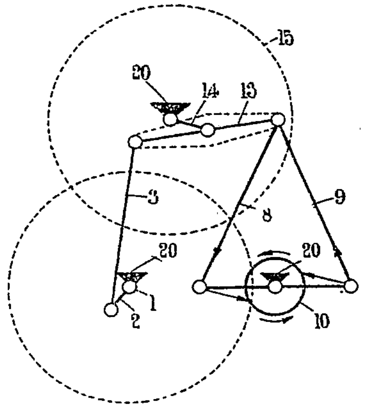

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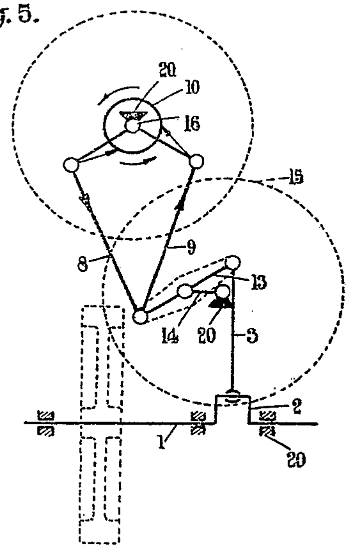

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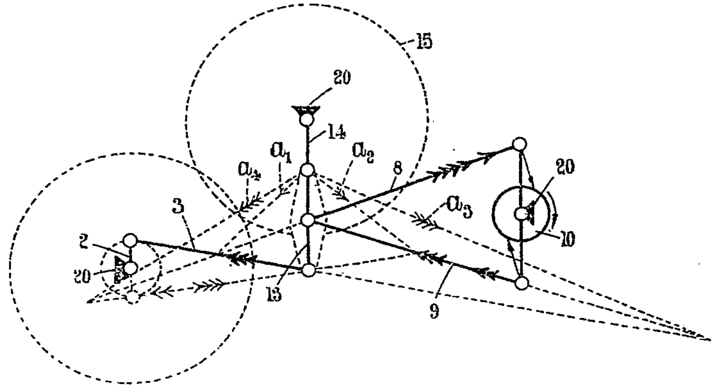

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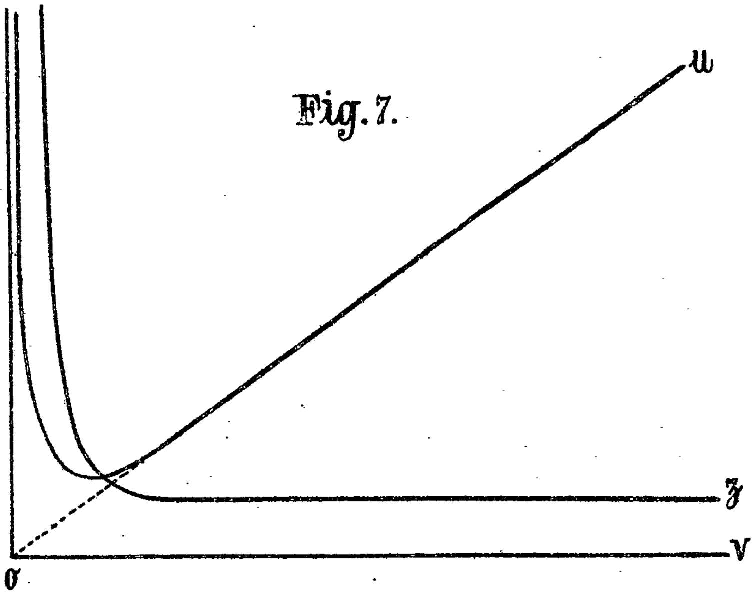

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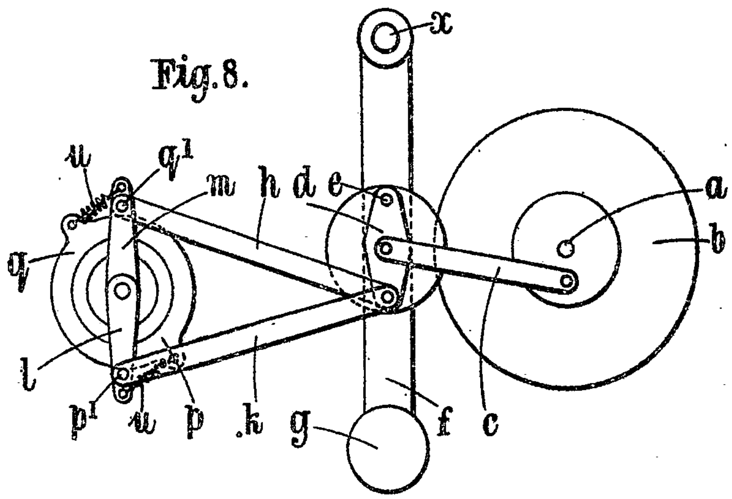

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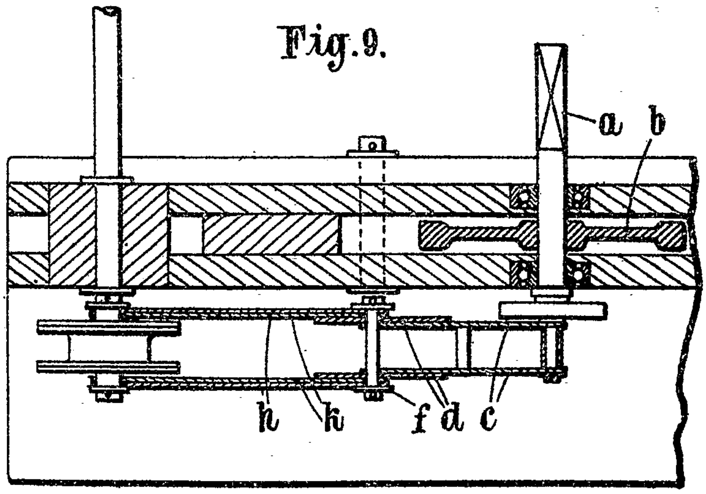

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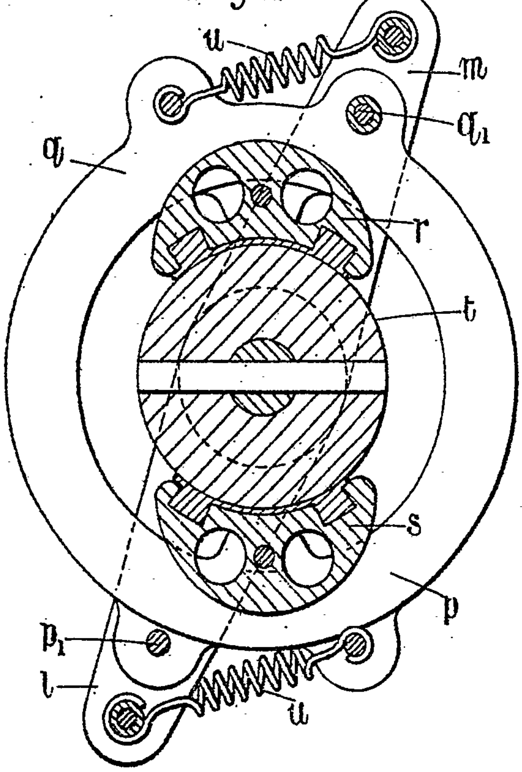
Fig. 10.



