

June 17, 1941.

W. GUIER

2,246,478

POWER UNIT

Filed May 15, 1940

2 Sheets-Sheet 1

Fig. 1.

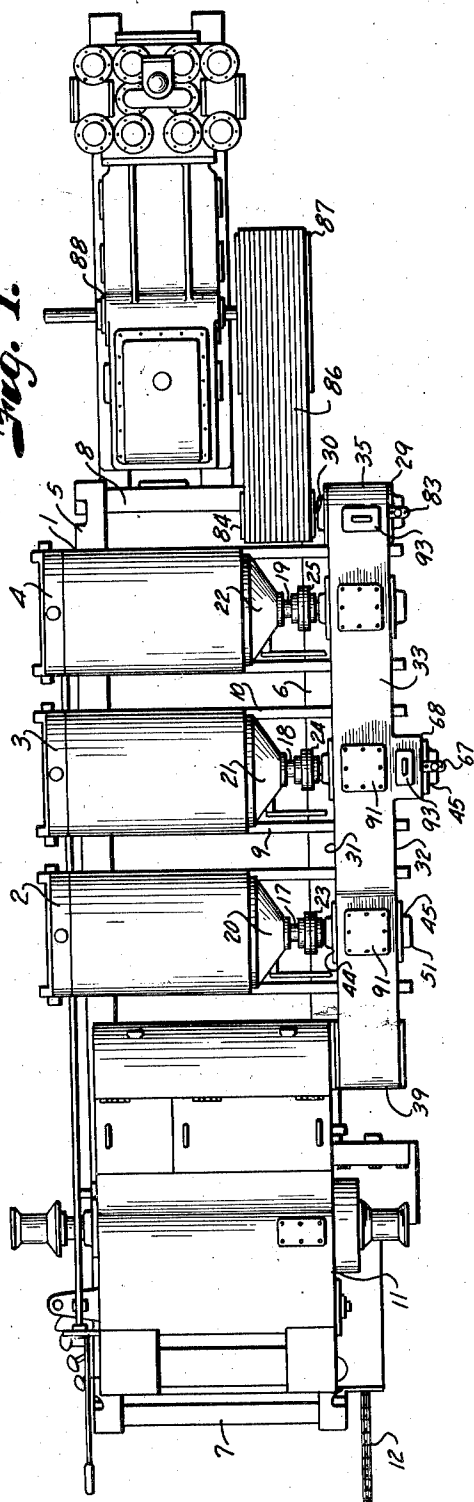
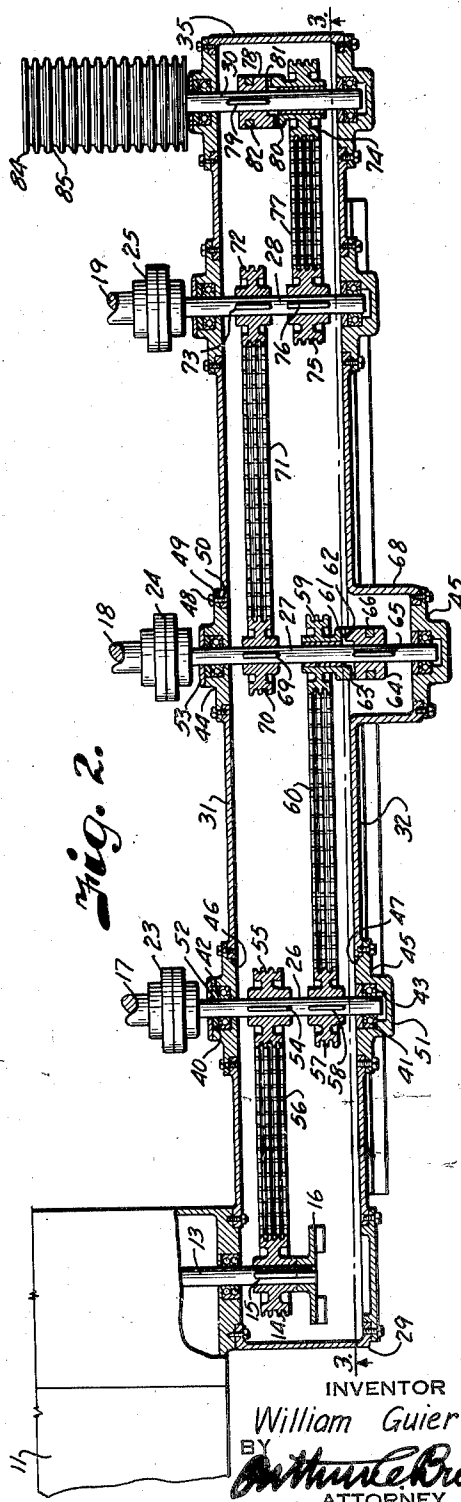


Fig. 2.



