

Dec. 2, 1941.

A. MARSH

2,265,078

ENGINE

Filed Jan. 23, 1941

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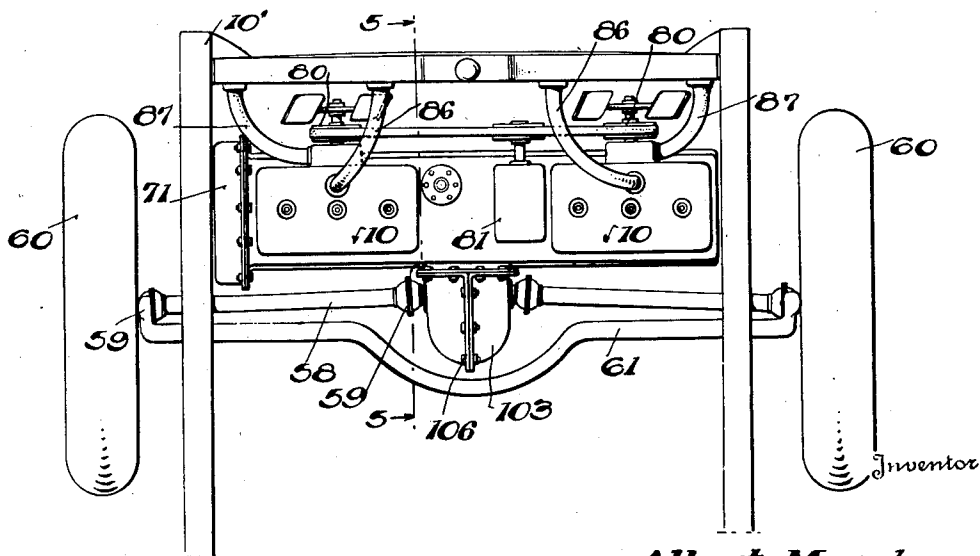
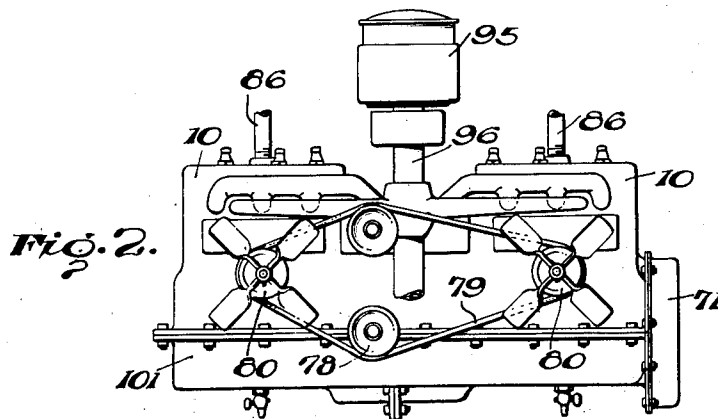
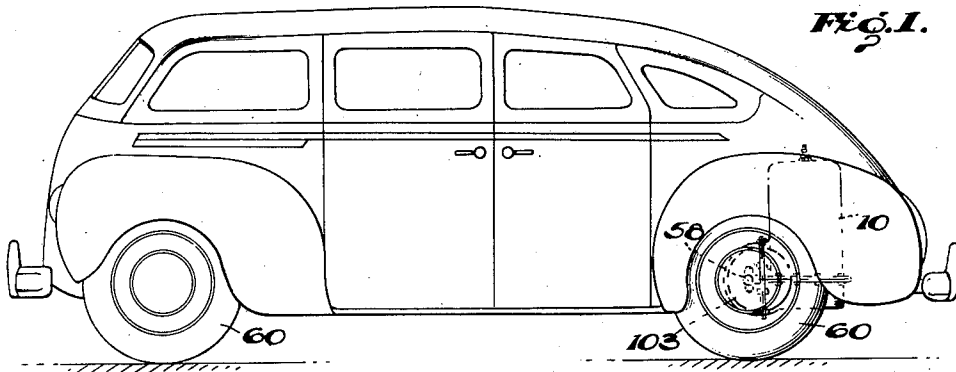


FIG. 3.

