

April 8, 1941.

J. F. SMITH

2,237,394

OIL WELL RIG

Filed Feb. 27, 1939

4 Sheets-Sheet 1

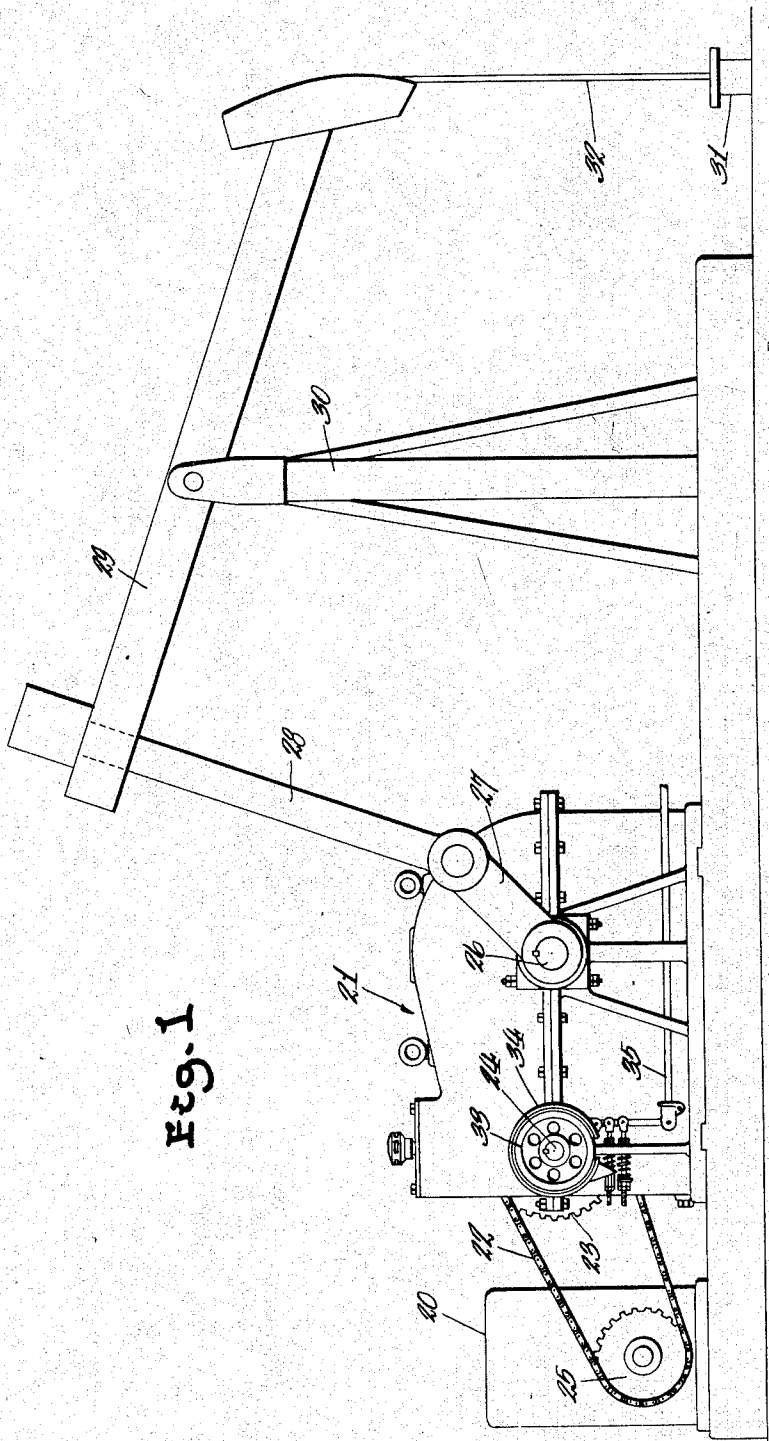


Fig. 1

James F. Smith

INVENTOR

By *Freeman, Hunt, Albert, and Weidman*
ATTORNEYS

April 8, 1941.

