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W. N. ALLAN.

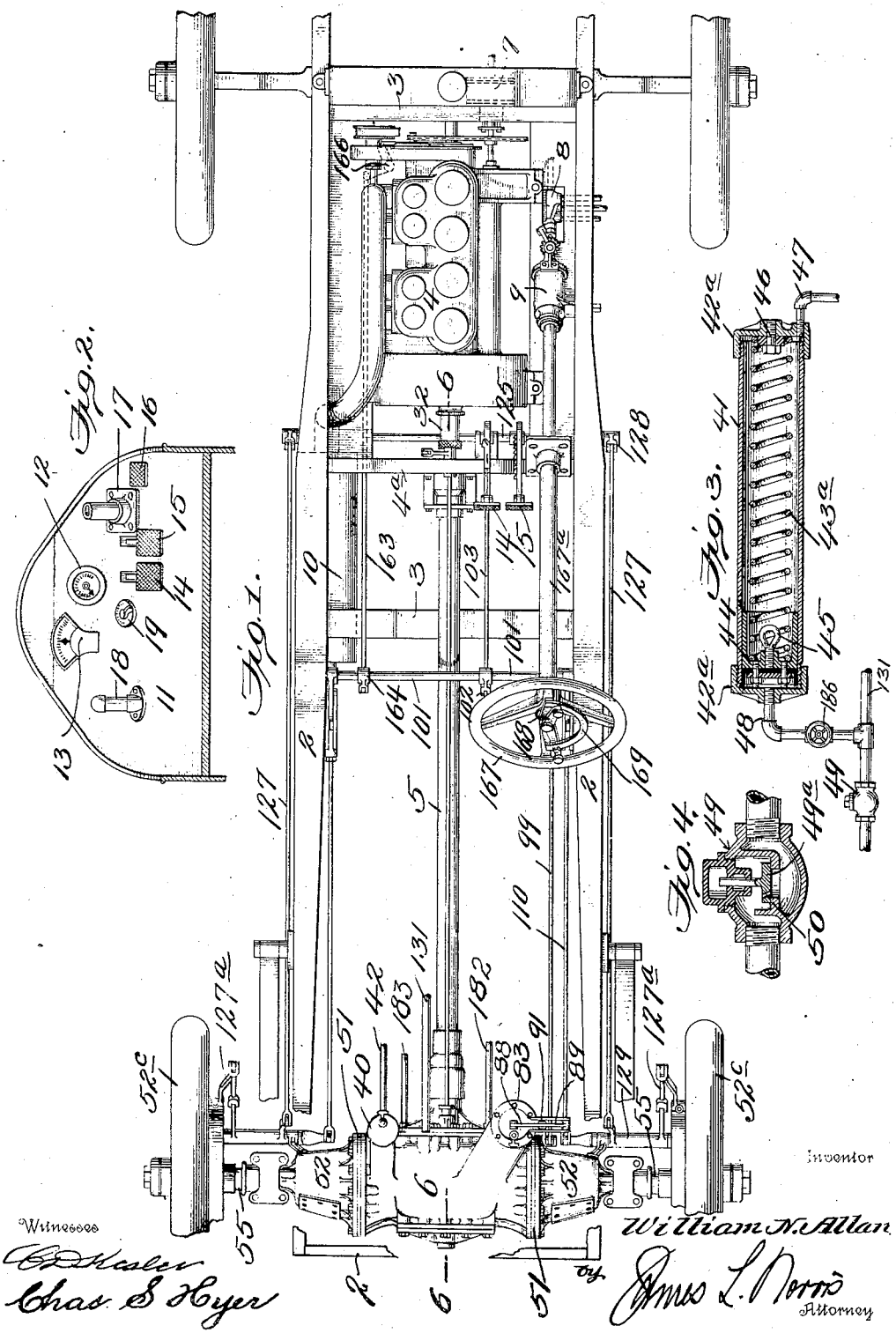
AUTOMOBILE DRIVING MECHANISM.

APPLICATION FILED AUG. 22, 1914.

1,203,450.