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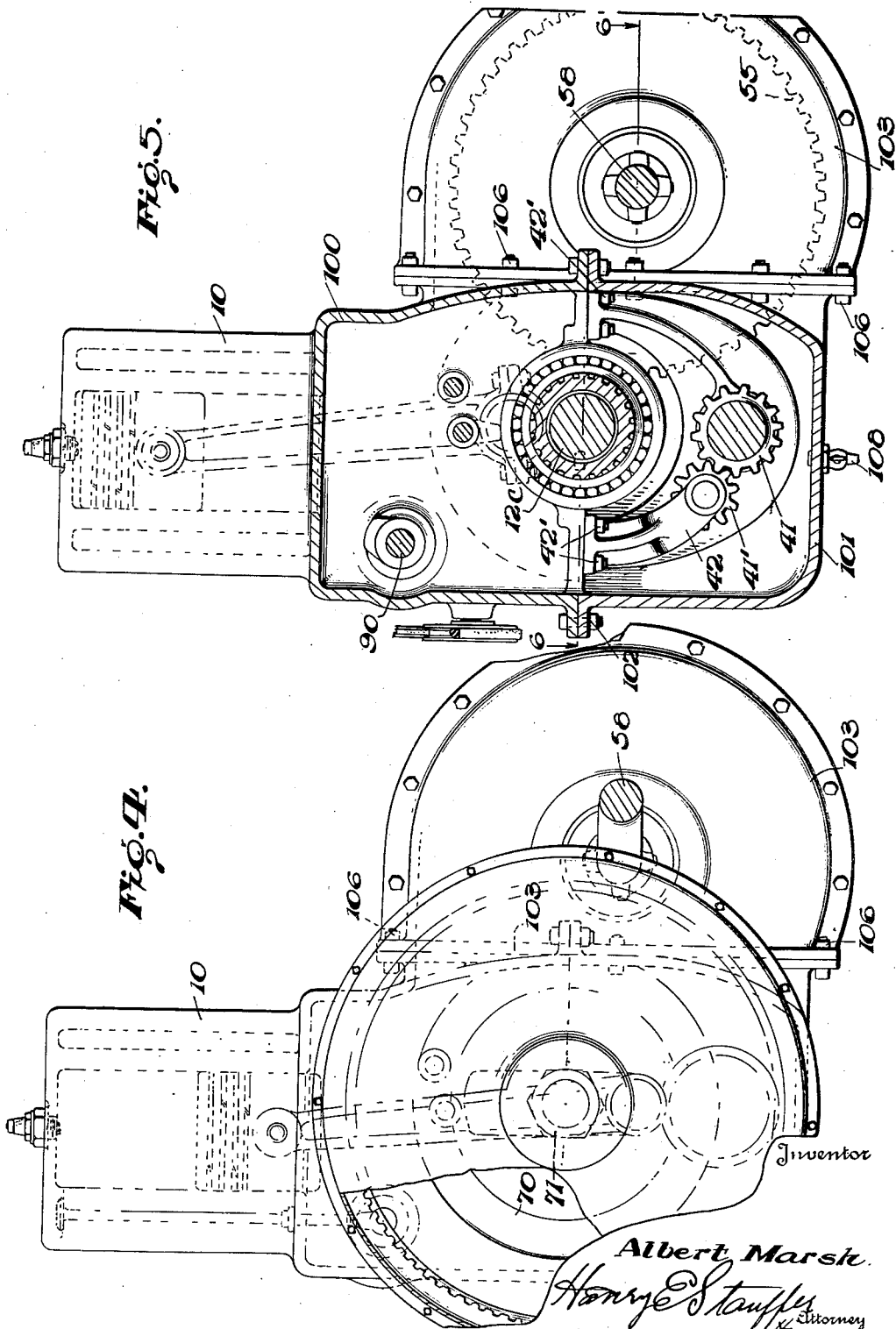
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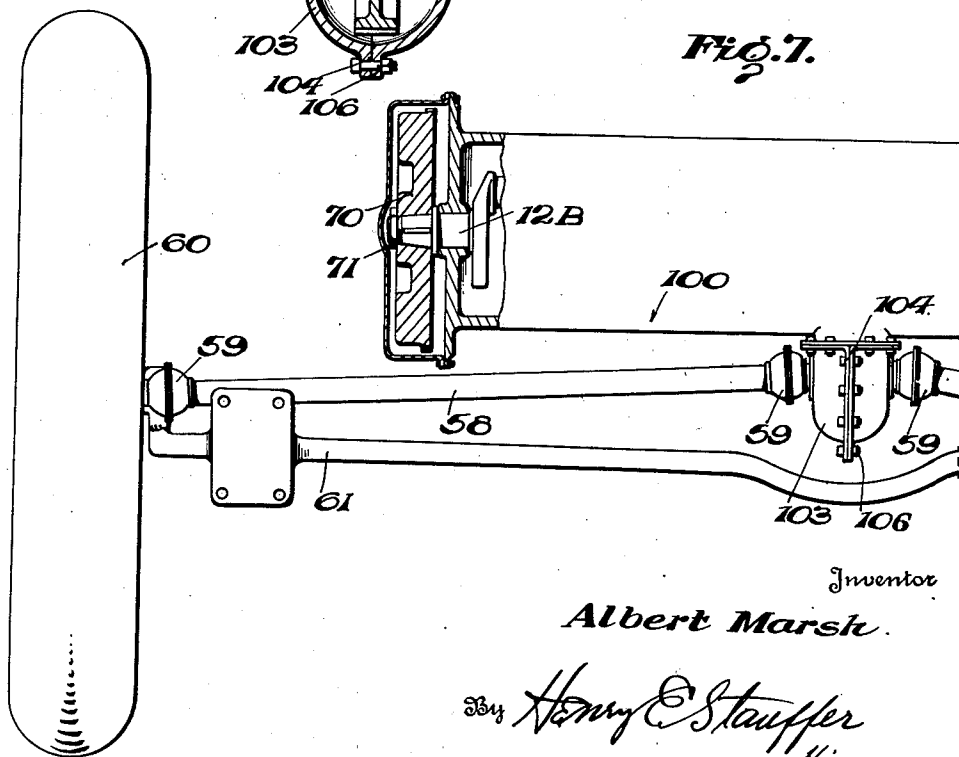
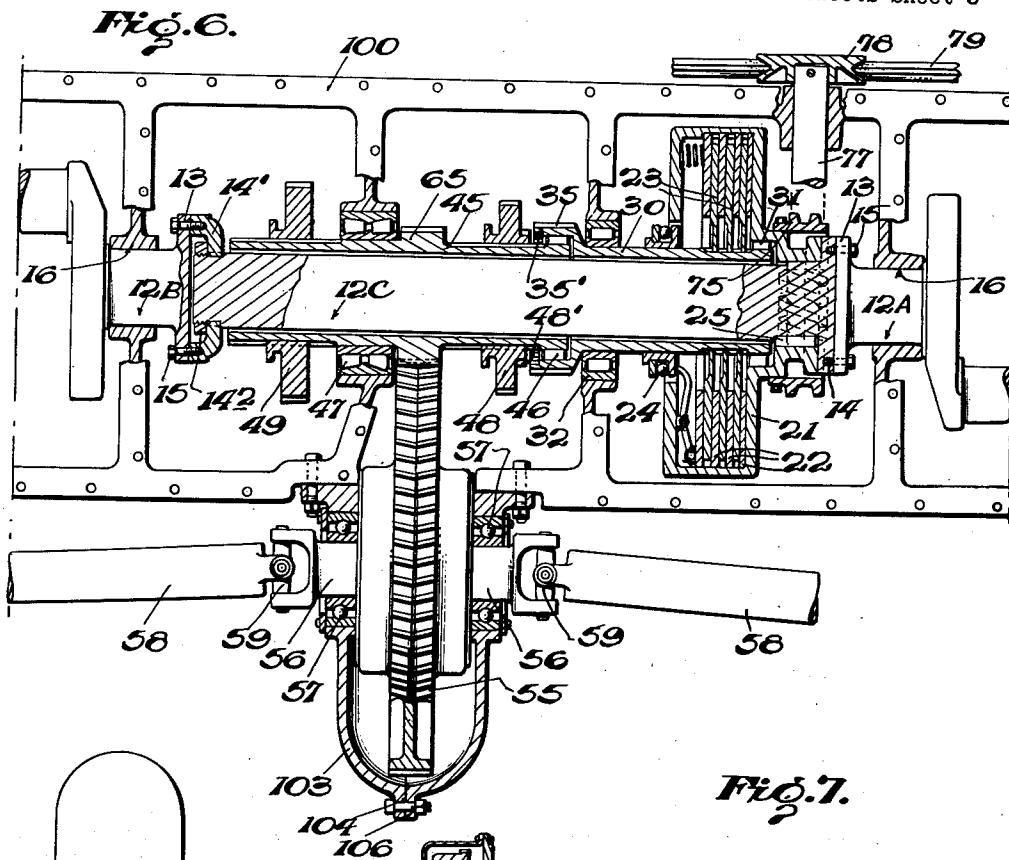
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Inventor

