Feb. 9, 1960 J. H. WILSON 2,924,121

UNIVERSAL SHAFT DRIVE COMPOUND FOR ROTARY DRILLING RIGS

Original Filed Jan. 21, 1953 3 Sheets-Sheet 1

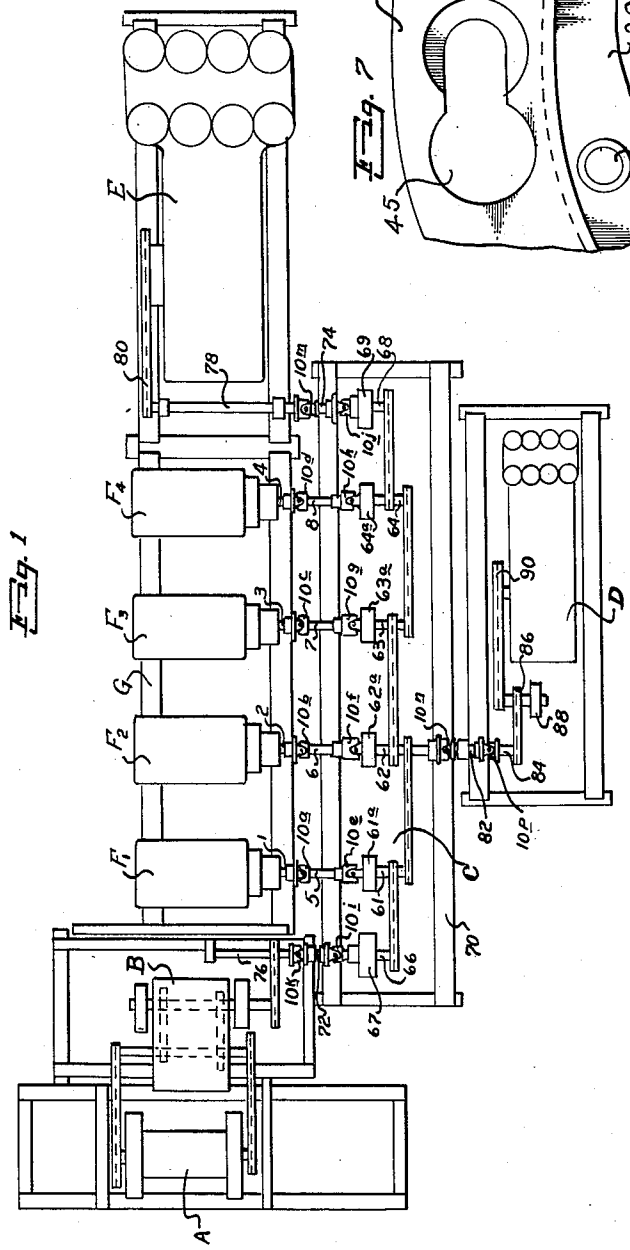


Fig. 1

Fig. 7