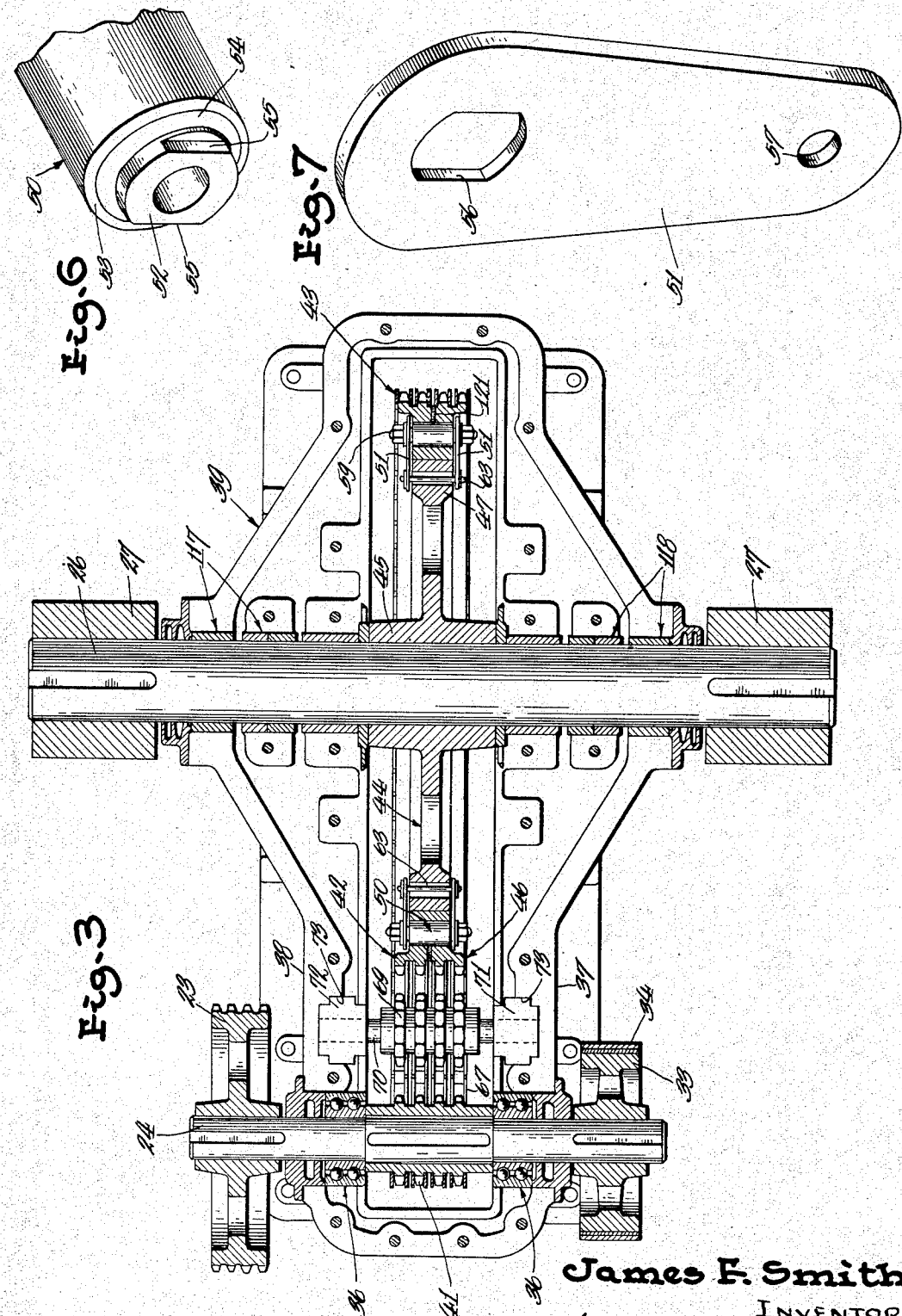
J. F. SMITH

2,237,394

OIL WELL RIG

Filed Feb. 27, 1939

4 Sheets-Sheet 3



James F. Smith
INVENTOR
BY *Freeman, Swart, Albrecht, and Weidman*
ATTORNEYS

April 8, 1941.

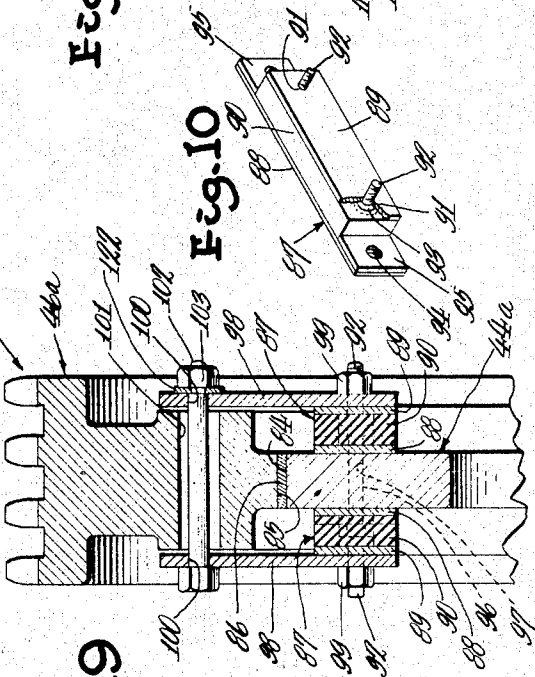
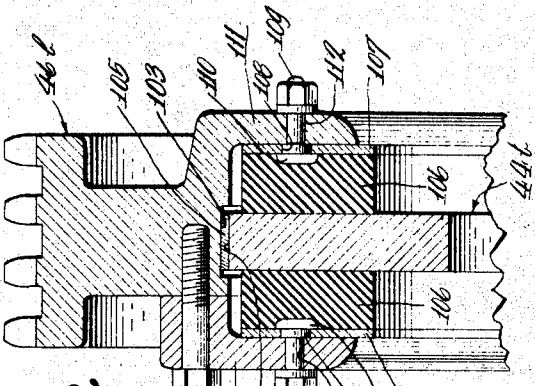
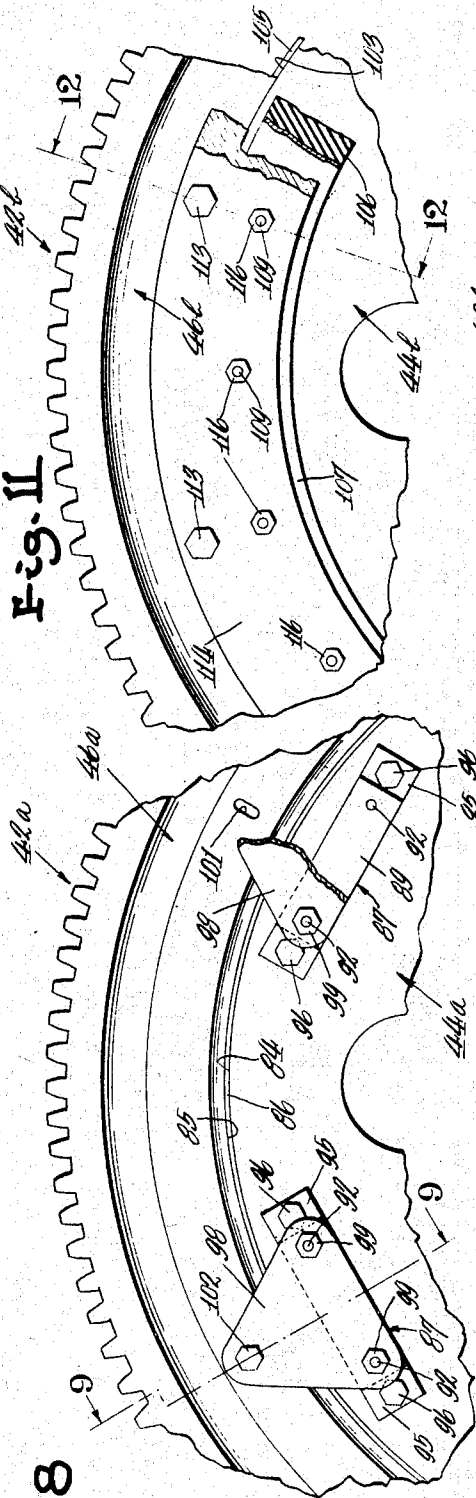
J. F. SMITH