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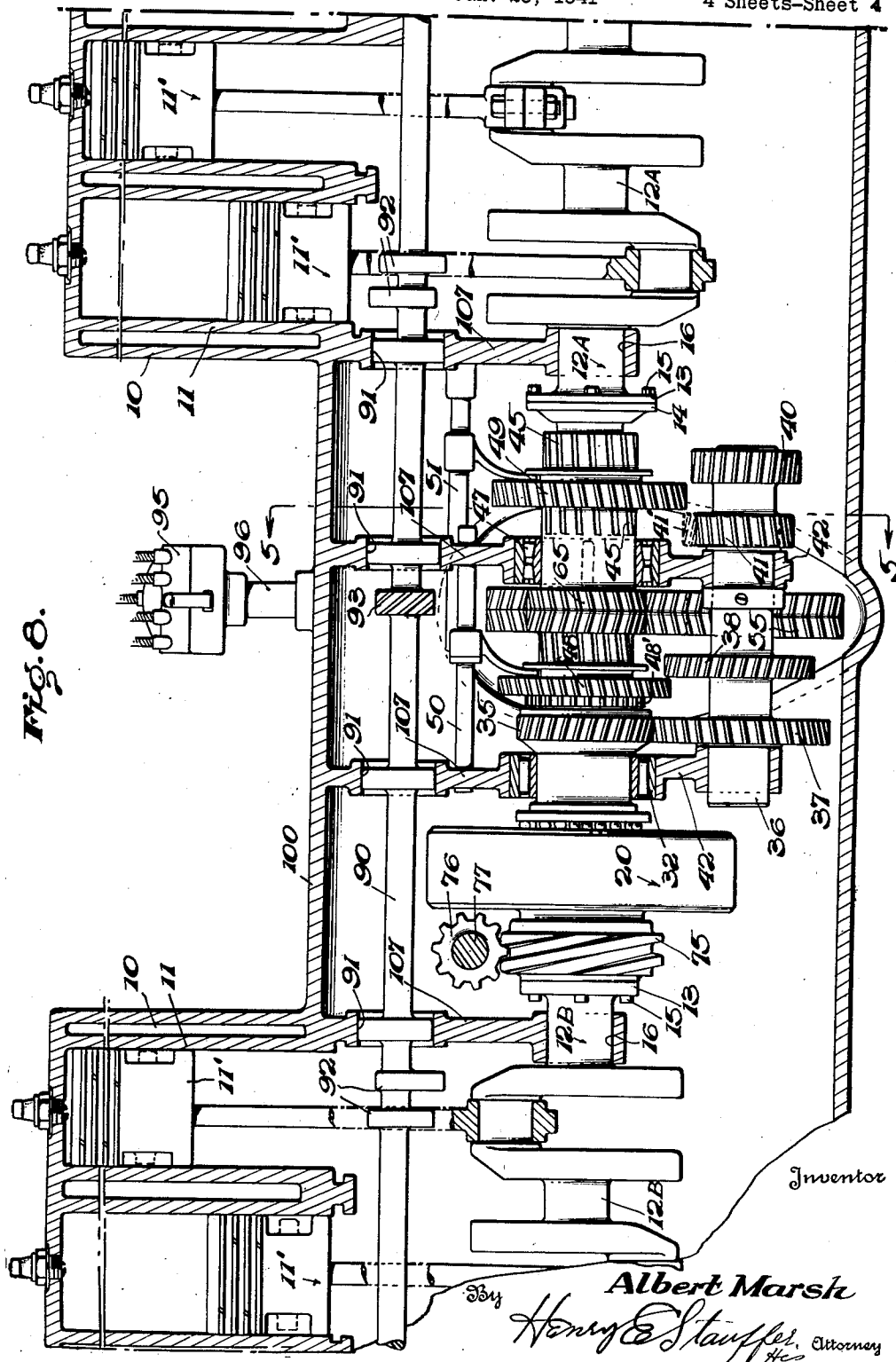
A. MARSH