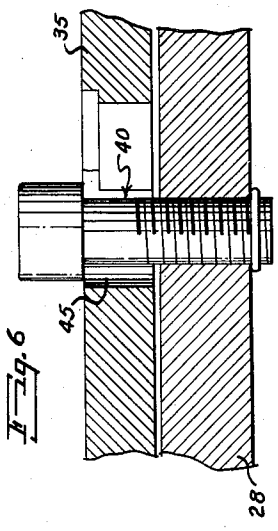


Fig. 6

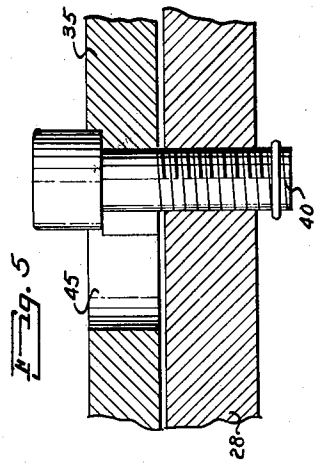


Fig. 5

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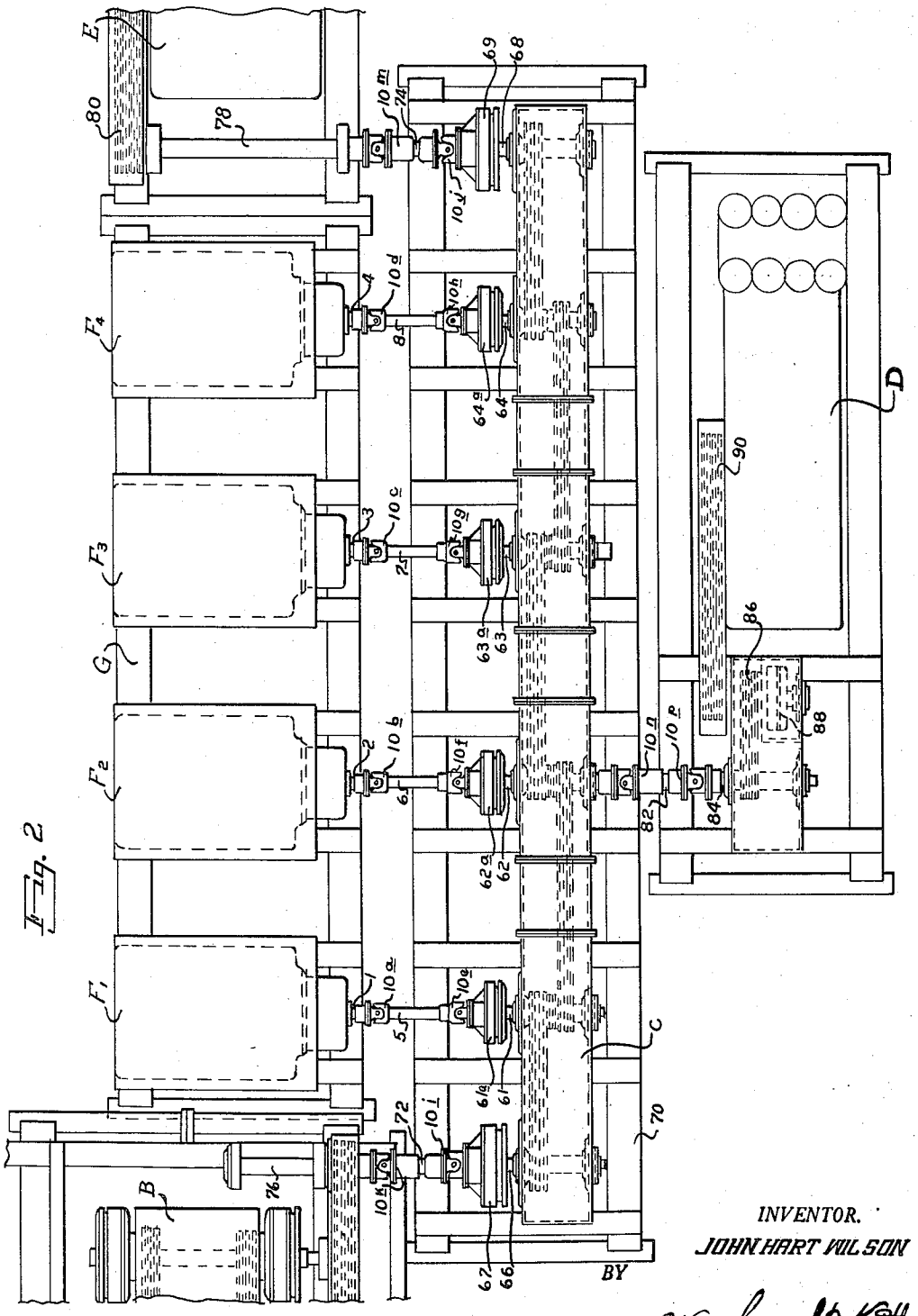