2,237,394

OIL WELL RIG

Filed Feb. 27, 1939

4 Sheets-Sheet 4



James F. Smith

INVENTOR

By *Tremmer, Scott, Albrecht and Widdowson*
ATTORNEYS

227

Patented Apr. 8, 1941

2,237,394

UNITED STATES PATENT OFFICE

2,237,394

OIL WELL RIG

James F. Smith, Sandusky, Ohio, assignor to The
Union Chain and Manufacturing Company,
Sandusky, Ohio, a corporation of Ohio

Application February 27, 1939, Serial No. 258,784

18 Claims. (Cl. 74-227)

This invention relates more particularly to oil well rigs. In its most specific aspects the invention is particularly adapted for operating an oil well pump. In general, in such power transmission apparatus the load, imposed on the apparatus either due to the mode of operation of parts of the apparatus or due to the driven work device, or both, periodically fluctuates or otherwise places more or less sudden strains on the apparatus, and this tends to and often results in injury to the apparatus, and particularly, injury to the speed reduction drive forming part of the apparatus. The invention has for its principal object the improvement of such power transmission apparatus.

The novel features of the invention will appear from this specification and the accompanying drawings showing several embodiments of the invention, and forming a part thereof, and all these novel features are intended to be pointed out in the claims.

In the drawings:

Figure 1 is a side elevation of an oil well rig embodying the invention.

Figure 2 is a vertical sectional view of a unit embodying speed reduction power transmitting apparatus, forming part of the rig shown in Figure 1, and showing said apparatus in side elevation.

Figure 3 is a section taken on the line 3-3 of Figure 2, looking in the direction of the arrows.

Figure 4 is a fragmentary side elevation, on a larger scale than Figure 2, of a portion of a sprocket wheel forming part of the apparatus shown in Figure 2, certain parts being omitted for the sake of clearness.

Figure 5 is a section taken along the line of 5-5 of Figure 4, looking in the direction of the arrows.

Figure 6 is a fragmentary perspective view of a detail, on a scale larger than Figures 4 and 5.

Figure 7 is a perspective view of a detail, on the same scale as Figure 6.

Figure 8 is a fragmentary side elevation of another embodiment of a sprocket wheel, some of the parts of the fragmentary view being broken away.

Figure 9 is a section taken on the line 9-9 of Figure 8, looking in the direction of the arrows.

Figure 10 is a perspective view of a detail of the embodiment shown in Figures 8 and 9.

Figure 11 is a fragmentary side elevation of another embodiment of a sprocket wheel, and

Figure 12 is a section taken along the line

12-12 of Figure 11, looking in the direction of the arrows.

Referring to Figure 1 of the drawings, the embodiment here shown comprises any suitable form of prime mover 20, here shown as adapted to drive encased power transmitting apparatus 21 by means of a chain 22 cooperable with a sprocket wheel 23 associated with a shaft 24 of the power transmitting apparatus 21 and with a sprocket wheel 25 associated with the prime mover 20. Power is transmitted from the sprocket wheel 23 to a shaft 26 through speed reduction mechanism, as will appear hereinafter. As here shown, two cranks 27 are keyed to opposite ends of the shaft 26, one of the cranks being visible in side elevation in Figure 1. The cranks 27 are respectively pivotally connected to pitmans 28, in turn suitably connected to one end of a walking beam 29 pivotally mounted on a post 30. The other end of the walking beam 29 is suitably connected to a work device such as a pump (not shown) in an oil well 31. The connection to the pump or work device is here shown as a flexible cable 32 suitably connected to one end of the walking beam 29. One end of the shaft 24 is here shown as provided with a brake drum 33 with which is cooperable a brake band 34 actuatable by means of a brake rod 35 in any suitable or desired way.

Referring now to Figures 2 and 3, the driving shaft 24 is here shown as carried by and rotatable in ball bearings 36, carried by opposite walls 37, 38 of a horizontally divided housing 39. The housing 39 comprises two principal parts fastened together by bolts 40, the joint between the housing parts defining the plane in which lie the axes of the shafts 24 and 26. The driving shaft 24 is adapted to transmit power to the driven shaft 26 by band means in driving relation to wheels mounted on the shafts 24, 26 respectively, and, as here shown, the wheels are sprocket wheels 41, 42 with which a chain 43 cooperates. A suitable and desired speed reduction is of course attained by making the driving wheel 41 small and the driven wheel 42 large, but as far as certain features of the invention are concerned it is not essential that there be speed reduction.

The driving wheel 41 is here shown as keyed to the shaft 24.

The shaft 26 which carries the driven wheel 42 is carried by and rotatable in bearings 117, 118, in turn carried by and mounted in bearing supports extending laterally from the divided housing 39.

The housing 39 is preferably oil-tight and filled with oil or other suitable lubricant. An inspection

tion opening is provided at the top of the housing 39, which may be closed by a cover 119, and this cover may carry an oil breather 120.