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ENGINE

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UNITED STATES PATENT OFFICE

2,265,078

ENGINE

Albert Marsh, Tallahassee, Fla.

Application January 23, 1941, Serial No. 375,670

13 Claims. (Cl. 180-54)

Generally speaking, my invention is in automobile engines, and particularly in such engines as are intended to be placed at the rear of the vehicle driven by them.

One of the objects of the invention is to provide a transversely mounted rear engine, which is evenly balanced as to the distribution of its weight.

Another object is to provide means by which the power of the engine may be transmitted to the vehicle in a very direct and positive manner.

A further object is to produce a transversely mounted rear engine which shall be compact in its construction, and so be adapted for use in the limited space which is commonly available for such engines.

Further objects are: to produce a construction in which the clutch and the transmission are embodied in the engine assembly; and in which both the clutch and the transmission elements are arranged in alinement with the power cylinders of the engine, some of which are arranged on one side of the automobile and others on the other side thereof; to mount the clutch and the transmission elements, usually mounted on the main shaft of the transmission, on special sleeve shafts which surround, but rotate independently of the main crank shaft.

A still further object is to produce an engine in which a portion of the engine shaft, together with the clutch and the main transmission shaft and parts carried thereby, may be readily assembled, and which may be easily removed and replaced as a whole for inspection or repair.

While any primary motor elements may be used, my invention is particularly applicable to internal combustion engines of the multi-cylinder type; and, in order to secure the best distribution of weight, the cylinders and their pistons and other associated parts are equally disposed on the two ends of the engine frame, so that when the engine is mounted transversely of the automobile, as is the preferred arrangement, the weight of the engine will be equally distributed on both sides of the longitudinal axis of the chassis of the automobile. It will thus be understood that the term "end," as used herein with reference to the frame of the engine, applies to a portion of the engine frame adjacent one of the side members of the automobile chassis when the engine is mounted transversely in the chassis.

In my preferred arrangement, there is one engine shaft to serve the power elements of both ends of the frame. This shaft may be a single unitary structure, but certain advantages will be

secured by forming the same in three parts; namely, two crank shafts proper, one for each block of cylinders, and a member to connect the two crank shafts proper but to be separable therefrom.

In the drawings:

Fig. 1 is a view of an automobile such as is especially suited for a rear mounting of its engine.

Fig. 2 is a view of the engine of my invention, as it appears when looking into the rear of the automobile, showing the belt for driving the water pumps, generator, cooling fans, etc.

Fig. 3 is a rear view of an automobile chassis, with my engine installed therein behind the rear axle of the same.

Fig. 4 is an end view of the engine, looking from the left side of Fig. 3 but from inside the side member of the chassis.

Fig. 5 is a vertical section of the engine, taken on the line 5-5 of Fig. 3, looking in the direction of the arrows.

Fig. 6 is a horizontal section of the central portion of the engine, taken on the line 6-6 of Fig. 5, looking in the direction of the arrows.

Fig. 7 is a view similar to Fig. 6, but on a smaller scale, and showing principally the fly-wheel of the engine and its relation to the axle of the automobile.

Fig. 8 is an elevation of the central portion of the engine, looking at it from the rear, the oil pan, blocks, and frame members being in section.

Referring now in detail to the drawings, the power producing elements of the engine may be of any suitable kind, but are here shown of the explosive type. The fundamental thought is that these elements shall be mounted on both sides of the car, so that each side shall bear approximately the same weight in so far as the power plant is concerned. Thus, there are two engine blocks 10, one on each side of the longitudinal axis of the frame 10'. Each block may have any desired number of cylinders 11 and pistons 11'. Three are shown in Fig. 3, but this showing is illustrative only.

The engine shaft extends clear across the engine, and is here shown as made in three parts; a section 12A for the cylinders on the right side of the engine as it is viewed in Fig. 6; a section 12B for the cylinders on the left side of the engine; and an intermediate section 12C which, as shown, is rigidly connected to, but is easily separable from, the sections 12A and 12B. Each of the sections 12A and 12B is provided with crank throws, one for each piston, and therefore equal in number to the cylinders and pistons

used on the respective sides of the engine. The crank shaft 12A is provided with a flange 13, Fig. 6, and the intermediate section 12C is formed with a corresponding flange 14, which flanges are to be rigidly secured together, as by bolts 15. The crank shaft 12B is likewise provided with a flange 13, similar to the flange 13 on the crank shaft 12A. The corresponding end of the intermediate shaft section 12C is provided with a removable flange 14', similar to the flange 14 on the right side thereof, but secured in place, not by being formed integrally with the shaft, but by some releasable securing means, as by the ring or nut 14². Any other suitable means for fastening the flange 14' securely to the intermediate section may of course be used. Bolts 15, similar to the bolts 15 which hold the right flanges together, are used to hold together the left flanges 13 and 14'.