Fig. 2

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UNIVERSAL SHAFT DRIVE COMPOUND FOR ROTARY DRILLING RIGS

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Fig. 3

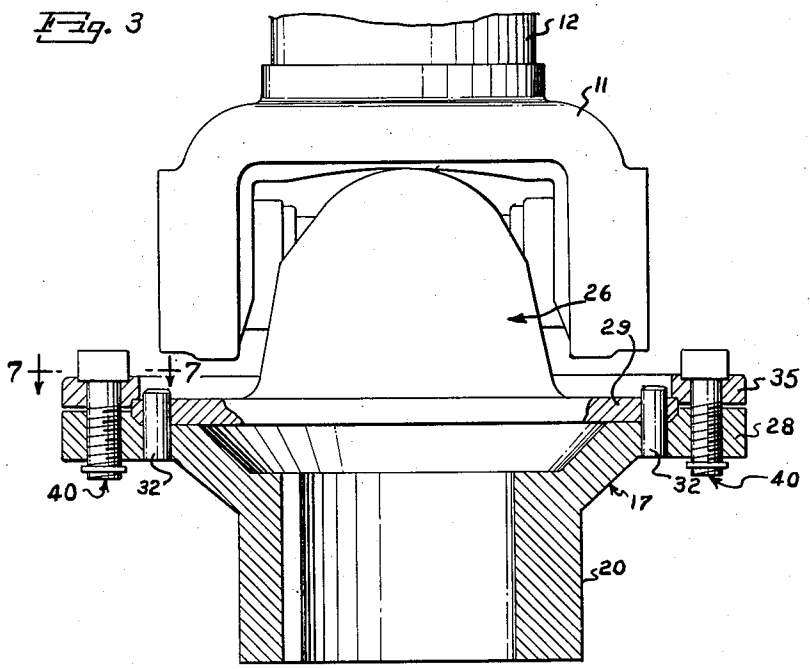
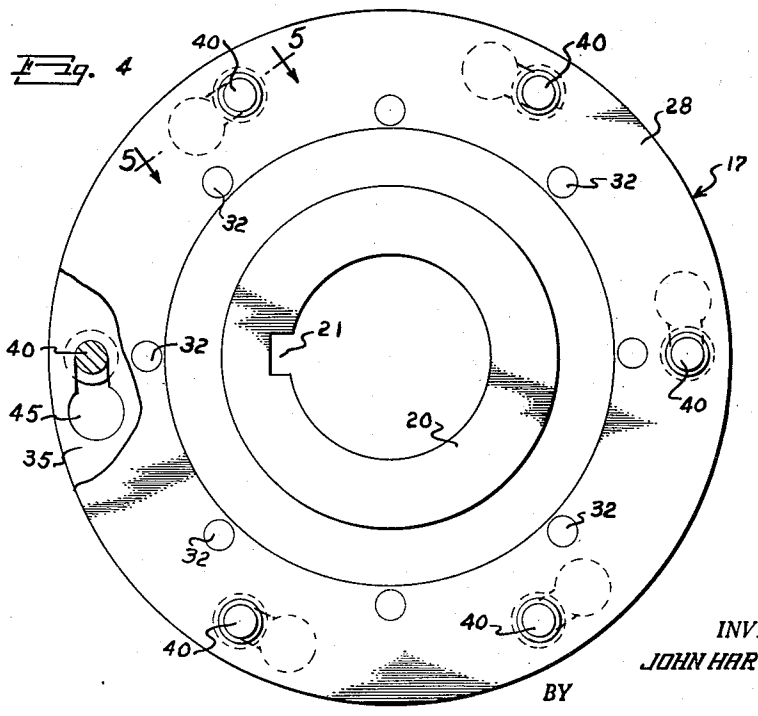


Fig. 4



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United States Patent Office 2,924,121 Patented Feb. 9, 1960

2,924,121

UNIVERSAL SHAFT DRIVE COMPOUND FOR ROTARY DRILLING RIGS

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Original application January 21, 1953, Serial No. 332,440, now Patent No. 2,803,474, dated August 20, 1957. Divided and this application November 1, 1956, Serial No. 619,800

11 Claims. (Cl. 74—665)

This invention relates to improvements in drives for drilling rigs, and more particularly to drives utilizing universal joints, thereby obviating the necessity for exact alignment, as has heretofore been necessary for the proper functioning of drilling rig drives.

It has long been the practice to compound two or more internal combustion engines in unitary driving relation so that the power of each engine could be applied individually to mud pumps and to the rotary table while drilling, but all the engines could be combined to supply power to the hoisting drum when pulling pipe. However, in compounding the engines into a single power unit, three different general arrangements have been previously used to enable the unit to be taken apart into eight foot width sections, so they could be transported over highways.

The first of these methods was to make the compound a long, unitary case section with shafts extending outward on the engine side and provided with a radial type constricting clutch which would engage a drum located on the engine fly wheel. With this arrangement, the engines were removed and transported separately from the compound, and then replaced in alignment with the compound shafts for use. This method has the disadvantage of the difficulty that is encountered in realigning the engine shafts with the respective compound shafts, and if they were not aligned, a great load was thrown on the adjacent bearings, which might result in breakage of either the shafts or the bearings in the compound, or the breaking of the crank shaft in the engine, breaking the converter, if a converter was used.