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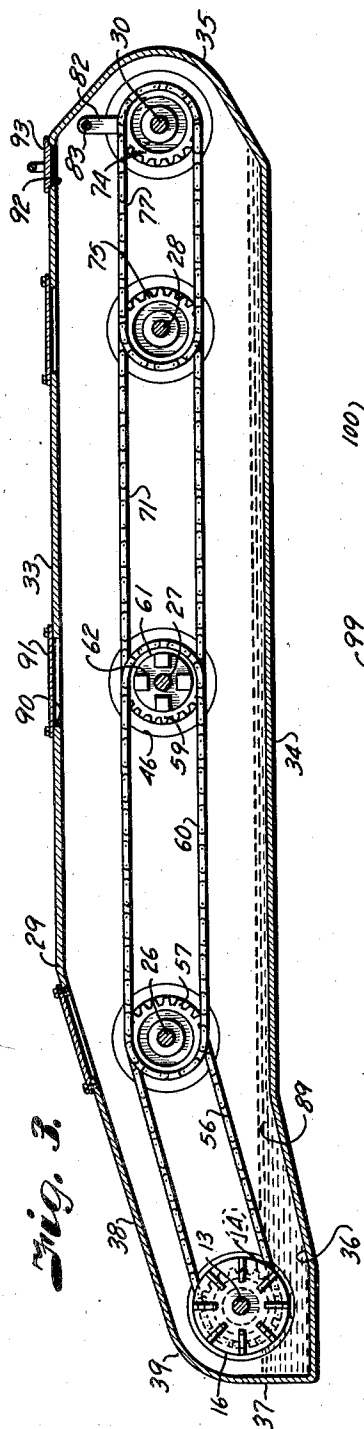
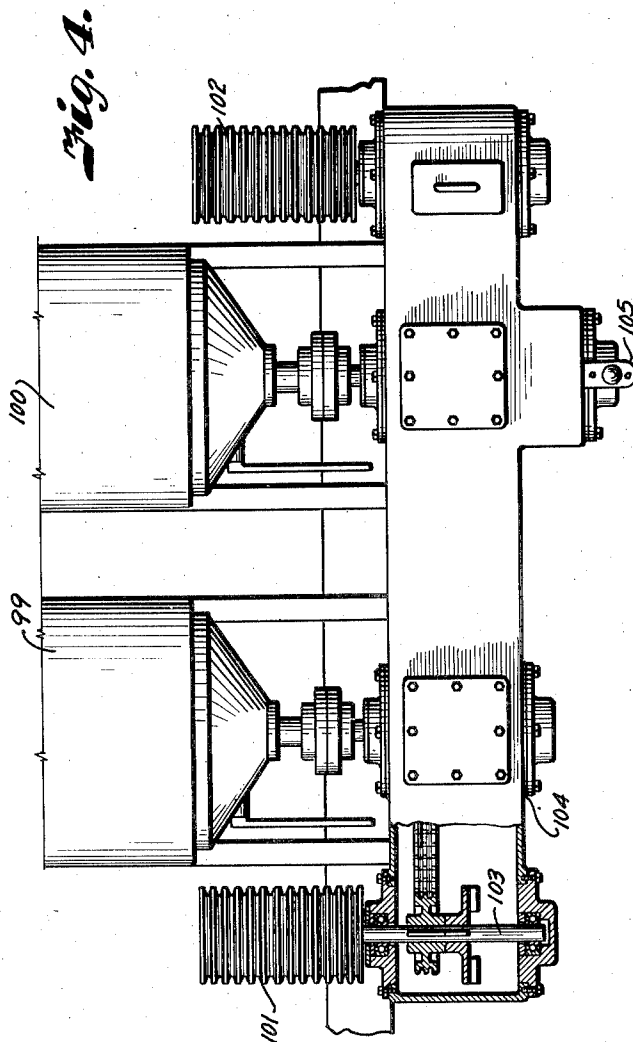
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2 Sheets-Sheet 2