Patented Oct. 31, 1916.

10 SHEETS—SHEET 1.



Witnesses

Chas. S. Hyer

Inventor

William N. Allan

by James L. Norris

Attorney

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AUTOMOBILE DRIVING MECHANISM.

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1,203,450.

Patented Oct. 31, 1916.

10 SHEETS—SHEET 2.

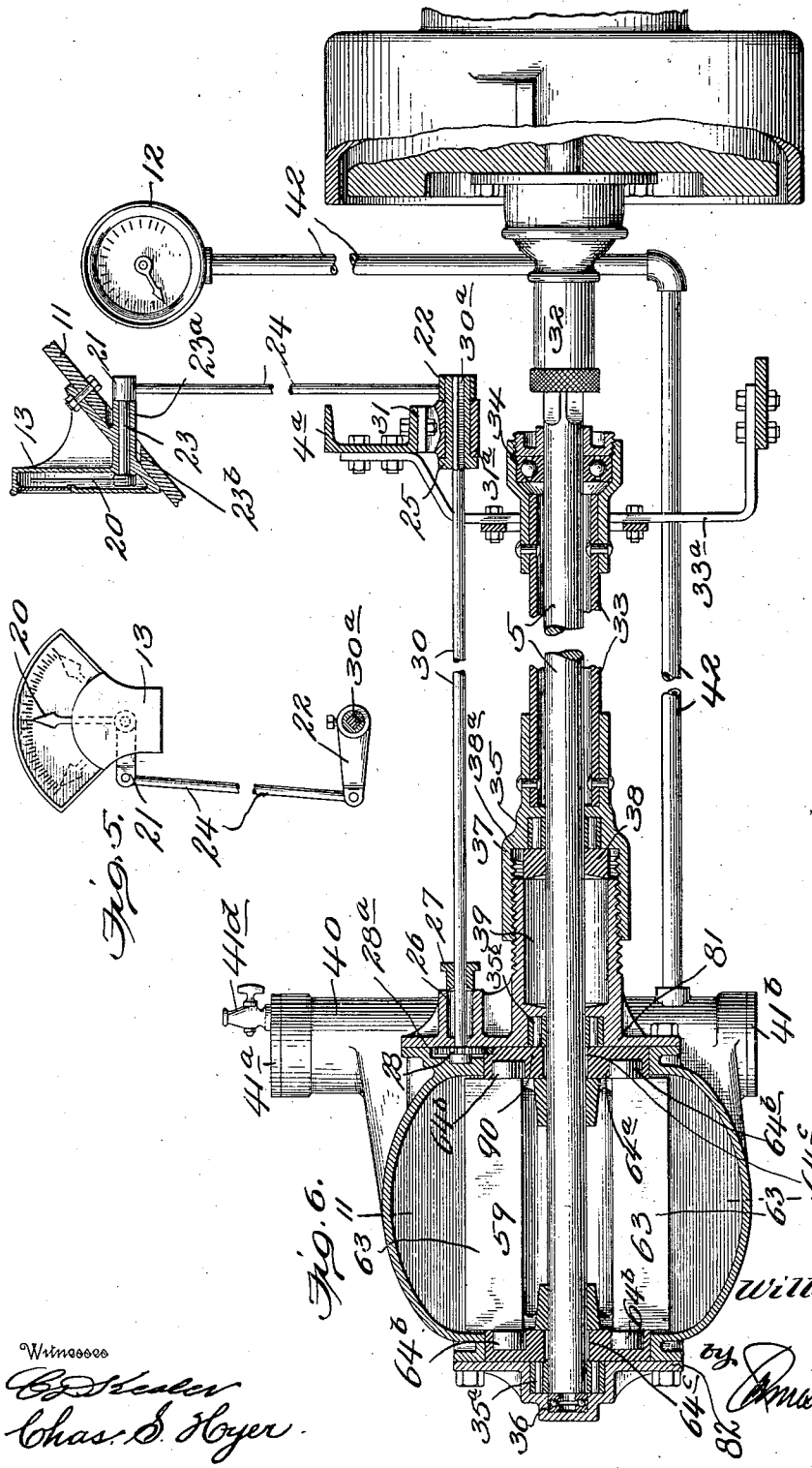


Fig. 5.