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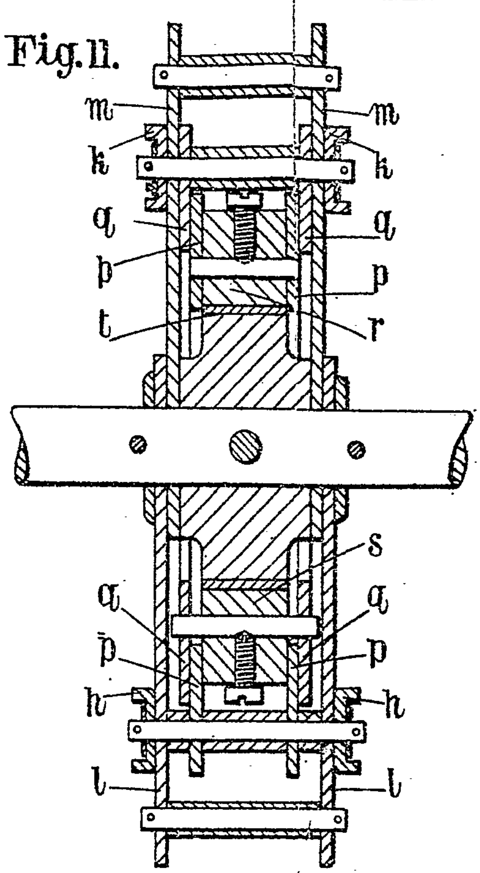

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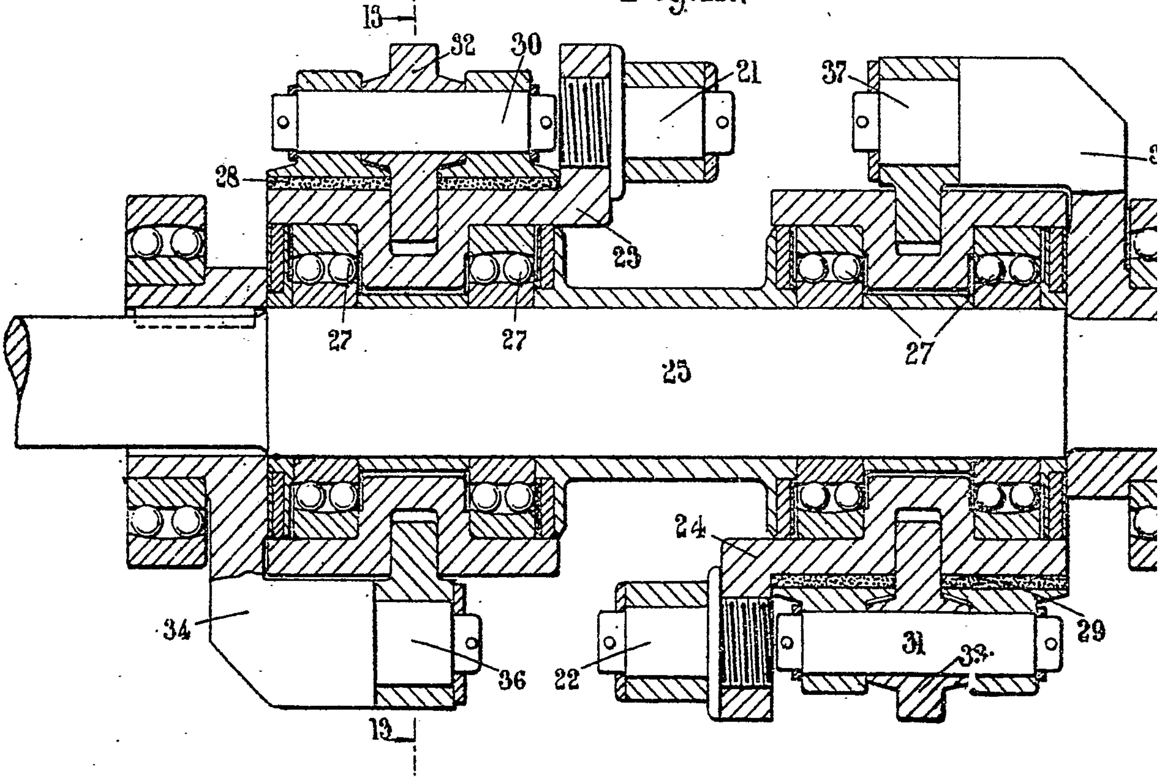

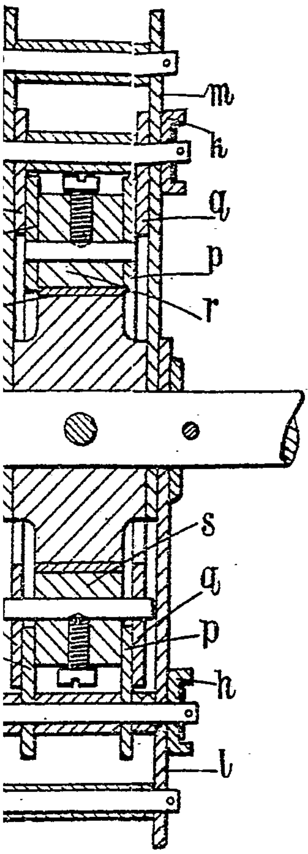

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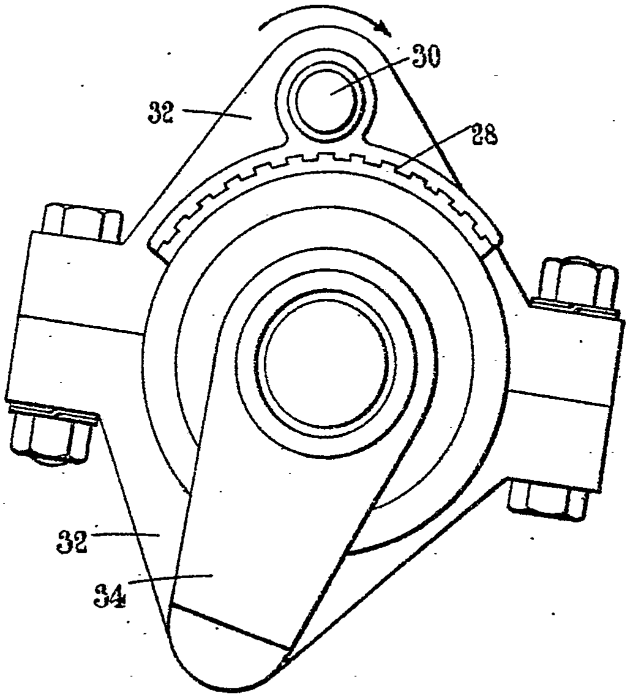