Thus, the three shaft sections 12A, 12B and 12C are all rigidly secured together, so as to operate as a unit. A sectional engine shaft is used for the purpose of facilitating assembling and disassembling of certain parts which surround the intermediate section. The removable flange is also for this purpose.

The shafts 12A and 12B rotate in suitable bearings, as in bearings 16, 16. These may be of any desired construction, and are here shown merely as typical bearings.

Auxiliary appliances

In this engine, as in all others of the explosive type, it is necessary that there be a clutch for connecting the engine with the parts to be driven thereby. And it is necessary also, at least for automobile use, to employ a speed-change transmission for delivering the power of the engine to the car in a variable manner. Such devices perform, in my construction, the same functions as they usually perform. Both the clutch and the transmission are of usual construction, but the mode of their mounting has been modified for special reasons, to obtain special advantages, as will now be explained.

In order to secure compactness of the parts and directness of power delivery, both the driving side of the clutch, and the principal elements of the transmission, are mounted to rotate around, but out of contact with the engine shaft, and these parts are located around the intermediate section of the shaft, and thus, not only utilize the space between the two blocks 10, but maintain the balance of the weight of the power plant with respect to the automobile.

No novelty is claimed in the clutch itself, and any suitable clutch may be used. That here shown is of the usual multiple friction disk type. As is commonly the case, one side of the clutch is driven by the engine, and the other is arranged to drive the car, through the transmission.

The clutch 20 is best shown in full lines in Fig. 8, and in section in Fig. 6. The outer portion 21 has friction plates 22 secured thereto, and these cooperate with inner plates 23 which are driven thereby. The part 21 is securely fastened to the intermediate section of the engine shaft in any suitable manner, as by a key 25, so as to move in unison therewith. A clutch release bearing 24, of ordinary construction, is provided to release the clutch. The inner plates 23 are engaged in slots in the clutch driven shaft 30.

As explained above, one of the principal objects of the invention is to secure an engine of lateral balance; that is, an engine which can be mounted transversely of the automobile chassis, prefer-

ably at the rear end thereof, and wherein the weight on one side of the median line of the automobile shall be the same, or approximately the same, as that on the other side thereof; and at the same time have the large gear of the differential and the driving pinion therefor approximately in the median line of the automobile. To that end, the engine is in effect divided; that is, two cylinders or sets of cylinders, of equal weight, or approximately equal weight, shall be used one set on one side of the chassis, and the other on the opposite side thereof. And to carry out this thought further, the clutch and transmission are likewise so mounted that the weight of these elements is equally distributed on the chassis.

The clutch and the transmission as here illustrated do not differ in principle from those employed generally at this time, but these parts are here rearranged and are mounted differently from what is now common practice. This is with two objects in view: first, to make the engine as a whole more compact; and, second, to secure approximately equal lateral distribution of the load.

To secure compactness of the engine, both the clutch and the transmission are arranged between the two groups of power elements, and concentric with the intermediate portion of the engine shaft. Further, the driving pinion is integral with or secured to the transmission shaft. And the shifting gears are splined on the transmission shaft as usual, but one shifting gear is shown as located on one side of the driving pinion while the other shifting gear is on the other side thereof.

The clutch driven shaft 30 (Fig. 6) is shown as in the form of a tube or sleeve surrounding the intermediate section 12C of the engine shaft, but adapted to rotate free of this shaft in its own bearings 31 and 32, here illustrated as roller bearings, the former, 31, on the inside of the hub of the driven section 21 of the clutch, and the latter, 32, in a web of the framework of the engine.

This clutch driven shaft performs the same functions as those usually performed by a shaft of this nature. It drives the automobile directly (except for the common reduction gearing) when the car is in "high" gear, or indirectly through suitable speed changing gears when the car is in "intermediate," "low" or "reverse" gears.

The principal transmission elements are mounted on a second tubular shaft 45, here termed the main transmission shaft, which is likewise mounted to rotate around, but also out of contact with, the intermediate section 12C of the engine shaft. Shaft 45 is preferably in direct line with the clutch driven tubular shaft 30, and is arranged to rotate in bearings of its own 46 and 47.

A pinion 65, cut on or separately formed but rigidly secured to the shaft 45, directly drives the automobile through the large gear of the differential, as will be more fully described below.

Cooperating with the tubular shafts 30 and 45 is a countershaft 36 and speed change gears, as is common in typical transmission mechanism.

Formed on, or rigidly secured to, the clutch driven shaft 30, is the main driving gear 35 (Figs. 6 and 8), which meshes with and drives the gear 37 secured on the counter-shaft 36, thus rotating the counter-shaft, and the gears secured thereon, namely, the intermediate or second gear 38, the low or first gear 40, and the reverse or backing gear 41.

A shiftable gear 48 is splined on the tubular shaft 45, and is adapted when moved in one direction (to the right in Fig. 8) to mesh with the intermediate gear 38; and another shiftable gear 49, also splined on shaft 45, is adapted when moved to the right (Fig. 8) to engage with the low gear 40 on the counter-shaft, and when moved to the left to engage with the idler 41' which is constantly in mesh with the reversing gear 41.