Fig. 6.

Witnesses

Chas. S. Hoyer.

Inventor

William N. Allan

by James L. Norris

Attorney

W. N. ALLAN.

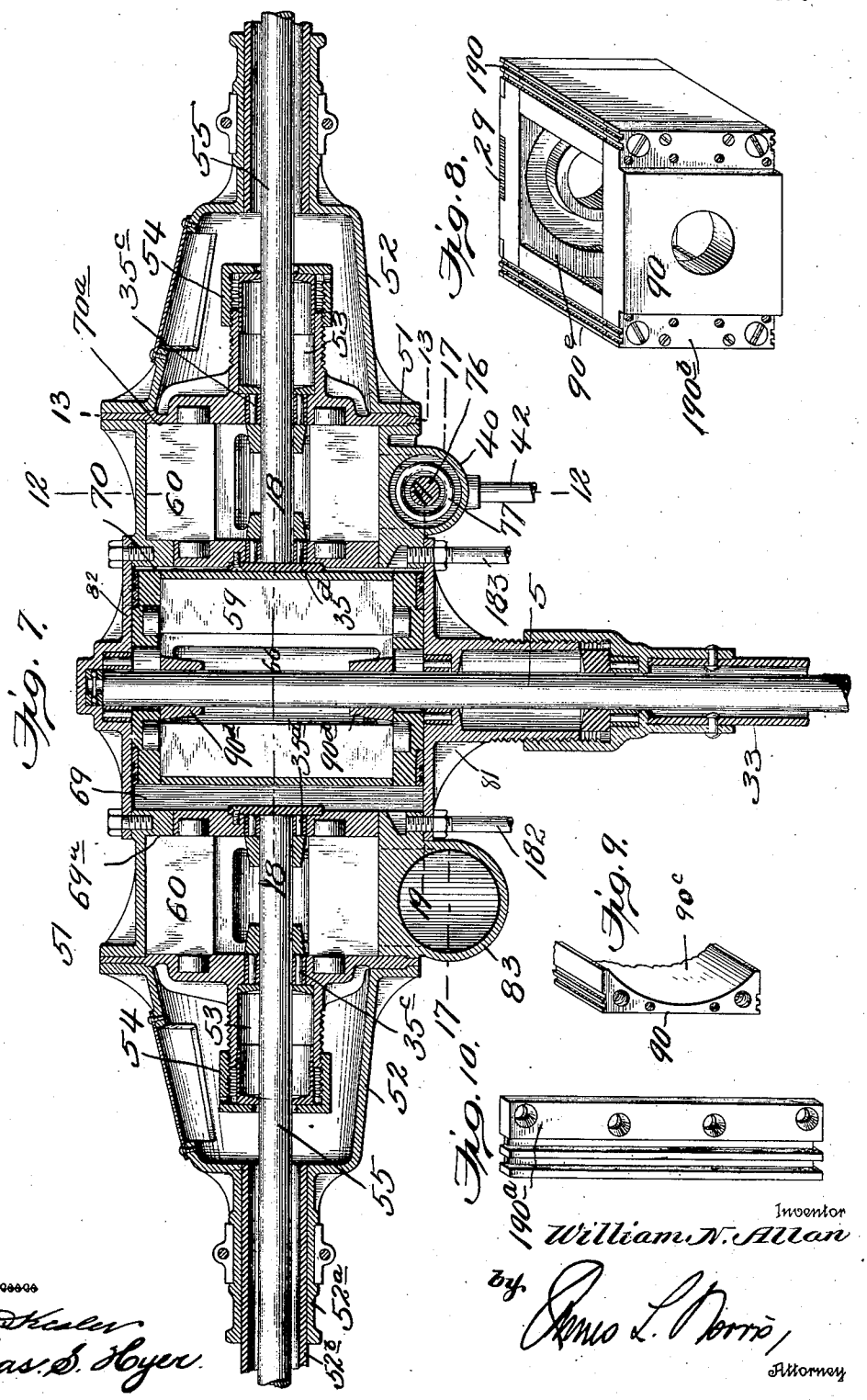
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Patented Oct. 31, 1916.