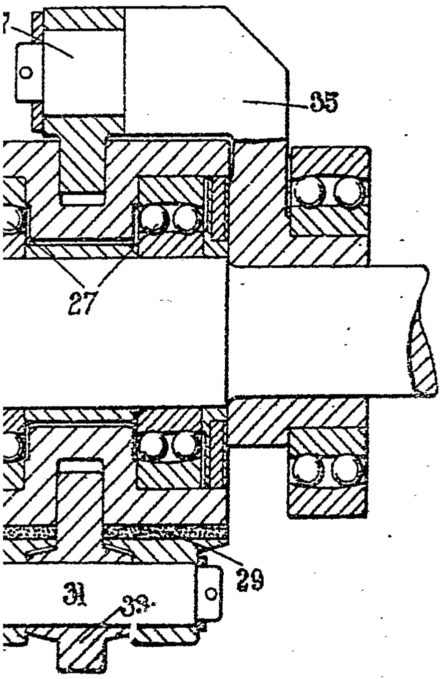

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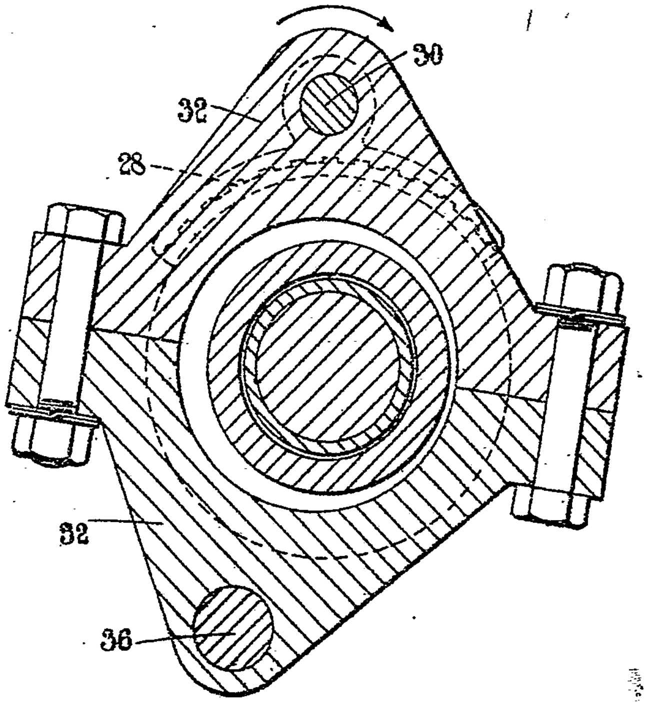

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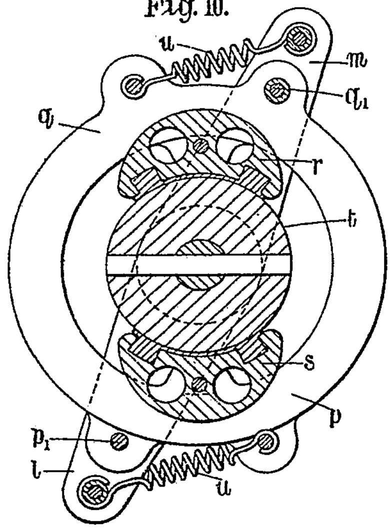

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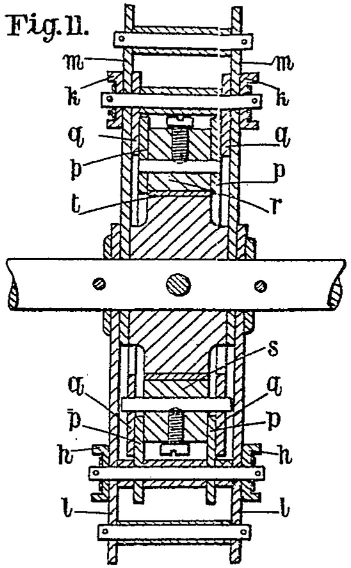

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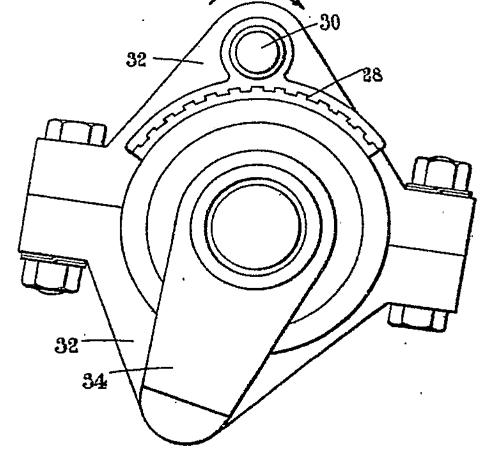

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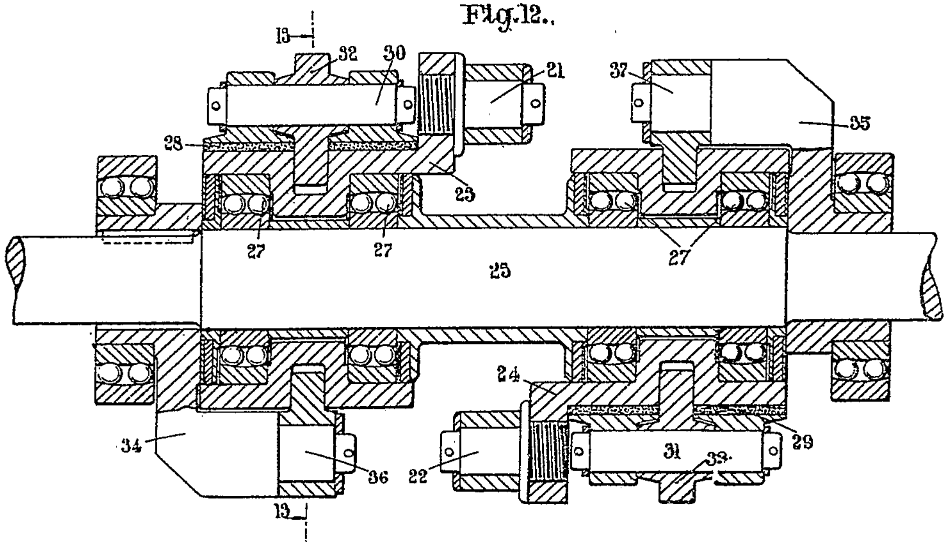