The driven wheel 42 comprises as one principal part a spider 44 the hub 45 of which is keyed to the driven shaft 26, and, as the other principal part, a sprocket rim 46. The spider 44 is provided with a rim 47, the peripheral surface 48 of which is cylindrical as here shown, and the sprocket rim 46 is provided with a cylindrical surface 49, which, as here shown, fits the cylindrical surface 48 of the rim of the spider, but this fit is such that the sprocket rim 46 may rotate relatively to the spider 44. While the sprocket rim 46 and the spider 44 are relatively rotatable, such relative rotative movement is limited, as will appear.

The sprocket rim 46 and the spider 44 are so connected to each other that when there is relative rotative movement of the sprocket rim and the spider away from a neutral position, energy will be stored tending to return the sprocket rim and the spider to the neutral position. This connection comprises a suitable and desired number of cushion bushings 50 each provided with a pair of links 51 connected to the bushings 50 and also connected, in this instance, to the rim 47 of the spider (see also detail views, Figures 6 and 7).

Each cushion bushing 50 comprises a metallic generally cylindrical hollow core 52, preferably of steel, disposed within a metallic sleeve 53, preferably of steel, the core and the sleeve having interposed therebetween a tubular member 54 of resilient material. The member 54 of resilient material is preferably made of a moldable material, such as "neoprene," for example, and is desirably molded to the core 52 and assembled in the sleeve 53 under high pressure. It will be evident that the resilient member may be made of any other suitable material. The ends of the core 52 project beyond the ends of the member 54 and the sleeve 53, and are generally cylindrical but provided with flat spots 55. Cooperable with the ends of the core 52 are the links 51 each having an aperture 56 complementary to the cross-sectional form of the cooperating end of the core 52. Each link 51 also has an aperture 57 at the other end of the link.

The sprocket rim 46 is provided with a plurality of transverse cylindrical holes 58 of a size to fit and have inserted therein the sleeves 53 of the respective bushing 50. After a bushing 50 is inserted in one of these holes, 58, as shown in Figure 4, links 51 are assembled with the reduced ends of the core 52 of the bushing and a bolt 59 is inserted through the hollow center of the core 52. The bolt 59 is shown as threaded at both ends and nuts 60 cooperating with the threaded ends are provided to retain the parts assembled. The nuts 60 desirably bear against washers 61 which in turn bear against the respective ends of the core 52. For purposes of assembly, as will appear, it is desirable that the bushing 50 be rotatable in the hole 58 provided in the sprocket rim; the links 51 of course are rotatable in unison with the bushing 50. For the purpose of connecting the ends of the links 51 in operative relation to the spider 44, the spider is provided with a plurality of holes 62, somewhat radially elongated, so circumferentially spaced that they may be brought into radial alignment with the holes 58 in the sprocket rim; whereupon a given pair of links 51 is swung to a position such that the apertures 57 of the pair of links are in substan-

tial registry with a given hole 62. A pin 63 is then inserted through the apertures 57 and hole 58. The pins 63 may be retained in position by means of cotter pins 64; and washers 65 may be interposed between the cotter pins and the links 51. The pins 63 are of a size so that they are slidable in the respective holes 62, and of course all of the pairs of links 51 are connected to the spider 44 as has been described in connection with a given pair of links. When the parts have been thus assembled each bushing 50 is held against rotation in its respective hole 58 by means of a set screw 121, or in any other suitable way.

For the portions of the chain 43 extending between the sprocket wheels 41, 42, that is, the tangent portions 66, 67, slack take-up means is provided. As here shown, this slack take-up means includes an idler sprocket 69 carried by and rotatable about a shaft 70, the ends of which are in turn carried by a pair of slidable blocks 71, 72 (see Figure 3). The slidable blocks 71, 72 are here shown as slidable in guideways 73 formed in the respective opposite walls 37, 38 of the housing 39. The idler sprocket 69 is biased transversely of the chain portion 67 so as to take up slack therein, by means here shown as a weight 74 which may be connected to the sliding blocks 71, 72 in any suitable way as by means of the chain 75. The weight 74 may also be constructed so as to be guided in the guideways 73. Here shown as in engagement with the chain portion 66 is an idler sprocket 76 which is carried by and rotatable about a shaft 77 in turn carried by slidable blocks (not visible) similar to the blocks 71, 72. The blocks which carry the shaft 77 of the idler sprocket 76 are slidable in guideways 78 in the walls 37, 38 of the upper portion of the housing 39, and these guideways are here shown as in vertical alignment with the guideways 73 in the lower portion of the housing. The upper idler sprocket, 76, is biased upwardly, transversely to the chain portion 66 which it engages, by means of a weight 79 suitably connected to the sliding blocks carrying the shaft 77 by a chain 80, here shown as passing over a pair of sprockets 81, 82 carried by auxiliary shafts. The weight 79 may be guided by guideways 83 formed in the walls 37, 38 of the upper portion of the housing 39.

The operation of the embodiment shown in Figures 1 through 7 is as follows. As the prime mover causes rotation of the driving shaft 24, the chain 43, driven by the sprocket wheel 41, causes torque to be applied to the sprocket rim 46, and thereupon the sprocket rim 46 will rotate relatively to the spider 44 a predetermined amount. Such rotation causes circumferential movement of the cores 52, force being of course transmitted thereto through the members 54, and, at the same time, the circumferential movement of the cores causes each pair of links 51 and the respective cores 52 associated therewith to turn about the axis of the respective core while the respective sleeve 53 is held against rotation with respect to the sprocket rim 46. The resilient members 54 accordingly resist relative rotation of the sprocket rim 46 and the spider 44, in either direction of rotation, and are placed under stress by said relative rotation. It is of course evident that the reaction of the stressed members 54 tends to bring the parts back to the neutral position shown in Figure 2. Upon relative rotation between the sprocket rim 46 and the spider 44, the pins 63 move radially outwardly in the holes 62 a certain amount, but, un-

less overload conditions exist, the pins 63 will not move outwardly far enough to engage the outer ends of the holes 62.