10 SHEETS—SHEET 3.



Witnesses

C. F. Kesler

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by. Denis L. Norris,

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AUTOMOBILE DRIVING MECHANISM.

APPLICATION FILED AUG. 22, 1914.

1,203,450.

Patented Oct. 31, 1916.

10 SHEETS—SHEET 4.

Fig. 11.

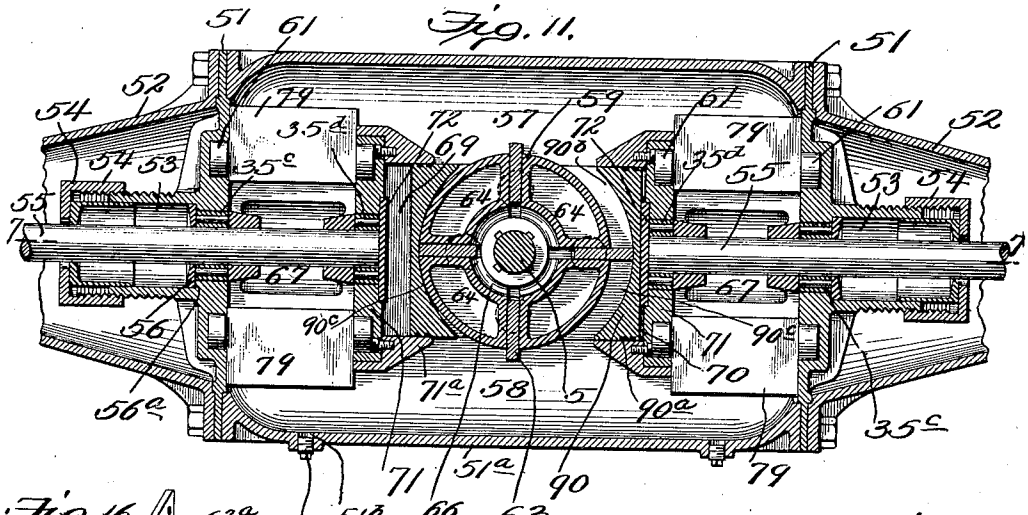


Fig. 16.

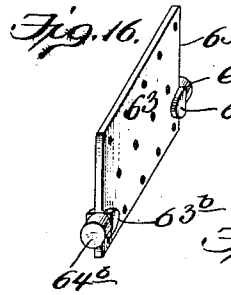


Fig. 14.

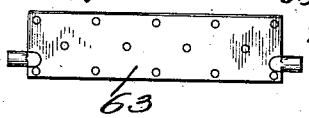


Fig. 15.

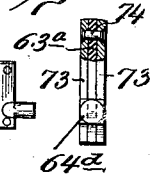
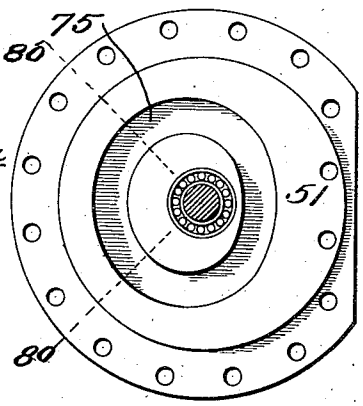


Fig. 12.

Fig. 13.



Witnesses

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AUTOMOBILE DRIVING MECHANISM.

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1,203,450. Patented Oct. 31, 1916.

10 SHEETS—SHEET 5.

Fig. 17.