A second arrangement used to accomplish this purpose, was to make the compound sections so they could be taken apart, when it was necessary to make a move. In this arrangement the engines are mounted on skids and rigidly connected to a compound case section on the opposite end of the same skids. In such an arrrangement, the compound case sections must be taken apart and the chains which interconnect the shafts in driving relation in the respective compounds must also be taken apart. The compound sections that are connected to the respective engines must also be disconnected in order that each engine and each compound case section may be moved separately. The objection to this method is that it is necessary, not only to separate the case sections, but to take the chains apart, which chains are in an oil bath, therefore it is also necessary to cover up the open ends of the compound case sections, to prevent the entrance of grit and other foreign matter. Then with the move completed, the units must be set up again and the compound case sections put together, and the chains reconnected, all of which was difficult and time consuming. There was also danger of getting dirt, grit and the like in the oil bath case, unless great care was exercised.

A third method contemplates the use of a swinging compound, but this method, in which the compound sections swing about a common shaft, when the engines are spaced on normal center distances results in an overall height too great to be carried on a truck bed, which overall height is grater than allowed on highways, and this arrangement has the further objection in that, when lowered, it is difficult to put the shaft couplings together, and again these shaft couplings run in an oil bath, and since they must be taken apart, are subject to grit and the like getting into the housings, to cause wear on the shaft couplings.

The arrangement covered in this present application has none of the objections pointed out for the other arrangements, as the oil bath cases are not taken apart, and no chains need be disconnected, and when the engine sections are put together, there is no difficulty in aligning the various engine and compound units, as the universal shafts will permit a very considerable amount of misalignment, which is not true of any of the other arrangements.

In the present invention, a compound arrangement is provided, whereby two or more engines may be coupled together in unitary driving relation.

An object of this invention is to provide a drilling rig drive and driven elements which may be mounted on separate units, which are of a width suitable for handling and for moving over highways so as to be within the legal road width limit, or to pass through narrow passages or the like, and yet may be connected into a composite machine by universal shaft drives.

Another object of this invention is to provide universal shafts with quick detachable universal joints, which will obviate the necessity of removing or of exposing parts normally running in an oil bath, to dirt, grit, and other hazards incident to the disconnection thereof.

Still another object of the invention is to provide a compounding arrangement whereby two or more engines or prime movers may be compounded together through universal shaft connections, so that tue alignment between the drive and driven shafts is not a requisite for effective operation.

A further object of the invention is to provide an engine compounding arrangement which will enable the engines which are compounded together to be readily disassembled and reassembled, in a minimum of time and with a minimum number of tools.

Yet another object of the invention is to provide a universal drive for rotary drilling rigs and the like, which is simple in construction, easy to connect and to disconnect, which is efficient in operation, and which may be manufactured at a relatively low cost.

A still further object of the invention is to provide a power unit with a plurality of engines mounted on a skid sill unit, each of which engines has a drive shaft adapted to connect to a complementary driven shaft of a compound unit, the interconnecting shafts of which units may be disconnected and each skid sill unit will be within the legal road width limit so as to be transported over highways.

A yet further object of the invention is to provide a compound having suitable flexible universal joints mounted on the respective ends of the shafts thereof, with a separate skid having two or more prime movers mounted thereon in approximately the same spaced relation as the shafts in the compound case, the shafts of the respective prime movers being connected to the respective compound shafts by means of universal shafts.

With these objects in mind and others which will become manifest as the description proceeds, reference is to be had to the accompanying drawings, in which like reference characters designate like parts in the several views thereof, in which:

Fig. 1 is a diagrammatic view of a drilling rig, which employs four engines which are mounted transversely on an elongated skid sill unit, which engines and skid sills

comprise one unit, and showing a compound mounted on a separate, elongated skid sill unit, the shafts of which compound are connected to the respective shafts of the engines, pumps, and rotary drilling rig, the manner of connecting the compound unit to the respective drive and driven units form the particular subject matter of the present application;

Fig. 2 is an enlarged, fragmentary plan view of the power and transmission unit, as shown in Fig. 1;

Fig. 3 is a view partially in plan and partially in horizontal longitudinal section of a universal joint of the Cardan type which embodies the principles of the invention;

Fig. 4 is a view, in elevation, of the joint as seen from the bottom of Fig. 3;

Fig. 5 is a fragmentary sectional view of a detail of a flange gripping connection for effecting the driving element of the two parts of one of the joint members, the arrangement being in assembled and locked position;

Fig. 6 is a similar view of the same detail in unlocked position, ready for disassembly of the parts; and

Fig. 7 is a fragmentary face view of the flange clamping means, with the bolt removed, such as seen from line 7—7 of Fig. 3, or from the top of either Fig. 5 or 6.