The gear 35 has, on the inside of its body, or in a flange on the side thereof, gear teeth or locking faces 35', and the gear 48, which is splined on the shaft 45 is provided with cooperating locking faces 48', so that when this gear 48 is moved in one direction, it engages its teeth or faces 48' with the locking faces 35' on the inside of gear 35, and the sleeve shaft 45 is then clutched to and so driven directly by the shaft 30; or, if the gear 48 is shifted in the other direction, the teeth on the rim of the gear engage with teeth on the intermediate gear 38, as earlier explained. By this arrangement, the car is thrown either into high gear, by coupling the shafts 30 and 45 directly together, or into second gear, by connecting gear 48 with gear 38 on the counter-shaft.

Somewhat similarly, by a shifting of the gear 49, which likewise is splined to shaft 45, motion is transmitted to the shaft 45, either from the low gear 40, or from the reversing idler 41' and reversing gear 41. A shifting rod 50 is provided for effecting movement of the gear 48, and a similar shifting rod 51, for shifting the gear 49.

Motion is transmitted to the wheels of the automobile through differential gearing of the usual type, not shown in detail, but which includes the large gear 55, driven by the pinion 65, and driving, through proper gearing, the short shafts 56, running in suitable bearings, as the ball bearings 57 (Fig. 6), which short shafts are in turn coupled to the driving axles 58 through universal joints 59. Other universal joints 59 (Fig. 7) connect the axles 58 to the wheels 60 of the automobile. A rigid axle 61 is shown for holding the wheels in alinement and supporting the weight of the automobile. Both the large gear 55 and its driving pinion 65 are here illustrated as herring-bone gears, but of course it is not essential that they be of this construction.

As stated before, the gearing of the transmission does not differ in principle from that of the ordinary transmission in use at the present time; but according to my invention, wherein the shafts 30 and 45 are in the form of sleeves which rotate around, but out of contact with, the engine shaft 12C, and wherein many of the principal transmission elements are enabled to rotate around the engine shaft, a more compact assembly is obtained, the essential elements of the mechanism being brought together into a relatively limited space.

This removable section 12C of the engine shaft, the clutch, the transmission shaft and the clutch driven shaft, the counter-shaft and gearing, and other cooperating parts, which are removable with the shaft section 12C, constitute a sub-organization or sub-assembly which may properly be the subject matter for manufacture and sale, and the basis for patentable claims.

In Fig. 7, which is a view of the left end of the engine and cooperating parts as shown in Fig. 6, although on a smaller scale, a flywheel 70

is illustrated as secured to the crank shaft 12B. The flywheel is provided with a housing 71 of any suitable construction.

A spiral gear 75 (Figs. 6 and 8), secured to some part of the engine shaft, as 12C, drives a companion spiral gear 76 which is secured to a transverse shaft 77, to which shaft is fastened a pulley 78 for driving belt 79 which, in turn, drives fan and pump assemblies 80 and generator 81 (Fig. 3).

A radiator is mounted on the rear of the chassis, and is connected with the engine blocks 10 by upper hoses 86 and lower hoses 87, for the circulation of cooling medium.

A cam shaft 90 extends across the entire structure (Fig. 8), and is provided with suitable bearings 91 in the frame work, and with valve operating cams 92. The means for driving the cam shaft is not shown, but is of the ordinary type of gearing. The cam shaft carries a suitable gear 93, here shown as a spiral gear, which is used to drive the distributor 95 through shaft 96 in proper timed relation to the pistons.

The frame of the engine is somewhat elongated, and, as earlier explained, when the engine is used as an automobile power plant, is designed especially to be positioned transversely of the chassis, and at the rear thereof. The frame comprises a main body 100, which supports the cylinder blocks 10, 10, which may be integral with or separable from the frame. An oil pan 101 is attached to the lower portion of the frame 100 by means of bolts or screws 102 (Fig. 5). The lower part of the frame member 100 and the oil pan 101 together constitutes the crank-case of the engine. The crank-case is somewhat larger than is usual, for both the clutch and the transmission are enclosed therein.

The engine shaft, preferably made of the three connected sections 12A, 12B and 12C, is mounted in the bearings 16, 16, and such other bearings as are necessary. And, as heretofore explained, in the preferred arrangement, the clutch surrounds and is driven by the removable section 12C of the engine shaft; the clutch driven shaft and the main transmission shaft are cylindrical in form, and surround this same portion of the engine shaft, but rotate in their own bearings. The transmission counter-shaft is mounted in the crank-case in cooperative relation to the main transmission shaft.

Bearing supports for the engine shaft and the surrounding sleeve shafts are provided in the webs 107 of the engine frame. These webs and bearing supports are perhaps best shown in Figs. 5 and 8.

The main gear of the differential also has a casing 103, divided as at 104. The portions of this differential housing are secured together, and to the engine proper by bolts or screws 106. This housing communicates with the crank case, so that oil may flow from the one to the other.

To disassemble the transmission, clutch and crank shaft, the oil is of course first drained from the engine, by opening the drain cock 108. The oil pan 101 then is taken off. The hangers 42 which support the counter-shaft 36, and which carry on their upper portions the lower cups for the bearings 32 and 47, are disconnected by removing the bolts 42'. Bolts 15 which secure shaft 12C to 12A and 12B are then taken out, and the entire transmission mechanism, including shaft 12C, tubular shafts 30 and 45, clutch and driving gears, may be removed.