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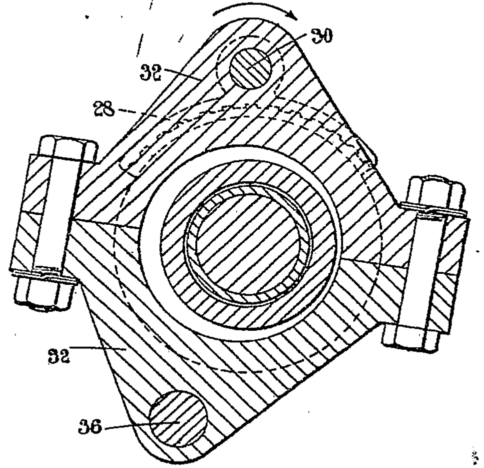

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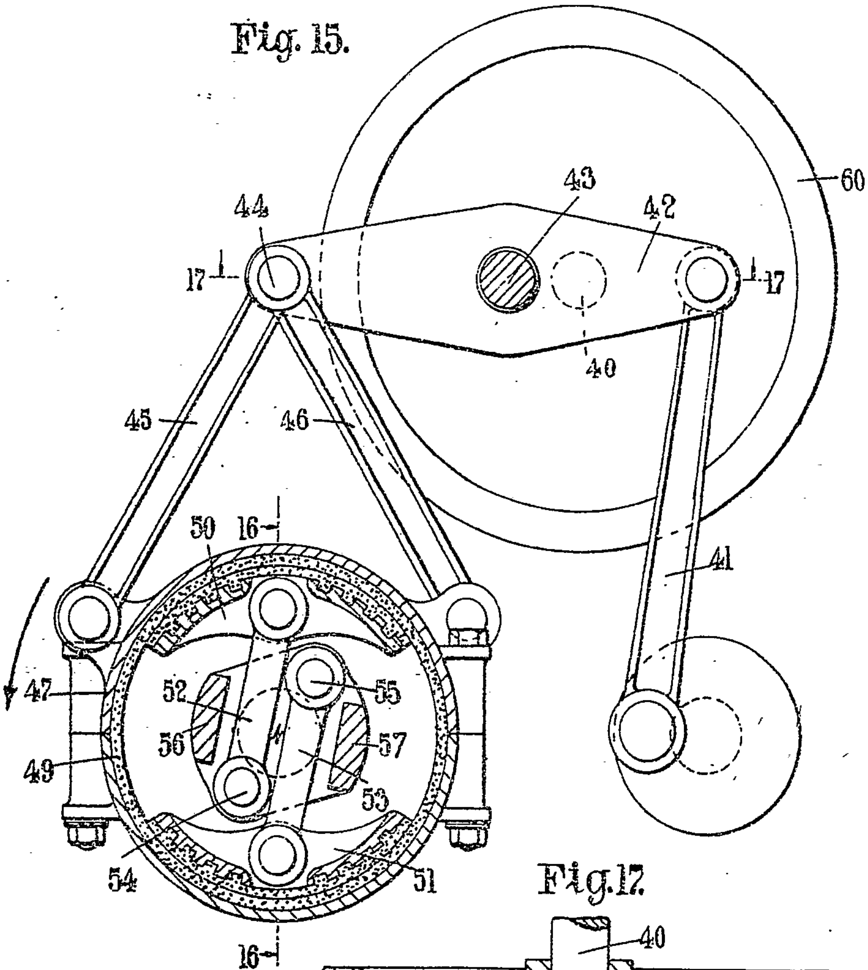

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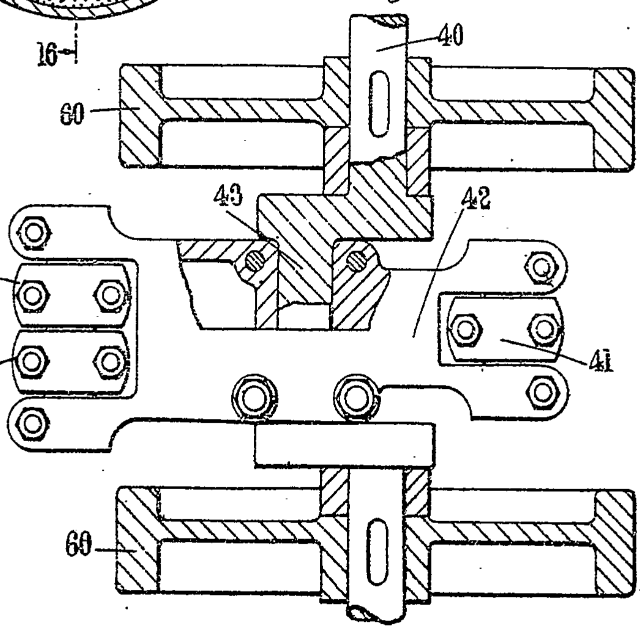

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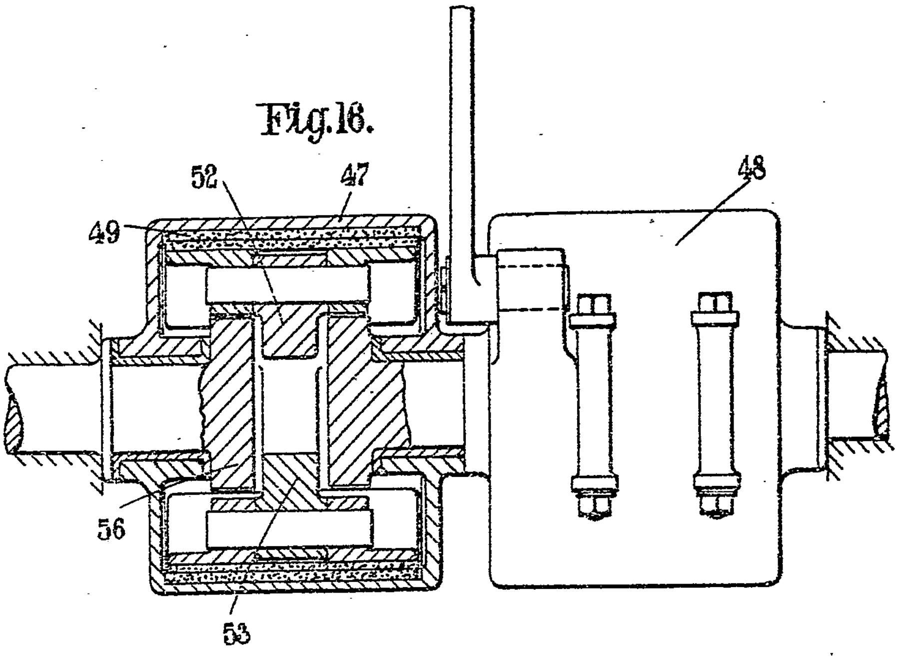