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2,246,478

POWER UNIT

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Application May 15, 1940, Serial No. 335,395

11 Claims. (Cl. 60—97)

This invention relates to a power unit for operating the mechanism of a rotary well drilling rig or similar equipment wherein variable amounts of power are required to operate the individual units thereof, and at times when an extremely large amount of power is required. For example, in rotary drilling of wells, it is usually the practice to provide one engine for operating the mud pump whereby a drilling fluid is circulated from the bottom of the bore-hole to carry the cuttings to the top of the well and another engine is employed to operate the draw-works and rotary. It so happens that the mud or slush pump requires a great deal of horse-power but only a limited amount of power is required to operate the rotary. However, when running in and withdrawing the drilling string, maximum horse-power is required and to provide for such occasions it is becoming the practice to compound the two engines to provide for cases requiring maximum horse-power, and when running the drill pipe or casing the mud pump is uncoupled from the compounded unit.

It is, therefore, the principal object of the present invention to provide for compounding a plurality of individual power units so that they are readily selectively connectable to assure adequate power in performing the respective operations with the least possible horse-power.

Other objects of the invention are to provide a simple compact compounding arrangement completely housed in an oil-tight case; to provide the connecting assemblies for ready removal from the case; to provide for ready inspection of any of the compound drives; and to provide a compound arrangement readily separable from the engines or motor units and which can be readily assembled in a minimum of time with the least possible effort.

It is also an object of the invention to provide a compound unit wherein the over-all width of the assembly is reduced by mounting the drive pulleys on the inside of the compound connections to provide a compounding arrangement wherein there is a more balanced and centralized pull between the power units and their driven mechanisms to eliminate weaving and distortion of the unit assemblies.

Other objects of the invention are to provide a compounding arrangement having continuity of line, which has a minimum of operating levers, and which is provided with a maximum number of interchangeable parts all easily accessible even though tightly housed in an oil-tight case.

In accomplishing these and other objects of the invention, hereinafter pointed out, I have pro-

vided improved details of structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a plan view of a power unit for a rotary well drilling apparatus wherein the engines are compounded in accordance with the present invention.

Fig. 2 is an enlarged horizontal section through the compounding connection particularly illustrating the oil-tight case in which the various drives and clutches are contained.

Fig. 3 is a vertical section on the line 3—3 of Fig. 2.

Fig. 4 is a plan view of a modified form of the invention.

Referring more in detail to the drawings:

1 designates a power unit constructed in accordance with the present invention, and which includes a plurality of internal combustion engines here shown as three in number, 2, 3 and 4, that are mounted on a suitable base frame including sills 5 and 6 interconnected by cross-members 7 and 8. The engines are mounted on transverse sills 5 and 6 at one end thereof, the draw-works 11 being mounted on the opposite ends of the sills in alignment with the rotary of a drilling rig (not shown).

The draw-works may be of any conventional design in that it includes a winding drum and a driving connection with a rotary by means of a chain or the like 12. Power is selectively transmitted to the chain 12 and winding drum or windlass from a shaft 13 projecting through a bearing in a side of the draw-works and carrying a sprocket 14 which is secured thereto by a spline 15. Also keyed on the shaft alongside the sprocket is an impeller 16 for centrifugally discharging a lubricant as later described. When the motor units are mounted on the cross-sills 9 and 10, the power shafts 17, 18 and 19 thereof are located so that they all may be interconnected by means of driving connections having continuity of line in accordance with the present invention.

Each of the engines is provided with a clutch indicated by the housings 20, 21 and 22, whereby the power shafts are respectively connectable and disconnectable from the crank-shafts of the engines. The shafts 17, 18 and 19 are connected by couplings 23, 24 and 25 with shaft extensions 26, 27 and 28 respectively. The shaft extensions are enclosed within an oil-tight casing 29 of sufficient length to enclose the sprocket 14 at one end and to house a driven shaft 30 at the other. The casing 29 includes parallel side walls 31 and

32 connected by a top 33 and a bottom 34. The end enclosing the shaft 30 is preferably rounded, as at 35, while the opposite end extends downwardly to form an oil sump 36 therein closed at the end by a vertical wall 37 rounding into the downwardly inclined portion 38 of the top as indicated at 39. The shaft extensions 26, 27 and 28 are rotatably supported in bearings 40 and 41 housed within recesses 42 and 43 in bearing plates 44 and 45 closing openings 46 and 47 in the sides of the casing. The plates 44 and 45 are removably secured to the sides of the housing by suitable fastening devices, such as screws 48, extending through openings 49 in the plates and into threaded sockets 50 formed in the side walls of the casing. Each outer plate 45 has a cap 51 closing over the end of the shafts so as to avoid necessity of a packing. The inner bearing plates, however, carry packing elements 52 encircling the shaft and retained in sealing engagement therewith by rings 53 suitably secured to the bearing plates.