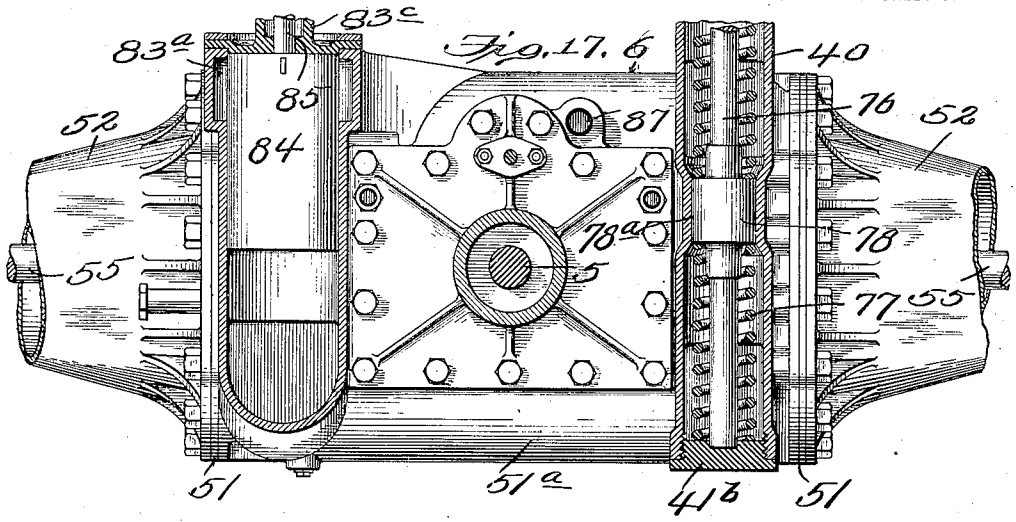


Fig. 18.

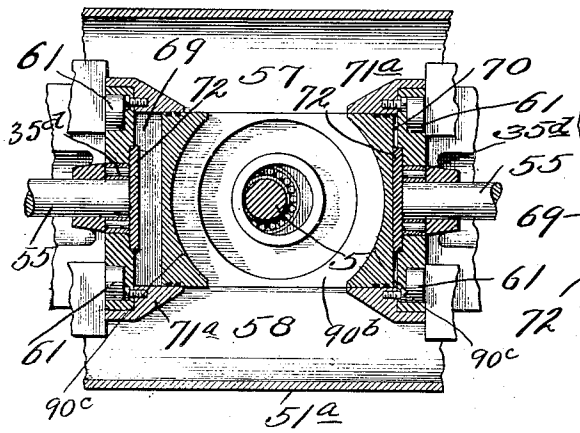


Fig. 19.

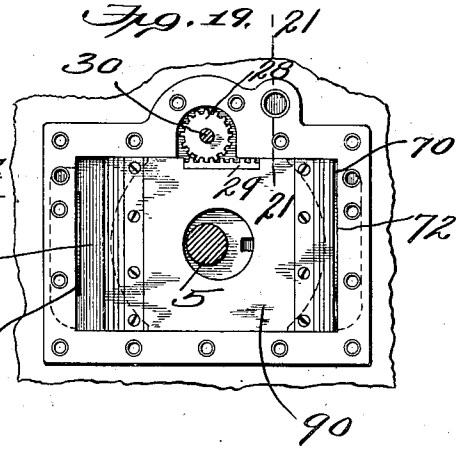


Fig. 20.

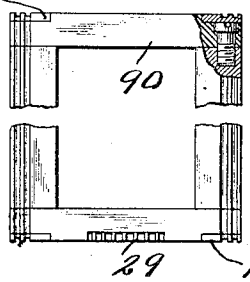
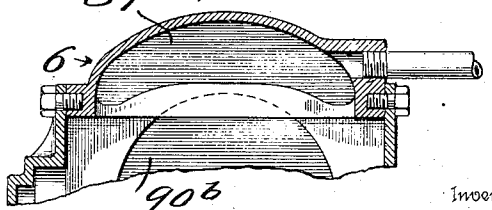


Fig. 21.