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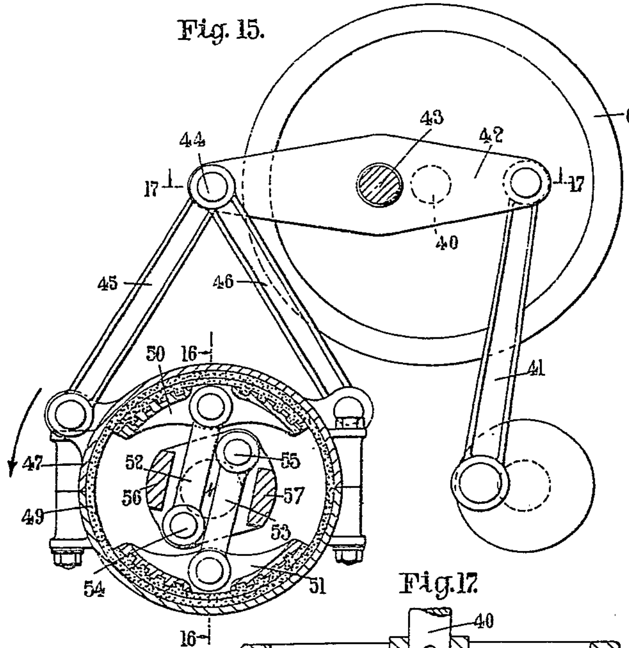

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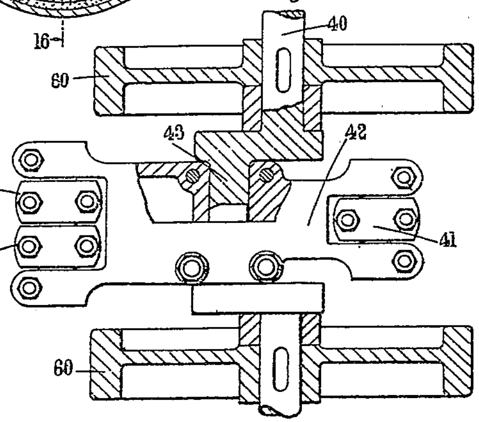

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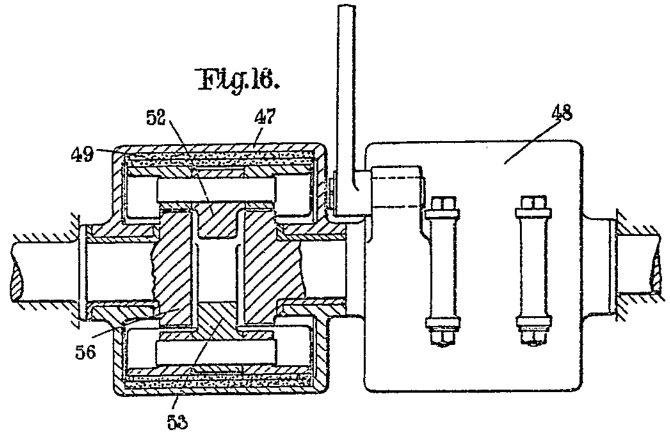

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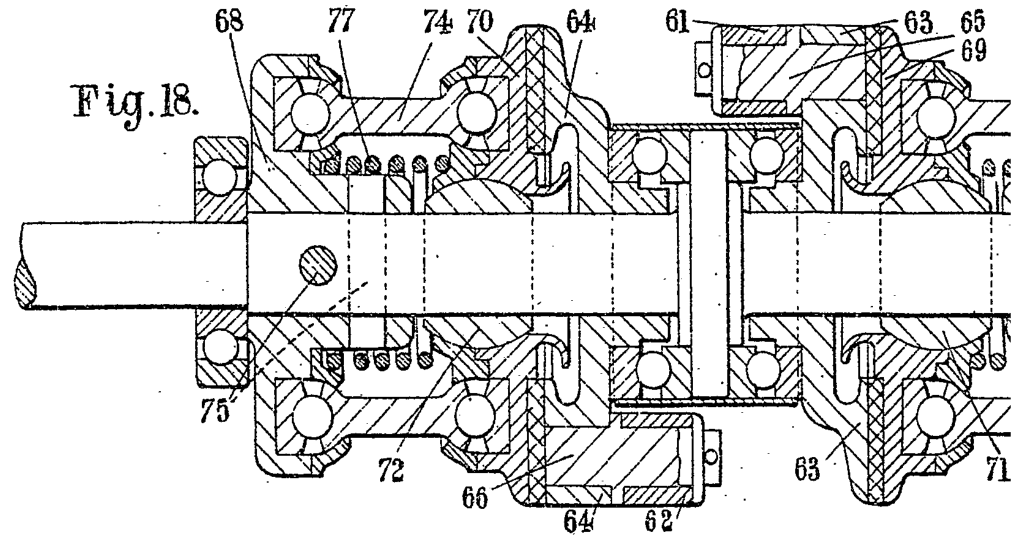

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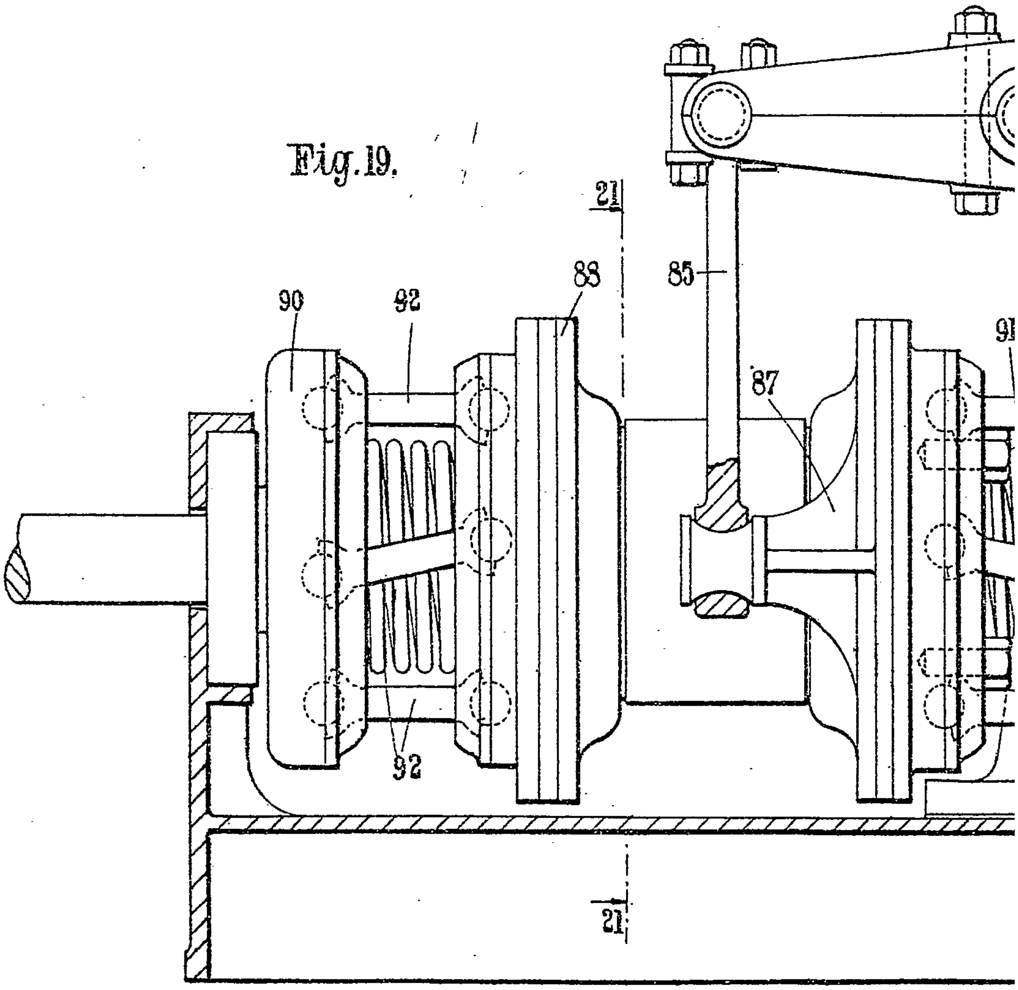