The amount of relative rotative movement between the sprocket rim 46 and the spider 44, and the amount of the stress put upon the members 54 of the bushings 50 will depend upon the resisting torque of the spider, the resisting torque being in turn determined by such factors as the position of the crank and associated parts transmitting movement to the pump in the well 31, the position of the pump piston, the load conditions, and so on. Assuming that the sprocket wheel 41 is rotated in a clockwise direction, increase in tension in the portion 67 of the chain will tend to lift the weight 74, and, conversely, decrease in tension will permit the weight to descend. With initial suitable tension in the chain 43, these motions are of course slight. Assuming, by way of example, a reduction in the resisting torque of the spider 44, a predetermined decrease will result in a predetermined incipient speeding up of the spider tending to relative movement of the spider with respect to the sprocket rim 46 while the sprocket rim tends to maintain its original relation with respect to the chain 43 and the wheel 41, initially due to the incipient unstressing reaction of the previously stressed members 54. Meanwhile, the reduction in tension in the chain portion 67 tends to permit the weight to descend, but meanwhile also, the sprocket wheel 41 tends to be speeded up by the prime mover 20, due to the reduction in tension. The parts thus assume a new relative position dependent upon the varying conditions of resisting torque, without causing jumping or whipping of the chain. In any event, whatever be the theory of operation, it has been found that the cooperation and interaction of the parts, constructed and arranged as hereinbefore described, prevents jumping or whipping of the chain and the consequent frequent breaking of the chain, and, accordingly, makes feasible a drive of the chain type under fluctuating and shock load conditions.

For example, hitherto, chain driven speed reduction units have never been successfully applied on oil well pumping units, because of frequent chain failure, and resort has been had to more expensive speed reduction apparatus, involving, for example, herringbone gears, which apparatus is not only more expensive, but involves difficulties and expense in replacement of broken parts such as not involved in a chain type of drive.

Only one slack take-up means is necessary if the apparatus is to be used for rotation of the sprocket wheel 42, as a whole, in but one direction, and two take-up means are necessary only where it is desired that the apparatus may be utilized for rotation of the sprocket wheel 42, as a whole, in either direction.

It will be understood that while a predetermined maximum number of holes 58, in the sprocket rim for example, and a corresponding predetermined maximum number of holes 62 in the spider for example, may be provided, it is not essential that all of these sets of holes be utilized, that is, any desired number of cushion bushings 50 and associated links 51 may be used, up to a desired and suitable maximum number, so that the wheel 42 may be assembled to suit the conditions of operation to be met. Also, the disclosed construction affords further means of

adjustment to suit conditions, in that, not only may different bushings 50 be interchangeably used, but different links 51 may be used. For example, the links 51 illustrated may be replaced by links of the same form but in which the hole 57 is located at a different distance from the center of the hole 56.

Referring now to the embodiment shown in Figures 8, 9, and 10. The sprocket wheel 42a shown in Figures 8 and 9, may take the place of the sprocket wheel 42. The sprocket wheel 42a comprises a spider 44a having a peripheral cylindrical surface 84, and a sprocket rim 46a having a cylindrical surface 85 cooperable with the cylindrical surface of the spider, and, in this instance, if desired, a suitable bearing element 86 is shown as interposed between these surfaces. If, desired, the bearing element may be made of "oilite." To control relative rotative movement as between the sprocket rim 46a and the spider 44a, a plurality of connections are made between the sprocket rim and the spider, as will now appear. Each of these connections comprises a cushioning unit 87, shown in perspective in Figure 10. This cushioning unit, 87, is here shown as comprising two metal plates 88, 89, preferably steel, between which is disposed a member 90 of resilient material. This member 90 is preferably made of material which may be molded to the plates 88, 89, and may be made of such material as already set forth in connection with the member 54. The plate 89 is here shown as provided with two suitably spaced holes 91 through which project outwardly the threaded shanks 92 of two bolts the heads 93 of which are at the inside surface of the plate 89 where they are embedded in the resilient member 90. The plate 88 is longer than the plate 89, extending beyond the ends of the resilient member 90, and these extensions are provided with apertures 94. If desired, apertured washers 95 may be disposed over and fastened to the extending portions of the plate 88.

Considering the connection between the spider 44a and the sprocket rim 46a, at the section illustrated in Figure 9, this connection includes two cushioning units 87 such as shown in Figure 10, disposed on opposite sides of the spider 44a and fastened to the spider by means of bolts 96 passing through the holes 94 in the cushioning units and registering holes 97 in the spider. The bolts 96 are provided with heads and nuts which bear against the respective washers 95. The connection further includes a pair of plates 98, here shown as of triangular form, these plates having holes registering with the bolts 92 projecting from the respective cushioning units 87, each plate being fastened to the respective cushioning unit by means of the nuts 99 engaging the threaded bolts 92. Each connecting plate 98 is thus fastened to the respective plate 89 of a cushioning unit. The connecting plates 98 are also each provided with a hole 100, and these holes are aligned with each other and with a hole 101, here shown as slightly elongated radially, passing transversely through the sprocket rim 46a, so that a bolt 102 may be passed through these registering holes. The bolts 102 is here shown as having a reduced threaded end which is provided with a nut 103 which bears against a washer 122 which in turn bears against the shoulder formed by the reduced end so that the bolt 102 and nut 103 are held assembled with the plates 98 but the plates are not tightened against the sprocket rim 46a, a desired amount of clearance being left.