Secured to the shaft extension 26 by a spline 54 is a sprocket 55 aligned with the sprocket 14 whereby the sprocket 14 is actuated from the engine 2 through a chain 56 operating over the respective sprockets. Power of the engine 3 may also be utilized in operating the shaft 13 of the draw-works, since the shaft extension 26 also carries a sprocket 57 secured thereto by a spline 58 which aligns with a sprocket 59 ordinarily freely rotatable on the shaft extension 27. The sprockets 57 and 59 are interconnected by an endless chain 60. The hub 61 of the sprocket 59 is provided with a clutch face 62 which is engageable by a similar face 63 on a clutch collar 64, the clutch collar 64 being slidably connected with the shaft 27 by a spline 65. The clutch collar is actuated by a yoke 66 having suitable connection with an operating lever 67, Fig. 1.

In order to accommodate the clutch collar 64, the bearing plate 45 for that shaft is carried by an offset 68 as clearly shown in Fig. 2. It is thus obvious that when the clutch collar is moved into engagement with the hub of the sprocket 59, the engine 3 is also effective in driving the draw-works so that the power thereof is added to the power of the engine 2.

Also keyed on the shaft extension 27 by a spline 69 is a sprocket 70 aligning with the sprockets 14 and 55 previously described, which connects by an endless chain 71 with a sprocket 72 secured by a spline 73 to the shaft extension 28 whereby the power of the engine 4 is compounded with the power of the engines 2 and 3 when the clutch collar is engaged with the sprocket 59. The shaft 30 is mounted in bearing plates similar to the bearing plates previously described and carries a sprocket 74 rotated by a sprocket 75 which is secured to the shaft 28 by a spline 76, the sprocket 74 being rotated through a chain connection 77 operating over the respective sprockets. The sprocket 75 is adapted to drive the shaft 30 through a clutch collar 78 that is slidably keyed on the shaft by a spline 79, the clutch collar being provided with a clutch face 80 engageable with a similar clutch face 81 on the hub of the sprocket 74. The clutch collar 78 is actuated by a suitable shifting yoke 82 operably connected with a lever 83 as clearly shown in Fig. 1. The shaft 30 projects through the engine side of the case and carries a driving pulley 84, fixed to the projecting end thereof and provided with a plurality of grooves 85 for driving belts 86 running over the

driving pulley 87 of a mud pump 88 whereby the drilling fluid is circulated under pressure to and from the bore-hole as in conventional drilling practice.

The driving connections, as well as the bearings just described, are lubricated by a lubricant, indicated at 89, which is caused to move along the length of the casing and be centrifugally discharged by the propeller 16 onto the moving parts. In order to permit ready inspection of the driving connections, the top of the casing may be provided with suitable inspection openings 90 normally closed by plates 91. The offset 68 and top portion of the casing above the clutch collar 78 are provided with openings 92 closed by suitable lids 93.

The modified form of the invention illustrated in Fig. 4 shows the compounding of two engine units 99 and 100 wherein the power shafts are adapted to operate separately pulleys 101 and 102 carried on the projecting ends of shafts 103 journaled in the ends of a casing 104 similar to the shaft 30 previously described, the pulleys 101 and 102 being located on the engine side of the casing so as to provide a compact structure and better distribute the driving stresses between the engines and their load. The engines 99 and 100 are interconnected through a driving connection in the same manner as the engines 2 and 3 above described, the connecting clutch being mounted on the driven shaft for the engine 100 and operated by a suitable lever 105.