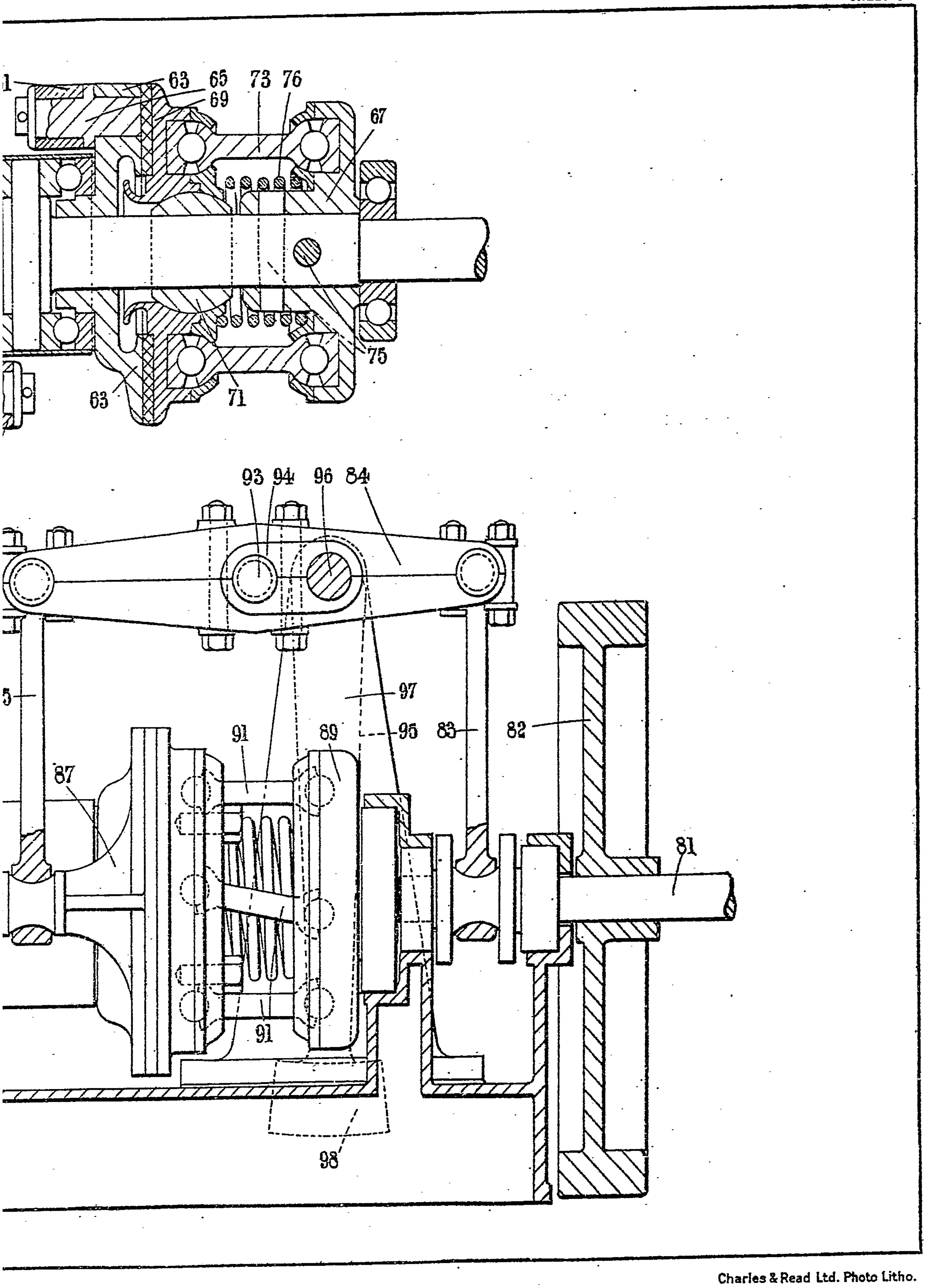

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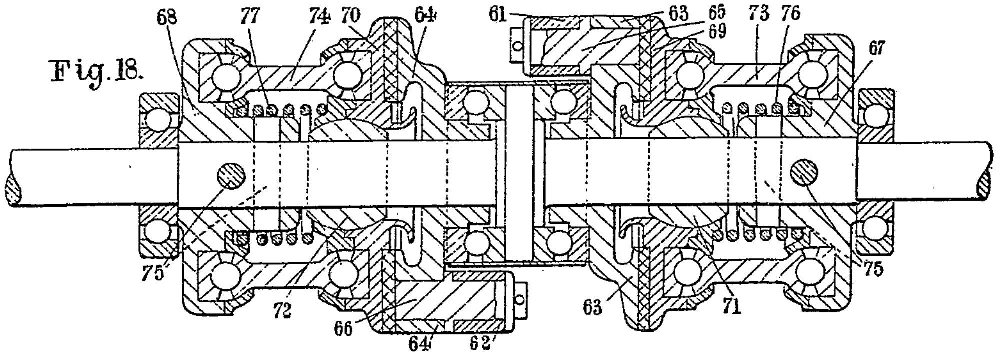