In the embodiment of my invention described and shown, only one oil reservoir is shown, it being intended that the entire power plant be lubricated by one relatively light oil. If desired, however, more than one reservoir can be provided, by sealing off portions of the crank-case, so that the pistons, main bearings, etc., can be lubricated by one grade of oil, and the differential and transmission lubricated by a heavier oil or grease.

It should be noted that certain elements of the engine are not shown at all, or are shown only generally. The starter, ignition system, and water pumps are among these elements. No novelty is claimed in these parts, and any suitable standard equipment may be used.

Having thus described the preferred embodiment of my invention, I claim:

1. In a power plant for automotive vehicles, the combination of an engine frame, two power producing means one on each end of the frame, an engine shaft having two aligned crank sections one for each power producing means and an intermediate removable section connecting the crank sections, a main transmission shaft surrounding and substantially parallel to but spaced from the intermediate removable section of the engine shaft, bearings for the transmission shaft, a driving pinion on the transmission shaft, and a friction clutch for driving the main transmission shaft and pinion thereon having its driven side connected to the removable section of the engine shaft to receive power therefrom and its driving side connected to drive the transmission shaft.

2. In a power plant for automotive vehicles, the combination of an engine frame, two groups of power producing elements one on each end of the engine frame, an engine shaft having aligned crank sections one for each group of power producing elements and an intermediate substantially straight removable section connecting the crank sections, a main transmission shaft surrounding but spaced from the intermediate connecting section of the engine shaft, bearings for the main transmission shaft, a driving pinion on the main transmission shaft, a second shaft likewise surrounding but spaced from the intermediate section of the engine shaft and in substantial alignment with the main transmission shaft, means for connecting and disconnecting the said second shaft and the main transmission shaft, and a clutch having its driven side connected to the intermediate substantially straight section of the engine shaft and having its driving side surrounding and connected to drive the said second shaft.

3. In a power plant for automotive vehicles, the combination of an engine frame having two groups of cylinders and pistons spaced apart but disposed in alignment with respect to each other, crank shafts one for each group of cylinders and pistons spaced apart but in alignment with each other, and a removable shaft section between and joining the crank shafts, a shaft rotating around but supported independently of the removable intermediate shaft section, and a clutch also surrounding the removable intermediate shaft and having its driven side secured to the removable intermediate shaft and having its driving side arranged to drive the shaft rotating around the said intermediate shaft.

4. In a power plant for automotive vehicles, the combination of an engine frame having two

groups of cylinders and pistons spaced apart but disposed in alignment with respect to each other, crank shafts one for each group of cylinders and pistons spaced apart but in alignment with each other, and a removable shaft section between and joining the crank shafts, a clutch driven shaft surrounding but rotating independently of the removable intermediate shaft section and removable therewith, a clutch connecting the removable shaft section and the driven shaft, and a main transmission shaft surrounding but spaced from the removable intermediate shaft arranged to be driven from the clutch driven shaft and removable therewith, whereby the intermediate shaft section and the elements surrounding the same may be removed as a group from the power plant.

5. In an automobile having a rear axle, a gear for rotating the axle, an engine frame mounted transversely of the automobile and in close spaced relation to the rear axle of the automobile, two power elements of approximately equal weight mounted one on one end of the frame and the other on the other end thereof, an engine shaft having two power sections one for each of the power elements, and an intermediate removable section rigidly connecting the power sections, so that the three sections rotate in unison and in a line which is substantially parallel to the rear axle of the automobile, a main transmission shaft mounted to rotate around the removable section of the engine shaft, a pinion carried by and adapted to rotate with the main transmission shaft and to run in mesh with the gear which rotates the axle, and clutch means for driving the main transmission shaft and pinion from the engine shaft, said main transmission shaft, pinion, and clutch means being removable with the intermediate section.

6. In an automobile having a rear axle, a gear for rotating the axle, an engine frame mounted transversely of the automobile and in close spaced relation to the rear axle of the automobile, two power elements of approximately equal weight mounted one on one end of the frame and the other on the other end thereof, an engine shaft having two power sections one for each of the power elements, and an intermediate removable section rigidly connecting the power sections so that the three parts rotate in unison and in a line which is substantially parallel to the rear axle of the automobile, a cylindrical main transmission shaft mounted to rotate around but out of contact with the engine shaft, bearings for the main transmission shaft, a pinion carried by and adapted to rotate with the main transmission shaft and to run in mesh with the gear which rotates the axle, and clutch means for driving the main transmission shaft and pinion from the engine shaft, said main transmission shaft, pinion, and clutch means being removable with the intermediate section.

7. In an internal combustion engine, the combination of a crank case, an engine shaft therein including two aligned crank sections and another aligned removable section connecting and rotating with the crank sections, a friction clutch surrounding and driven by and removable with the said removable section, and a transmission member also surrounding the removable shaft section and removable therewith and aligned with and adapted to be driven by the clutch, whereby the removable shaft section and the clutch and transmission member may be removed as a unit without removing the crank sections of the shaft.

8. In an internal combustion engine, the com-

5 combination of a crank case, an engine shaft therein including two aligned crank sections and another aligned removable section connecting and rotating with the crank sections, a friction clutch surrounding the removable section and removable therewith and having its driven side connected to be driven by the removable portion of the engine shaft, a transmission member also surrounding the removable shaft section and removable therewith and aligned with and adapted to be driven by the driving side of the clutch, whereby the removable shaft section and the clutch and transmission member may be removed as a unit without removing the crank sections of the shaft.