As indicated in Figure 8, any desired and suitable number of cushioning connections may be made between the spider 44a and the sprocket rim 46a.

The operation of the ring when a sprocket wheel 42a, such as shown in Figures 8 through 10, is utilized, instead of the wheel 42, is analogous to the operation already described in connection with the embodiment of Figures 1 through 7. It will be obvious that when, due to application of torque, there is relative rotative movement as between the sprocket rim 46a and the spider 44a, the plates 98 tend to move the plates 89 in a circumferential direction and also tend to turn each plate 89 about an axis transverse to the approximate center of the lateral face of the respective plate 89. The resilient members 90 accordingly resist the relative rotative movement of the sprocket rim 46a and the spider 44a, in either direction of rotation, and are placed under stress by said relative rotation.

It will be evident that the embodiment of Figures 8 to 9 affords adjustment to suit conditions analogously to the embodiment of Figures 1 to 7.

Referring now to the embodiment shown in Figures 11 and 12. A sprocket wheel 42b such as shown in Figures 11 and 12 may be utilized instead of the sprocket wheel 42. The sprocket wheel 42b comprises a spider 44b and a sprocket rim 46b, which have relatively rotatable cooperating cylindrical surfaces 104, 103, between which a bearing element 105 may be interposed as described in connection with Figures 8 and 9. The cylindrical surface 103 on the sprocket rim 46b is here shown as slightly recessed into the inner periphery of the rim. The sprocket rim 46b and the spider 44b are relatively rotatable, as in the previously described embodiments, and are likewise connected by means of a cushioning connection. In this instance, the cushioning connection comprises two resilient members 106 disposed on opposite sides of the spider 44b, each resilient member 106 being covered by an annular plate 107 having holes 108 through which project outwardly from the plate the shanks 109 of screw-threaded bolts, the heads 110 of which are on the inner surfaces of the plates 107. As in the case of the embodiment of Figures 8 through 10, the resilient members 106 are molded to the parts between which they are interposed, that is, in this instance, they are molded respectively to the spider 44b and to the annular plates 107. The sprocket rim 46b is provided with an annular flange 111 having holes 112 adapted to register with the bolts 109 projecting from one of the annular plates 107, and the other side of the sprocket rim 46b is adapted to have fastened thereto, by means of machine screws 113, a ring 114 having holes 115 adapted to register with the bolts 109 projecting from the other annular plate 107. The annular flange 111 and ring 114 are fastened to the annular plates 107 respectively by the provision of nuts 116 cooperating with the bolts 109 projecting from the annular plates 107. It will be evident that when torque is applied to the sprocket rim 46b, relative rotative movement between the sprocket rim 46b and the spider 44b will take place until the tension on the resilient members 106 is sufficient to overcome the resisting torque of the spider 44b, and that the operation of the apparatus is analogous to that already described in connection with Figures 1 through 7.

From the foregoing it will be apparent to those skilled in the art that each of the illustrated em-

bodiments of the invention provides a new and improved power transmission apparatus, and accordingly, each accomplishes the principal object of the invention. On the other hand, it also will be obvious to those skilled in the art that the illustrated embodiments of the invention may be variously changed and modified, or features thereof, singly, or collectively, embodied in other combinations than those illustrated, without departing from the spirit of the invention, or sacrificing all of the advantages thereof, and that accordingly, the disclosure herein is illustrative only, and the invention is not limited thereto.

I claim:

1. Power transmission apparatus, adapted for use under conditions wherein the relation between the load torque on said apparatus and the input torque to said apparatus is subject to sudden changes, comprising: rotatable driving wheel means; rotatable driven wheel means, including a first portion rotatable in unison with a driven shaft, and including a rotatable second portion, and including means for interconnecting said portions, so constructed and arranged that said portions have a non-power transmitting position with respect to each other and are relatively rotatable to a limited extent away from said position; power transmitting band means, about said driving wheel means and said second portion of said driven wheel means, so constructed and arranged that rotation of said driving wheel means is adapted to cause rotation of said driven wheel means; slack take-up means, including means engaging said band means between said two wheel means, and means biasing said engaging means in a direction to take up slack in said band means; and said means for interconnecting said portions comprising energy storing means so constructed and arranged that upon relative rotative movement of said first and second portions away from said position energy is so stored that said portions are adapted to be returned to said position by reason of release of said energy.

2. Power transmission apparatus, adapted for use under conditions wherein the relation between the load torque on said apparatus and the input torque to said apparatus is subject to sudden changes, comprising: rotatable driving wheel means; rotatable driven wheel means, including a first portion rotatable in unison with a driven shaft, and including a rotatable second portion, and including means for interconnecting said portions, so constructed and arranged that said portions have a non-power transmitting position with respect to each other and are relatively rotatable to a limited extent away from said position; power transmitting band means, about said driving wheel means and said second portion of said driven wheel means, so constructed and arranged that rotation of said driving wheel means is adapted to cause rotation of said driven wheel means; slack take-up means, including means engaging said band means between said two wheel means, and means including a gravity biased weight, constructed and arranged to bias said engaging means in a direction to take up slack in said band means; and said means for interconnecting said portions comprising energy storing means so constructed and arranged that upon relative rotative movement of said first and second portions away from said position energy is so stored that said portions are adapted to be returned to said position by reason of release of said energy.

3. Power transmission apparatus, adapted for

use under conditions wherein the relation between the load torque on said apparatus and the input torque to said apparatus is subject to sudden changes, comprising: rotatable driving wheel means; rotatable driven wheel means, including a first portion rotatable in unison with a driven shaft, and including a rotatable second portion, and including means for interconnecting said portions, so constructed and arranged that said portions have a non-power transmitting position with respect to each other and are relatively rotatable to a limited extent away from said position; power transmitting band means, about said driving wheel means and said second portion of said driven wheel means, so constructed and arranged that rotation of said driving wheel means is adapted to cause rotation of said driven wheel means; slack take-up means, including means engaging said band means between said two wheel means, and means biasing said engaging means in a direction to take up slack in said band means; and said means for interconnecting said portions comprising a resilient member so constructed and arranged that upon relative rotative movement of said first and second portions away from said position said resilient member is stressed and torque of said second portion is transmitted to said first portion through said resilient member.