Referring to the operation of the form of the invention illustrated in Figs. 1 to 3 inclusive, and assuming that the mud pump is being operated simultaneously with operation of the rotary, the clutch collar 78 is connected in driving relation with the sprocket 74 whereby the engines 3 and 4 are compounded to drive the mud pump through the sprockets 70 and 72, chain 71, and sprockets 74, 75 and chain 77. Under normal drilling operations, the clutch collar 64 will be disengaged from the sprocket 59, whereby the sprocket 59 may idle on the shaft 27. The rotary is therefore operated solely by the engine 2 through the sprocket 55, chain 56 and sprocket 14. When running in and withdrawing the drilling string, or handling the casing, maximum power is required on the draw-works, and as at this time the mud pump is shut down, the clutch collar 73 is disconnected from the sprocket 74 and the clutch collar 64 is engaged with the sprocket 59 so that all of the engines 2, 3 and 4 are effective in operating the draw-works.

It is obvious that I have provided a simple arrangement for selectively compounding the respective engines so as to provide adequate horsepower for operating the mud pump and rotary and that when greater power is required to operate the draw-works, all of the engines may be effectively compounded to perform the required operations.

In the form of the invention shown in Fig. 4, the pulley 102 may be connected with the mud pump similar to the pulley 84, while the other pulley 101 may be utilized for driving the draw-works or other operated mechanism. With this arrangement, the unit 99 may be of suitable horsepower to operate the rotary, and the unit 100 of suitable horsepower to drive the draw-works when greater power is required. It is obvious that the arrangement of the pulleys 84, 101 and 102 on the inside of the casings provides for better distribution of the pull and working

stresses between the motor units and the mechanism driven thereby, and also reduces the overall width of the power unit so that it is within the prevailing limits, when the power unit is transported from one location to another. It is also obvious that the compounding is effected by the clutch collar of the middle engine power shaft and that the other two engines are connected without any clutching means other than the engine clutches 20 and 22. It is also obvious that all the compounding connections are completely housed in an oil-tight casing and that the casing is suitably constructed to permit of ready assembly of the driving parts and inspection of any of the drives merely by removing the inspection covers.

The units compounded as described provide a multiple drive system, having continuity of line, are of compact construction, require no adjustment, and have power operating levers with all of the moving parts operating in oil adequately circulated by an impeller on one of the shafts.

It is also obvious that the sprockets are of like design and may be readily interchanged so that few standard parts are required in servicing the equipment.

What I claim and desire to secure by Letters Patent is:

1. An apparatus of the character described, including a plurality of engines having power shafts arranged in parallel, a driven shaft arranged in parallel relation with the power shafts, shaft extensions for the power shafts of the engines, driving connections between the power shaft extensions and one of the power shaft extensions and the driven shaft, said first named driving connection including a clutch for selectively coupling the engines, a lubricant-tight casing enclosing said driving connections, bearings in the casing, journalling the shaft extensions, couplings for detachably connecting the shaft extensions with the power shafts, and means on one of the shafts for moving a lubricant in the casing.

2. An apparatus of the character described, including a plurality of engines having power shafts arranged in parallel, shaft extensions for the power shafts, an elongated casing having bearings journalling the power shaft extensions, means exteriorly of the casing for detachably coupling the power shaft extensions with the power shafts of the engines, driven shafts journaled in the respective ends of the casing, driving connections in the casing for connecting the power shaft extensions, driving connections in the casing for connecting the driven shafts with the adjacent power shaft extensions, one of said driving connections including a clutch for selectively coupling all of the engines to one of the driven shafts, and clutch means for selectively rendering the driving connection for the other driven shaft ineffective when all of the engines are coupled to the first driven shaft.

3. An apparatus of the character described, including a plurality of engines having power shafts arranged in parallel, shaft extensions for the power shafts, an elongated casing having bearings journalling the shaft extensions, means exteriorly of the casing for detachably connecting the shaft extensions in coaxial alignment with the power shafts, driven shafts journaled in the respective ends of the casing, a driving connection in the casing for connecting the shaft extensions, driving connections in the casing for connecting each of the driven shafts with the adjacent shaft extension, and clutch means for

selectively rendering one of said driving connections ineffective whereby the engines individually operate the driven shafts.

4. In an apparatus of the character described, the combination with a plurality of engines having power shafts arranged in parallel, a unitary driving mechanism connecting the power shafts of the engines including an elongated casing having bearings journalling shaft extensions for said power shafts, shaft extensions journaled in said bearings, driven shafts journaled in the respective ends of the casing, driving connections in the casing for connecting the shaft extensions, driving connections in the casing for connecting the driven shafts with the adjacent shaft extensions, clutch means for selectively rendering one of said connections effective whereby all of the engines are connected to one of the driven shafts, clutch means for selectively rendering the driving connection for the other driven shaft effective when all of the engines are coupled to the first driven shaft, means on one of the shafts for circulating a lubricant in the casing, and couplings connecting the shaft extensions in coaxial alignment with the power shafts to support said unitary driving mechanism.