Witnesses

E. E. Kesler

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Inventor

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Attorney

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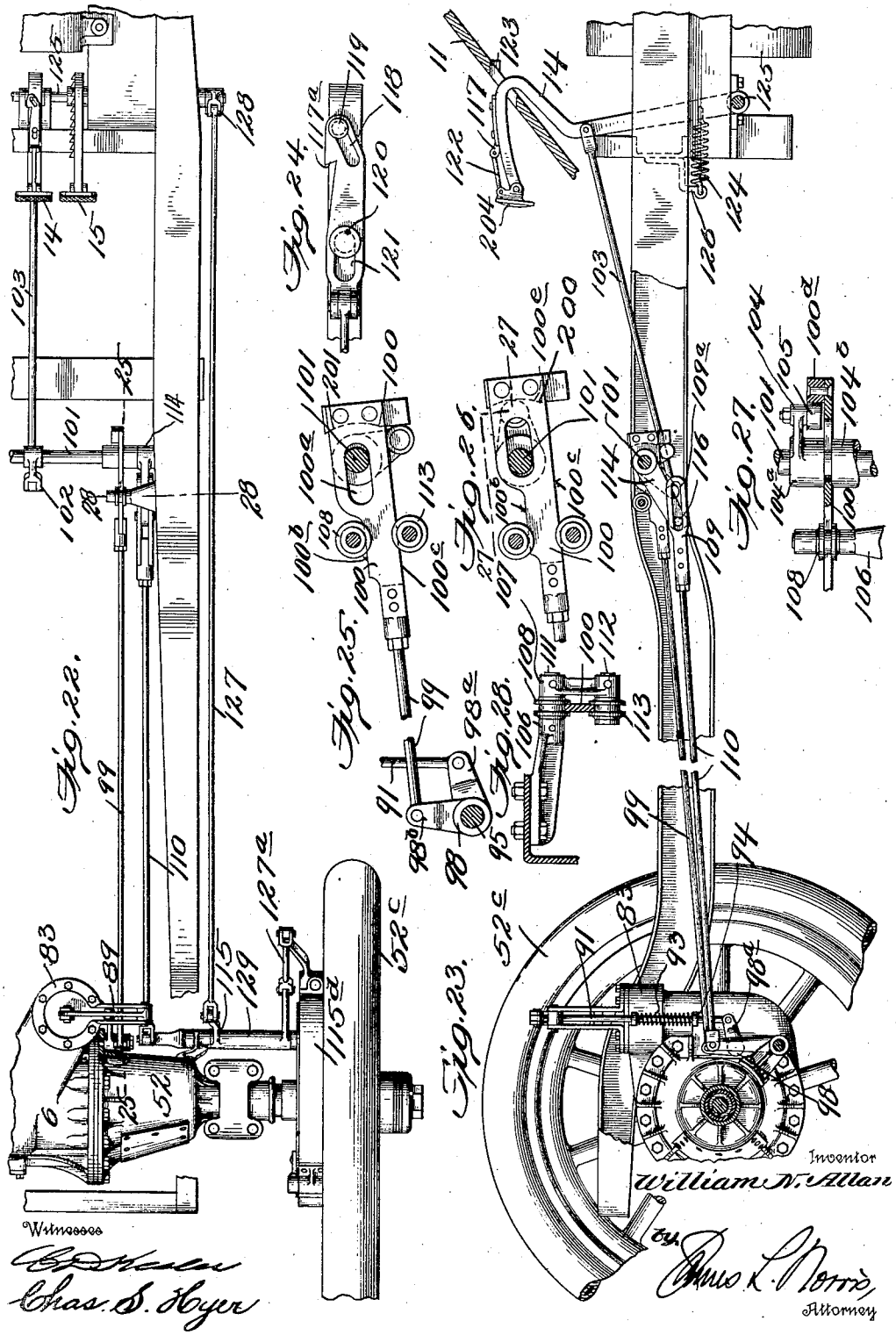
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Patented Oct. 31, 1916.

10 SHEETS—SHEET 6.



Witnesses

Chas. S. Hoyer

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AUTOMOBILE DRIVING MECHANISM.

APPLICATION FILED AUG. 22, 1914.

1,203,450.