With more detailed reference to the drawing, the reference character A designates the winch or winding drum assembly of a rotary drilling rig, which is usually referred to as the drawworks; B designates a clutch and chain drive arrangement, which is usually referred to as the transmission; C designates a power driving transmission assembly which is usually referred to as a compound, whereby the power is taken from a plurality of engines and distributed to a plurality of driven instrumentalities, such as mud pumps designated at D and E, respectively, and to the chain drive transmission designated at B, which in turn, drives the other elements of the rotary drilling rigs, such as the draw works A, and other elements, such as the rotary table or the like, which might be connected thereto.

A battery of engines F_1, F_2, F_3, and F_4 are mounted transversely of a pair of parallel skid sills G, each of which engines has a shaft, **1**, **2**, **3**, and **4**, respectively, extending outwardly therefrom, in the same direction and being substantially parallel.

Universal shaft assemblies **5**, **6**, **7** and **8** are in aligned relation with the respective shafts **1**, **2**, **3**, and **4**, with the adjacent ends of the respective shafts being connected together by means of the respective universal joints **10***a*, **10***b*, **10***c* and **10***d*, part of which respective universal joints are of the make up of the respective universal shaft assemblies. The outer ends of shafts **5**, **6**, **7** and **8**, have universal joints **10***e*, **10***f*, **10***g* and **10***h* thereon, which interconnect with the respective shafts **61**, **62**, **63** and **64**, which shafts have clutches **61***a*, **62***a*, **63***a*, and **64***a*, respectively thereon to selectively connect the respective engines F_1, F_2, F_3, and F_4, in driving relation with the respective shafts **61**, **62**, **63**, and **64**, and which shafts extend into compound unit C, as will best be seen in Figs. 1 and 2.

Further shafts **66** and **68** are provided transversely of parallel skid sills **70**, which shafts **66** and **68** have the respective clutches **67** and **69** thereon, to selectively connect shafts **66** and **68** in driving relation with shafts **72** and **74**, respectively. A portion of the respective shafts **66** and **68** extend outwardly in the same direction as shafts **5** through **8**, which shafts **66** and **68** have the respective universal joints **10***i* and **10***j* thereon and which shafts connect to the respective shafts **72** and **74**. The shaft **72** has a universal joint **10***k* thereon, which universal joint **10***k* has the other end thereof attached to shaft **76**, which shaft **76** is connected in geared relation through transmission B with the draw works A, in a manner well understood in the art of drilling.

A universal joint **10***m* has one end thereof connected to shaft **74** and the other end thereof connected to shaft **78** to connect pump E in driving relation therewith through chain drive **80**.

The shaft **62** has a universal joint **10***n* connected to one end thereof and to a shaft **82**, which in turn is connected with universal joint **10***p*, the other portion of which universal joint is connected to shaft **84** which drives through chain gearing **86** and clutch **88** to drive chain **90** connected to pump D.

The universal joints **10***a* to **10***p* inclusive, may be of the character as shown in Figs. 3 through 7, to enable the quick detachment thereof. It is to be noted that on detachment of the universal joints **10***a*, **10***c* and **10***d*, that the engine battery on sills G may be readily moved, without any appreciable overhang of portions of the separated joints. This enables the base to pass through narrow passages and to be within the restriction of legal road width limits, and likewise, universal joints **10***e*, **10***f*, **10***g* and **10***h*, as well as **10***i* and **10***n* may be separated to enable the compound unit C to be readily moved as a unit, and still be within the legal road width limits, and to pass through narrow passages, as the disconnected joints are within the confines of the width of the skid sills **70**. Likewise the pumps D and E may be moved by disconnecting universal joints **10***p* and **10***m* respectively.