5. In combination with a plurality of engines having parallel driving shafts, a draw-works and a slush pump located in direct longitudinal alignment with each other, pairs of sprockets on the driving shafts, flexible connections operating over the sprockets on an intermediate driving shaft and one of the sprockets on the other of said driving shafts to couple said driving shafts, one of the sprockets on the intermediate driving shaft being loosely mounted, a clutch selectively connecting said loosely mounted sprocket with said intermediate driving shaft, a casing enclosing said driving connections, driven shafts journaled in the end of the casing adjacent the draw-works and the slush pump respectively, a sprocket loosely mounted on one of the driven shafts, a flexible driving connection between said last named sprocket and a sprocket on the adjacent driving shaft, a driving connection between the other driven shaft and the immediately adjacent driving shaft, a driving member on the driven shaft adjacent the slush pump, a flexible connection connecting the driving member with the slush pump, and a clutch selectively connecting the sprocket on said last named driven shaft, said other driven shaft being connected in driving relation with the draw-works.

6. An apparatus of the character described, including a plurality of engines, a driven member having a driving connection with one of said engines, a second driven member having driving connection with the other of said engines, and a coupling connection between said engines including a clutch for selectively connecting said engines, said driven members being located in direct alignment with each other with respect to the longitudinal direction of said driving connections.

7. An apparatus of the character described, including a plurality of engines, means interconnecting said engines, a driven member having a driving connection with one of said engines, a second driven member having driving connection with two of said engines, clutch means selectively connecting all of said engines with the first named driven member, and a second clutch means for selectively disconnecting said last named driven member, said driven members being located in direct alignment with each other with

respect to the longitudinal direction of said driving connections.

8. In combination with a plurality of engines having parallel driving shafts, a draw-works and a slush pump having shafts parallel with the driving shafts, pairs of sprockets on the driving shafts, flexible connections operating over the sprockets on an intermediate driving shaft and one of the sprockets on the other of said driving shafts to couple said driving shafts, the sprocket on the intermediate driving shaft connecting the driving shaft with the draw-works shaft being loosely mounted, a clutch selectively connecting said sprocket with the driving shaft, a driving connection between the draw-works shaft and the adjacent driving shaft, a casing enclosing said driving connections, a driven shaft journaled in the end of the casing adjacent the slush pump, a sprocket loosely mounted on the last named driven shaft, a flexible driving connection between said last named loosely mounted sprocket and a sprocket on the adjacent driving shaft, a driving member on the last named driven shaft, a flexible connection connecting the driving member with the slush pump shaft, and a clutch selectively connecting the sprocket on the last named driven shaft.

9. An apparatus of the character described, including a plurality of engines having shafts arranged in parallel, extensions for said engine shafts, a casing journaled in the casing in parallel relation with the engine shafts and having ends projecting from the casing on the engine side thereof, driving connections between said shafts,

and couplings connecting the engine shafts with the extensions whereby the casing and said elements carried thereby are removable as a unit.

10. In combination with a plurality of engines having power shafts arranged in parallel relation, means mounting the engines for support as a single unit, means connecting said engines including an elongated casing, shaft extensions rotatably mounted in the casing in alignment with the respective power shafts, couplings interconnecting the power shafts with the shaft extensions exteriorly of the casing whereby the casing and shaft extensions are adapted for removal as a single unit, and driving connections in the casing between said shaft extensions.

11. In combination with a plurality of engines having power shafts arranged in parallel relation, means mounting the engines for support as a single unit, means connecting said engines including an elongated casing, shaft extensions rotatably mounted in the casing in alignment with the respective power shafts, couplings interconnecting the power shafts with the shaft extensions exteriorly of the casing whereby the casing and shaft extensions are adapted for removal as a single unit, driving connections in the casing between said shaft extensions, driven shafts journaled in the respective ends of the casing, driving members on said shafts aligning with each other in the longitudinal direction with respect to the driving connections, and means connecting the adjacent shaft extensions with the driven shafts.

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