Patented Oct. 31, 1916

10 SHEETS—SHEET 7.

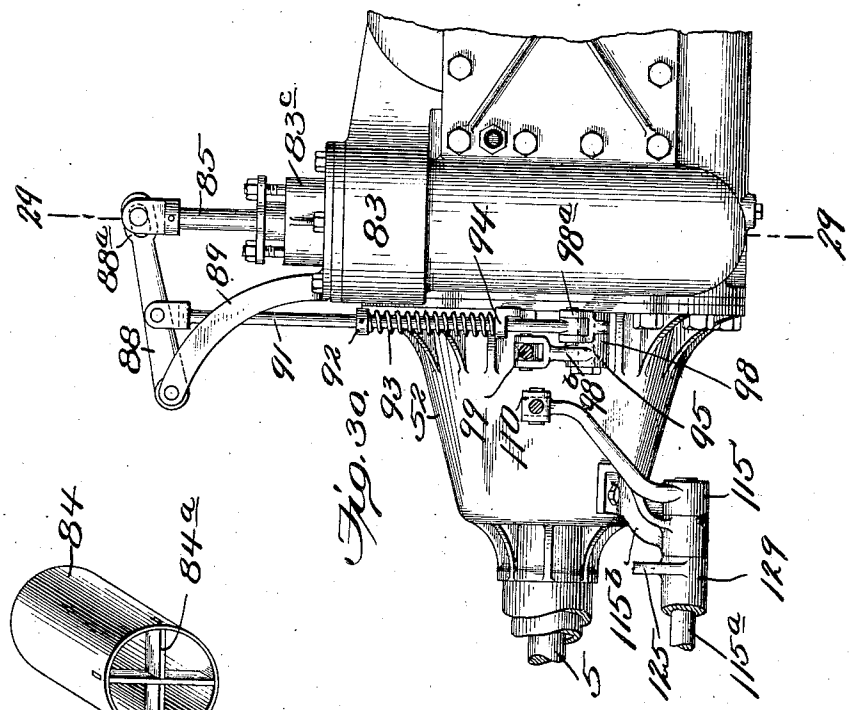


Fig. 30.

Fig. 33.

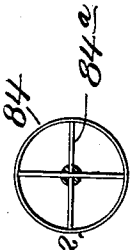


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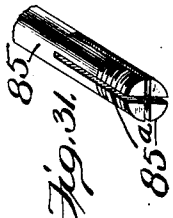


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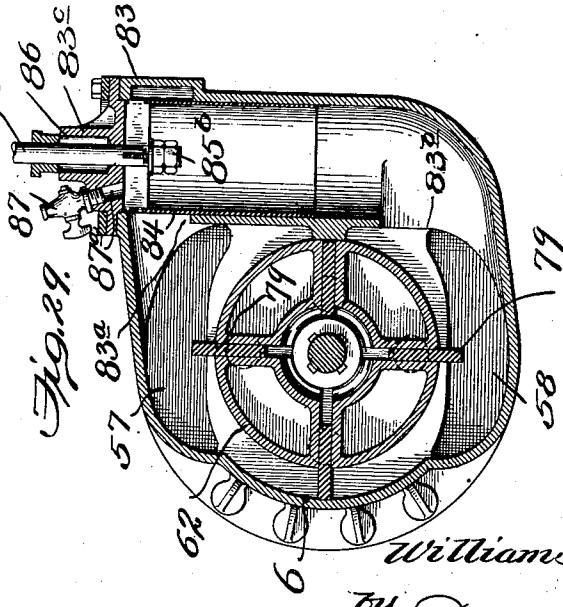


Fig. 29.

Witnesses

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AUTOMOBILE DRIVING MECHANISM.

APPLICATION FILED AUG. 22, 1914.

1,203,450.

Patented Oct. 31, 1916.

10 SHEETS—SHEET 8.

Fig. 34.