While the present joint is shown as being capable of performing the above mentioned functions, it is to be understood that any type of separable universal joint, such as shown in my copending application, Ser. No. 409,691, Threaded Nut Ring for Shaft Coupling, filed Feb. 11, 1954, which issued as Patent No. 2,875,231 on February 24, 1959, may be used, wherein quick detachment is a desirable feature. However, bolt flanged universal joints are also to be considered as being within the scope of the invention.

As indicated above, installations such as shown in Figs. 1 and 2 of the drawings, when a great number of universal joints are employed, many man hours of time are saved in the assembly and disassembly of rotary drilling rigs, by the utilization of quick detachable joints of the charatcer shown, or of the character described in the co-pending application as set out above, the use of such joints also provides insurance that bolts or other parts will not become misplaced or lost when the coupling is disassembled.

A quick detachable universal joint, as shown in Figs. 3 through 7, and in application Ser. No. 332,440, Quick Detachable Universal Joints, filed January 21, 1953, which issued as Patent No. 2,803,474, on August 20, 1957, comprises generally two basic parts, one being a coupling flange, designated generally at **17**, which has a shank **20** attached thereto which extends outwardly therefrom.

The other part of the universal joint being a universal joint fork assembly **26**, two of which forks are mounted on flange **29**. Pins **32** pass through flanges **17** and **29** and are held in secure relation by a ring **35** which is secured by bolts **40** to flange unit **17**. Keyhole slots **45** are provided in ring **35** to enable the quick detachment of flange **29** from flange **17**. The key-way **21** in shank **20** provides telescoping relation with the shaft on which shank **20** is mounted to enable sufficient longitudinal movement of shank **20** and flange **17** to enable the longitudinal disengagement of flange **17** therefrom, to enable the separation of flange **29** from flange **17**.

Having thus clearly shown and described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A drilling rig combination including two elongated skid sill units, said skid sill units being adapted to be arranged in side by side relation, a multiplicity of engines mounted on one of said skid sill units transversely thereof, each of which engines has a drive shaft, an elongated compound transmission unit mounted longitudinally on the other of said elongated skid sill units, which

transmission has a plurality of transverse driven shafts mounted thereon, certain of said shafts being adapted to connect in end to end relation with the respective drive shafts of said engines interconnecting shafts each having a universal joint on each end thereof, one of said universal joints on each interconnecting shaft being connected with one of said engine drive shafts, the universal joint at the other end of each said interconnecting shaft being connected to one of said driven shafts of said compound transmission unit, and separable joint means within the length of each of the said interconnecting shafts to enable the connecting and disconnecting of at least one universal joint on each interconnecting shaft.

2. In a drilling rig combination including two elongated skid sill units, said skid sill units being adapted to be arranged in side by side relation, a multiplicity of engines mounted on one of said skid sill units transversely thereof, each of which engines has a drive shaft, an elongated transmission unit mounted longitudinally on the other of said elongated skid sill units, which transmission has a multiplicity of transverse driven shafts mounted thereon, certain of said shafts being adapted to connect in end to end relation with the respective drive shafts of said engines, a pump base, a pump unit mounted on said base, which pump unit has a driven shaft mounted thereon, a draw-works base, a draw-works mounted on said draw-works base, which draw-works has a driven shaft mounted thereon, interconnecting shafts each having a universal joint on each end thereof, said universal joint at one end of each interconnecting shaft being connected with a drive shaft of said engines of said power unit, telescoping shafts each having a universal joint on each end thereof, said telescoping shafts interconnecting said pump unit wtih said transmission unit, said draw-works with said transmission unit so said pump unit and said draw-works will be driven by power transmitted through said transmission unit, and separable joint means within the length of said respective connecting shafts which have universal joints thereon, to enable the connecting and disconnecting of at least one universal joint on each of said shafts.

3. In a multiple engine drive unit for rotary drilling rigs, an elongated engine base, a plurality of engines mounted transversely on said elongated base and each having a drive shaft, an elongated transmission base, a plurality of driven transmission shafts mounted transversely of said elongated transmission base, certain of said driven shafts on said transmission base being in approximate axial alignment with certain of said drive shafts of said engines, a third series of shafts interposed between and in approximate alignment with certain of said engine drive shafts and the corresponding, approximately aligned transmission driven shafts, said third series of shafts each having a universal joint on each end thereof for interconnecting certain of said engine drive shafts with the approximately aligned, corresponding driven shafts of said transmission unit, and separable joint means within the length of each of said third series of shafts having universal joints thereon to enable connecting and disconnecting said shafts.