9. A balanced engine for automotive vehicles, comprising an engine frame mounted transversely of the vehicle, two groups of power elements of substantially equal weight mounted one on one end of the frame and the other on the other end thereof, two crank shafts in substantial alignment one for each group of power elements, an auxiliary shaft removably connecting the two crank shafts, a friction clutch one side of which surrounds and is driven by the said auxiliary shaft and the other side of which drives a sleeved shaft surrounding but spaced from the auxiliary engine shaft, the sleeved clutch driven shaft being provided with a driving gear, a sleeved transmission shaft also surrounding but spaced from the auxiliary shaft in substantial alignment with the first mentioned sleeved shaft, a driving pinion carried by the sleeved transmission shaft and adapted to communicate motion to the vehicle to be driven, a counter-shaft adjacent to and substantially parallel with the said sleeved shafts and having secured thereto a gear for meshing with and adapted to be driven by the driving gear on the sleeved clutch driven shaft and having secured thereto other gears of varying sizes, a clutch having a gear thereon splined on the sleeved transmission shaft for connecting the sleeved shafts together when moved in one direction, and, when moved in another direction, for causing the gear on the clutch to mesh with a gear on the counter-shaft so as to transmit motion from the sleeved clutch driven shaft variably to the sleeved transmission shaft, substantially as described.

10. In an automotive engine, the subcombination of elements comprising, a removable section of the engine shaft, a tubular clutch driven shaft surrounding the removable section of the engine shaft, a clutch having a driven side connected to the removable section of the engine shaft to be driven thereby and its driving side connected to operate the clutch driven shaft, a tubular main transmission shaft also surrounding the removable section of the engine shaft, a driving pinion mounted on the main transmission shaft and rotatable therewith, a shiftable gear splined on the main transmission shaft for connecting the clutch driven shaft and the main transmission shaft together when moved in one direction and for connecting these shafts together indirectly when moved in the other direction, and a second shiftable gear likewise splined on the main transmission shaft for connecting the shafts together through the low speed connection when moved in one direction and through the reverse gear when moved in the other direction.

11. In an automotive engine, a subcombination of elements comprising, a removable section of the engine shaft, a tubular clutch driven shaft

surrounding the removable section of the engine shaft, a clutch having a driven side surrounding and connected to be driven by the removable section of the engine shaft and its driving side surrounding and connected to operate the tubular clutch driven shaft, a main tubular transmission shaft also surrounding the removable section of the engine shaft, a driving pinion mounted on the main transmission shaft and rotatable therewith, a shiftable gear splined on the main transmission shaft between the pinion and the end of the shaft for connecting the clutch driven shaft and the main transmission shaft together when moved in one direction and for connecting these shafts together indirectly when moved in the other direction, and a second shiftable gear likewise splined on the main transmission shaft between the pinion and the other end of the shaft for connecting the shafts together through the low speed connection when moved in one direction and through the reverse gear when moved in the other direction.

12. A subassembly for explosive engines comprising, a removable and replaceable section of the engine shaft, a friction clutch including a driven and a driving section, the driven section being connected to the removable engine shaft to be driven thereby, a tubular clutch driven shaft surrounding the removable section arranged to be driven by the driving side of the clutch, a main transmission shaft also tubular surrounding the removable section of the engine shaft and in line with the first mentioned shaft; a pinion secured on the second tubular transmission shaft for rotation therewith; a counter-shaft adjacent to and substantially parallel with the removable shaft section having a driving gear and second, low, and reverse gears thereon or assembled therewith; a movable gear splined on the second tubular shaft at one side of the pinion and adapted when moved in one direction to engage the first mentioned tubular shaft to connect the second tubular shaft therewith for direct rotation thereby and when moved in the other direction to connect the second tubular shaft to the first tubular shaft through the second gear on the counter-shaft; and a second movable gear splined on the second tubular shaft on the other side of the pinion and adapted when moved in one direction to connect the second tubular shaft to the first through the low gear of the counter-shaft, and when moved in the other direction to connect the second tubular shaft to the first through the reverse gear of the counter-shaft for reverse rotation thereof.

13. In an internal combustion engine, the combination of an engine frame, two groups of power producing elements mounted opposite each other on the frame, an engine shaft comprising two aligned crank sections one for each group of power producing elements and an intermediate substantially straight section removably connected to and rotatable with the crank sections, a clutch surrounding the removable engine shaft section and removable therewith having its driven side connected to be driven by the removable portion of the engine shaft, a clutch driven shaft also surrounding the removable section of the engine shaft and removable therewith and connected to the driving side of the clutch to be driven thereby, a main transmission shaft also surrounding the removable section of the engine shaft and arranged to be driven either directly or indirectly from the clutch driven shaft, a pinion carried by the main transmission shaft

approximately midway thereof, a shifting gear splined on the main transmission shaft at one side of the pinion connecting the main transmission shaft to the clutch driven shaft when shifted in one direction and connecting these two shafts indirectly when moved in the other direction, and a second shifting gear also splined

on the main transmission shaft on the other side of the pinion connecting the shafts together for movement in low gear when moved in one direction and for connecting the shafts for reverse rotation of the main transmission shaft when moved in the other direction.

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