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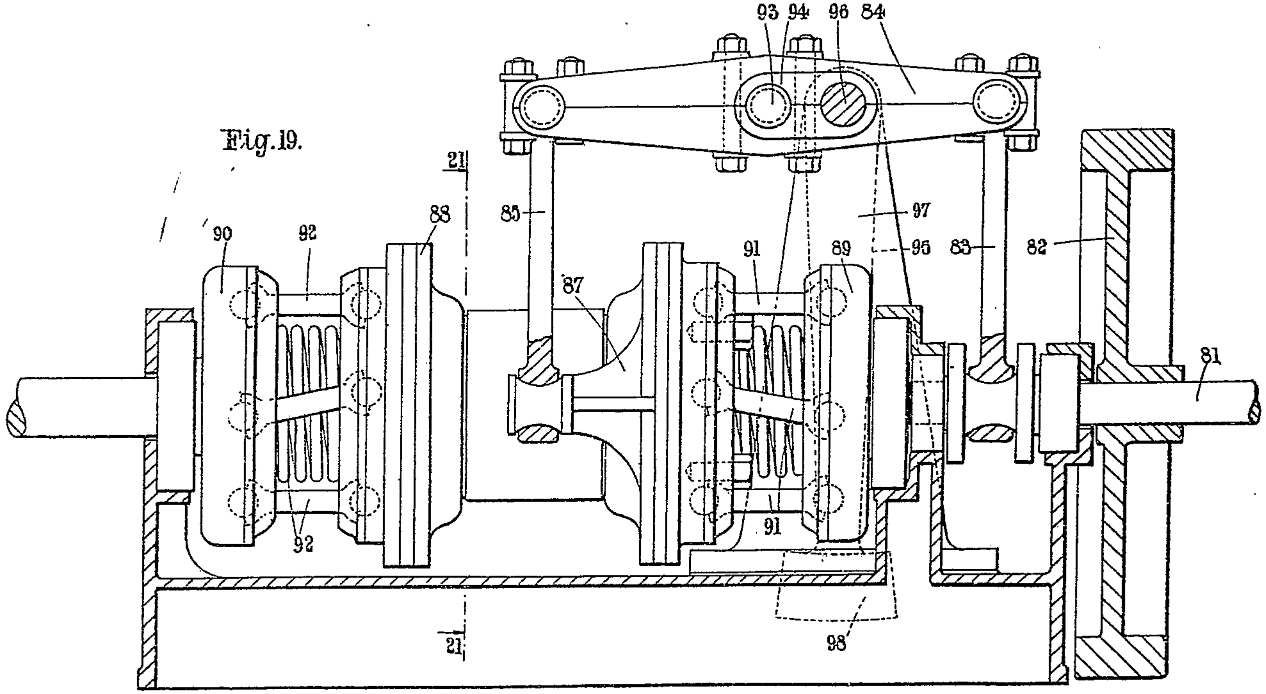

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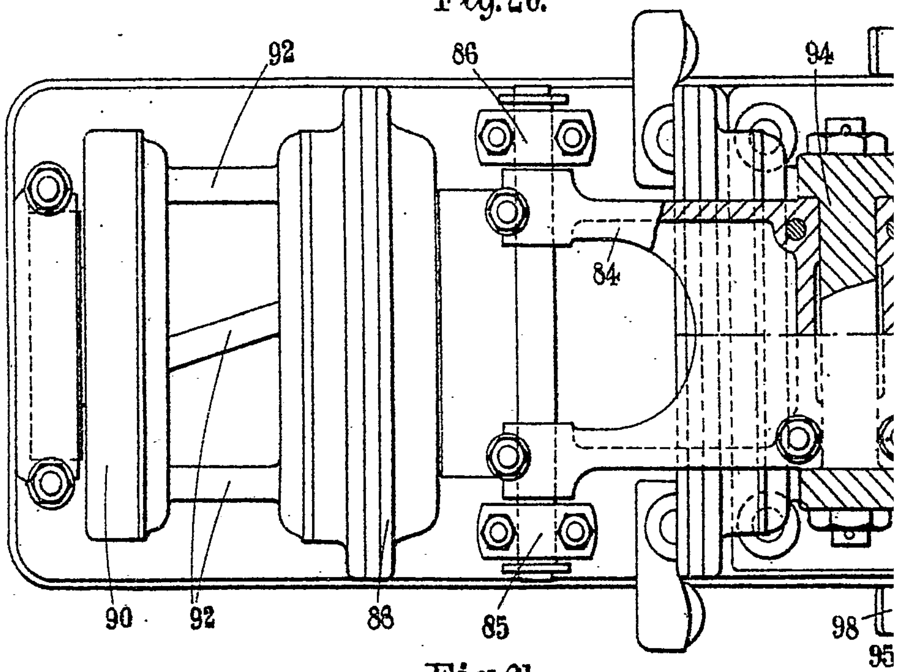

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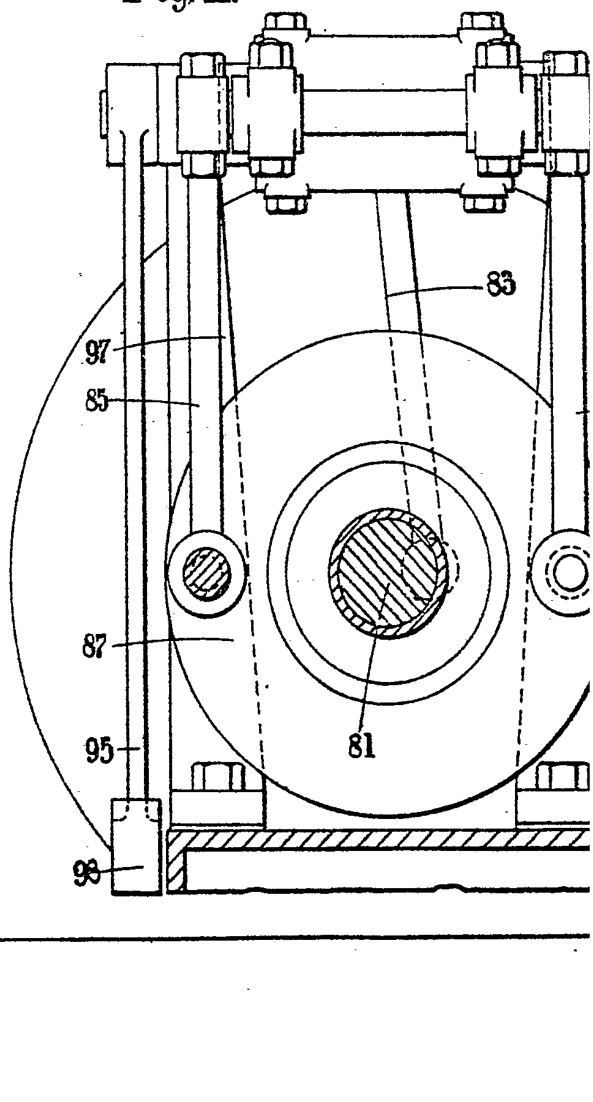