4. Power transmission apparatus, adapted for use under conditions wherein the relation between the load torque on said apparatus and the input torque to said apparatus is subject to sudden changes, comprising: rotatable driving wheel means; rotatable driven wheel means, including a first portion rotatable in unison with a driven shaft, and including a rotatable second portion, and including means for interconnecting said portions, said portions having a non-power transmitting position with respect to each other and being relatively rotatable to a limited extent away from said position; power transmitting band means, about said driving wheel means and said second portion of said driven wheel means, so constructed and arranged that rotation of said driving wheel means is adapted to cause rotation of said driven wheel means; slack take-up means, including means engaging said band means between said two wheel means, and means biasing said engaging means in a direction to take up slack in said band means; and said means for interconnecting said portions comprising a resilient member of molded plastic material so constructed and arranged that upon relative rotative movement of said first and second portions away from said position torque of said second portion is transmitted to said first portion through said resilient member.

5. Power transmission apparatus, adapted for use under conditions wherein the relation between the load torque on said apparatus and the input torque to said apparatus is subject to sudden changes, comprising: rotatable driving wheel means; rotatable driven wheel means, including a first portion rotatable in unison with a driven shaft, and including a rotatable second portion, and including means for interconnecting said portions, said portions having a non-power transmitting position with respect to each other and being relatively rotatable to a limited extent away from said position; power transmitting band means, about said driving wheel means and said second portion of said driven wheel means, so constructed and arranged that rotation of said driving wheel means is adapted to cause rotation of said driven wheel means; slack take-up means,

including means engaging said band means between said two wheel means, and means biasing said engaging means in a direction to take up slack in said band means; said means for interconnecting said portions comprising a plurality of unitary devices each comprising a resilient member so constructed and arranged that upon relative rotative movement of said first and second portions away from said position torque of said second portion is transmitted to said first portion through said resilient member; and said unitary devices and said portions being relatively so constructed and arranged that said unitary devices are individually assemblable with and disassemblable from said portions whereby the torque necessary to cause relative rotative movement of said portions may be adjusted.

6. Power transmission apparatus, adapted for use under conditions wherein the relation between the load torque on said apparatus and the input torque to said apparatus is subject to sudden changes, comprising: rotatable driving wheel means; rotatable driven wheel means, including a first portion rotatable in unison with a driven shaft, and including a rotatable second portion, and including means for interconnecting said portions, said portions being relatively rotatable to a limited extent; power transmitting band means, about said driving wheel means and said second portion of said driven wheel means, so constructed and arranged that rotation of said driving wheel means is adapted to cause rotation of said driven wheel means; slack take-up means, including means engaging said band means between said two wheel means, and means biasing said engaging means in a direction to take up slack in said band means; and said means for interconnecting said portions comprising a resilient member so constructed and arranged that it resiliently holds said portions in a definite relative rotative position and upon relative rotative movement of said first and second portions away from said position said resilient member is stressed and torque of said second portion is transmitted to said first portion through said resilient member.

7. Power transmission apparatus, comprising: rotatable wheel means, including a first portion rotatable in unison with a shaft, and including a rotatable second portion, and including means interconnecting said portions, so constructed and arranged that said portions are relatively rotatable to a limited extent; and said interconnecting means including a link and a connection between said link and one of said portions of said wheel means, and including a resilient member interposed between said link and the other portion of said wheel means, and being so constructed and arranged that relative rotation of said portions puts said resilient member under torsional type stress and torque of one of said wheel portions is transmitted to the other of said portions through said link and said resilient member.

8. Power transmission apparatus, comprising: rotatable wheel means, including a first portion rotatable in unison with a shaft, and including a rotatable second portion, and including means interconnecting said portions, so constructed and arranged that said portions are relatively rotatable to a limited extent; and said interconnecting means including a link and a lost motion connection between said link and a generally radially extending slot in one of said portions of said wheel means, and including a resilient member interposed between said link and the other por-

tion of said wheel means, so constructed and arranged that torque of one of said wheel portions is transmitted to the other of said portions through said link and said resilient member.

9. Power transmission apparatus, comprising: 5
rotatable wheel means, including a first portion rotatable in unison with a shaft, and including a rotatable second portion concentric with said first portion, one of said portions having a plurality of circumferentially spaced generally radially extending slots, said wheel means also including means for interconnecting said portions, so constructed and arranged that said portions are relatively rotatable to a limited extent; and said interconnecting means including a selected 10
plurality of circumferentially spaced generally radially disposed links and connections between said links and the other one of said portions of said wheel means and lost motion connections between said links and selected ones of said slots, and including resilient members interposed between the respective links and said other portion of said wheel means, and being so constructed and arranged that torque of one of said wheel portions is transmitted to the other of said wheel portions through said links and said resilient members.

10. Power transmission apparatus, comprising: a rotatable shaft; wheel means, including a first portion having a peripheral bearing surface and being rotatable in unison with said shaft, and including a relatively rotatable second portion of generally annular form having an inner peripheral bearing surface cooperating with said first named bearing surface; and means for interconnecting said portions, including a metallic member and a resilient member of molded plastic material fastened by molding to said metallic member and interposed between said metallic member and one of said portions of said wheel means, and including a connecting member disposed laterally of said portions of said wheel means and connected to said metallic member and to the other one of said portions of said wheel means, so constructed and arranged that torque of one of said wheel portions is transmitted to the other of said portions through said metallic member and said resilient member.