4. The device as set forth in claim 3, wherein a pump unit is provided, said pump unit being connected to said transmission unit by means of a telescoping shaft having a universal joint on each end thereof so as to be in end to end driving relation with a shaft of at least one of said engines.

5. In a compound for compounding a plurality of engines into a power driving combination, two elongated bases at least two engines mounted transversely on one of said elongated bases, said engines being mounted in side by side relation, with the drive shafts thereof being approximately parallel, said drive shafts extending outward from each of said engines and transversely of said elongated base, a gearing arrangement mounted on the other of said elongated bases, shafts on said last mentioned base in approximate axial alignment with the drive shafts of the respective engines, one connecting shaft on said last mentioned base for each of the respective drive shafts of said engines, at least one yieldable universal joint means of each of said connecting shafts, connection means on said connecting shafts for connecting said drive shaft of each engine with the respective shaft on said base.

6. The device as set forth in claim 5, wherein said yieldable universal joint means includes connection means therewith, which connection means are quickly detachable.

7. In a drilling rig combination including two elongated skid sill units, said skid sill units being adapted to be arranged in side by side relation, a multiplicity of engines mounted transversely of one of said elongated skid sill units and which forms a power unit, each of which engines has an outwardly extending drive shaft, an elongated transmission unit mounted longitudinally on the other of said elongated skid sill units, which transmission unit has a plurality of transverse driven shafts mounted thereon, certain of said driven shafts being adapted to connect in end to end relation with the respective drive shafts of said engines, interconecting shafts each having a universal joint on each end thereof, one of said universal joints on each interconnecting shaft being connected with the drive shaft of an engine of said power unit, the universal joints at the other ends of said interconnecting shafts being connected to said driven shafts of said transmission unit.

8. A drilling rig combination including two elongated skid sill units, said skid sill units being adapted to be arranged in side by side relation, a multiplicity of engines mounted transversely of one of said elongated skid sill units and which form a power unit, each of which engines has an outwardly extending drive shaft, an elongated transmission unit mounted longitudinally on the other of said elongated skid sill units, which transmission unit has a plurality of transverse driven shafts mounted thereon, certain of said driven shafts being adapted to connect in end to end relation with the respective drive shafts of said engines, a pump unit having a driven shaft mounted thereon, interconnecting shafts each having a two-part, quick detachable universal joint on each end thereof, the universal joints at one end of said interconnecting shafts being connected with the respective engine drive shafts, other of said universal joints at the other ends of said interconnecting shafts being connected with the respective driven shafts of said transmission unit, and another interconnecting shaft having a universal joint on each end thereof interconnecting one of said transmission shafts and the shaft of said pump unit, so as to drive said pump unit through said transmission unit.

9. A drilling rig combination including two elongated skid sill units, said skid sill units being adapted to be arranged in side by side relation, a multiplicity of engines mounted transversely of one of said elongated skid sill units and which forms a power unit, each of which engines has an outwardly extending drive shaft, an elongated transmission unit mounted longitudially on the other of said elongated skid sill units, which transmission unit has a multiplicity of transverse driven shafts mounted thereon, certain of said driven shafts being adapted to connect in end to end relation with the respective drive shafts of said engines, a draw-works unit having a driven shaft mounted therein, interconnecting shafts each having a two-part, quick detachable universal joint at each end thereof, one universal joint of each said interconnecting shaft being connected to the drive shaft of one of said engines of said power unit, the other universal joints of said interconnecting shafts being connected to the driven shafts of said transmission unit, an interconnecting shaft having a telescoping portion, and a two-part, quick detachable universal joint on each end thereof intercon-

necting said transmission unit in driving relation with said draw-works so as to transmit power from said power unit through said transmission unit to said draw-works.

10. A device as set forth in claim 7, wherein a pump unit is provided, said pump unit being connected to said transmission unit by means of a telescoping shaft having a universal joint on each end thereof so as to be in driving relation with at least one of said engines.

11. A device as set forth in claim 7, wherein at least one pump unit is provided, said pump unit being connected to said transmission unit by means of a telescoping shaft having a universal joint on each end thereof, and wherein one of said shafts of said plurality of driven transmission shafts is out of aligned, driving relation with a shaft of one of said engines, and wherein said last-mentioned transmission shaft is connected in end to end driving relation with the shaft of said pump unit.

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