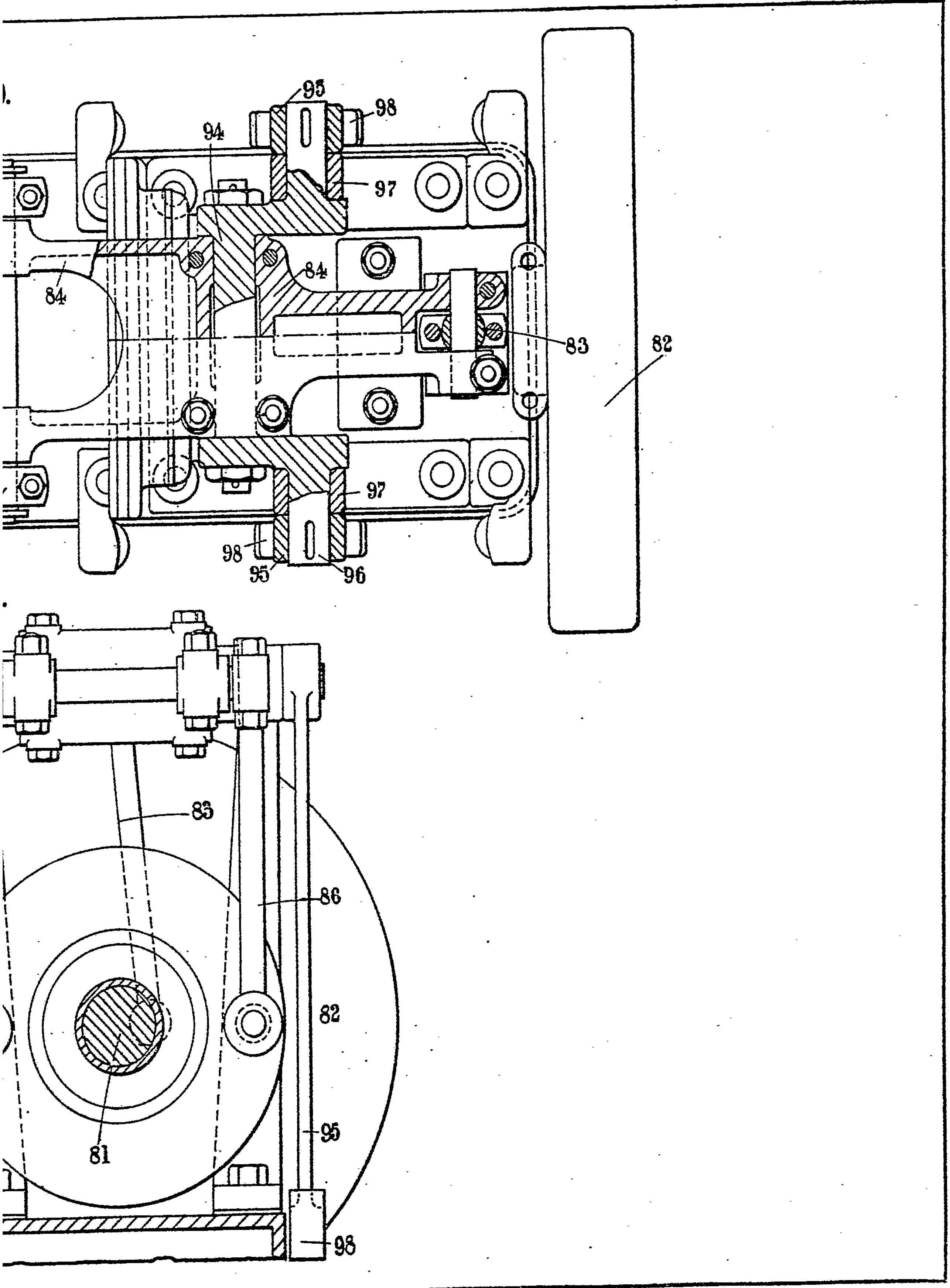

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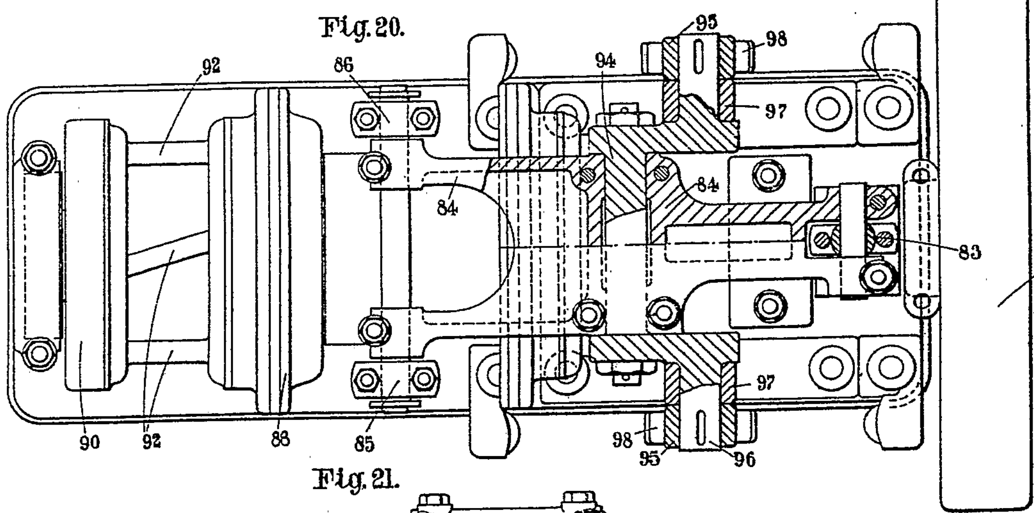

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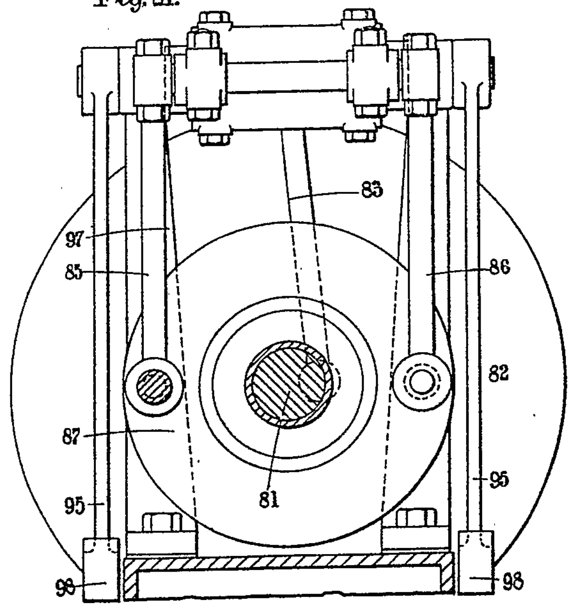

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