11. Power transmission apparatus, comprising: rotatable wheel means, including a first portion rotatable in unison with a shaft, and including a rotatable second portion, and including means for interconnecting said portions, said portions having a non-power transmitting position with respect to each other and being relatively rotatable to a limited extent away from said position; said means for interconnecting said portions comprising a plurality of unitary devices spaced circumferentially with respect to one of said portions and each said device comprising a resilient member and means fixedly connecting said member to said one of said portions, and being so constructed and arranged that upon relative rotative movement of said first and second portions away from said position torque of said second portion is transmitted to said first portion through said resilient member; and said unitary devices and said portions being relatively so constructed and arranged that said unitary devices are individually assemblable with and disassemblable from said portions whereby the torque necessary to cause relative rotative movement of said portions may be adjusted.

12. Power transmission apparatus, comprising: 75
rotatable wheel means, including a first portion

rotatable in unison with a shaft, and including a rotatable second portion concentric with and in the general plane of said first portion, and including means for interconnecting said portions, so constructed and arranged that said portions are relatively rotatable to a limited extent; and said interconnecting means including two sets of links, said sets being disposed at opposite sides of said portions, and connections between said links and one of said portions of said wheel means, and including also resilient means interposed between said links and the other portion of said wheel means, and being so constructed and arranged that torque of one of said wheel portions is transmitted to the other of said portions through said links and said resilient means.

13. Power transmission apparatus, comprising: rotatable wheel means, including a first portion rotatable in unison with a shaft, and including a rotatable second portion, and including means for interconnecting said portions, so constructed and arranged that said portions are relatively rotatable to a limited extent; and said interconnecting means including a generally radially disposed link and a connection between said link and one of said portions of said wheel means, and including a resilient member interposed between said link and the other portion of said wheel means, said resilient member having spaced surfaces a first of which is fixedly connected to said other portion of said wheel means and a second of which is fixedly connected to said link, said interconnecting means being so constructed and arranged that torque of one of said wheel portions is transmitted to the other of said portions through said link and said resilient member.

14. Power transmission apparatus, comprising: rotatable wheel means, including a first portion rotatable in unison with a shaft, and including a rotatable second portion, and including means interconnecting said portions, so constructed and arranged that said portions are relatively rotatable to a limited extent; and said interconnecting means including a link and a first connection between said link and one of said portions of said wheel means, and a second connection between said link and the other portion of said wheel means, said second connection comprising spaced metallic members one of which is fixedly connected to said other portion of said wheel means and the other of which is fixedly connected to said link, said second connection comprising further a resilient member spaced surfaces of which are fixedly connected to said metallic members respectively, said interconnecting means being so constructed and arranged that relative rotation of said portions puts said resilient member under torsional type stress and torque of one of said wheel portions is transmitted to the other of said portions through said link and said resilient member.

15. Power transmission apparatus, comprising: rotatable wheel means, including a first portion rotatable in unison with a shaft, and including a rotatable second portion, and including means interconnecting said portions, so constructed and arranged that said portions are relatively rotatable to a limited extent; and said interconnecting means including a link and a first connection between said link and one of said portions of said wheel means, and a second connection between said link and the other portion of said wheel means, said second connection comprising spaced

227

2,237,394

7

metallic members one of which is a tube extending substantially parallel to said shaft and fixedly connected to said other portion of said wheel means and the other of which is a rod substantially coaxial with said tube and fixedly connected to said link, said second connection comprising further a resilient tubular member the outer and inner peripheral surfaces of which are fixedly connected to the inner and outer surfaces of said tube and rod respectively, said interconnecting means being so constructed and arranged that torque of one of said wheel portions is transmitted to the other of said portions through said link and said resilient member.

16. Power transmission apparatus, comprising: 15
rotatable wheel means, including a first portion rotatable in unison with a shaft, and including a rotatable second portion, and including means interconnecting said portions, so constructed and arranged that said portions are relatively rotatable to a limited extent; and said interconnecting means including a link and a first connection between said link and one of said portions of said wheel means, and a second connection between said link and the other portion of said wheel means, said second connection comprising spaced metallic plates one of which is fixedly connected to a side of said other portion of said wheel means and the other of which is fixedly connected to said link, said second connection comprising further a resilient member spaced surfaces of which are fixedly connected to said metallic plates respectively, said interconnecting means being so constructed and arranged that torque of one of said wheel portions is transmitted to the other of said portions through said link and said resilient member.

17. Power transmission apparatus, comprising: rotatable wheel means, including a first portion

rotatable in unison with a shaft, and including a rotatable second portion, and including means interconnecting said portions, so constructed and arranged that said portions are relatively rotatable to a limited extent; and said interconnecting means including a link and a lost motion connection between said link and a generally radially extending slot in one of said portions of said wheel means, and including substantially coaxial elements between which is interposed resilient means, one of said elements being connected to said link and the other of said elements being connected to the other portion of said wheel means, said interconnecting means being so constructed and arranged that torque of one of said wheel portions is transmitted to the other of said portions through said link and said resilient means.

18. Power transmission apparatus, comprising: 20
rotatable wheel means, including a first portion rotatable in unison with a shaft, and including a rotatable second portion, and including means interconnecting said portions, so constructed and arranged that said portions are relatively rotatable to a limited extent; and said interconnecting means including a link and a lost motion connection between said link and a generally radially extending slot in one of said portions of said wheel means, and including spaced plates between which is interposed resilient means one of said plates being connected to said link and the other of said plates being connected to the other portion of said wheel means, said interconnecting means being so constructed and arranged that torque of one of said wheel portions is transmitted to the other of said portions through said link and said resilient means.

JAMES F. SMITH.