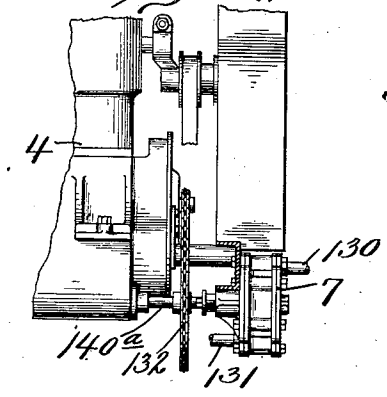


Fig. 35.

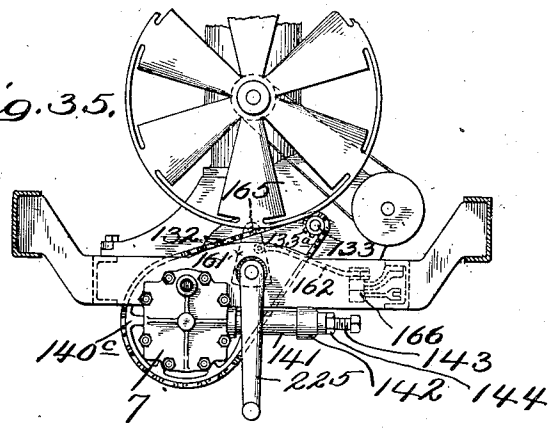


Fig. 36.

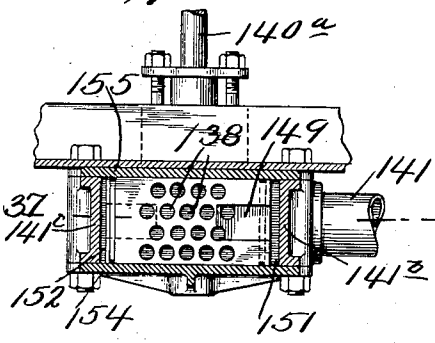


Fig. 39.

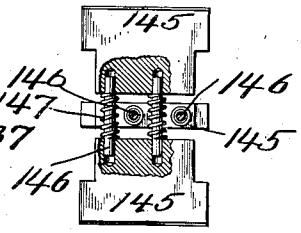


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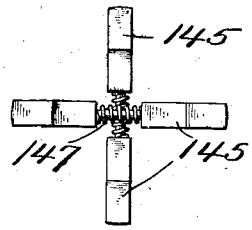


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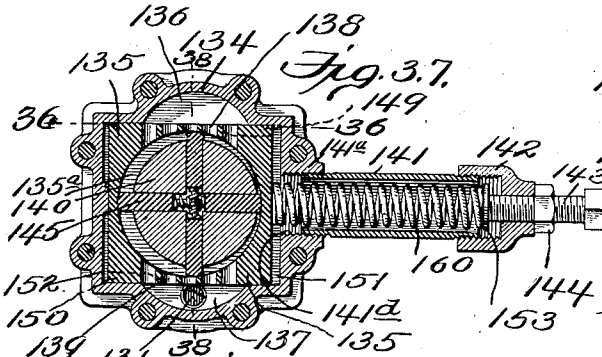


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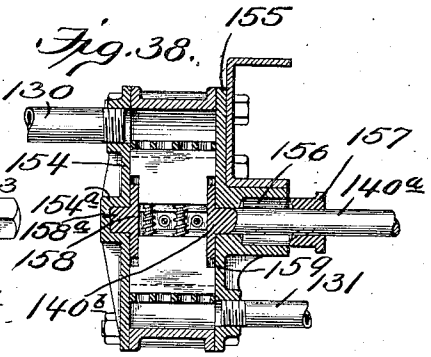


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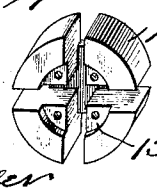


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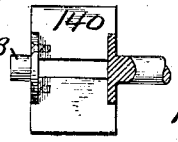
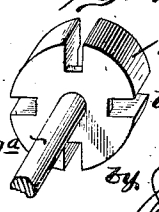


Fig. 43.



Witnesses

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AUTOMOBILE DRIVING MECHANISM.

APPLICATION FILED AUG. 22, 1914.

1,203,450.

Patented Oct. 31, 1916.

10 SHEETS—SHEET 9.

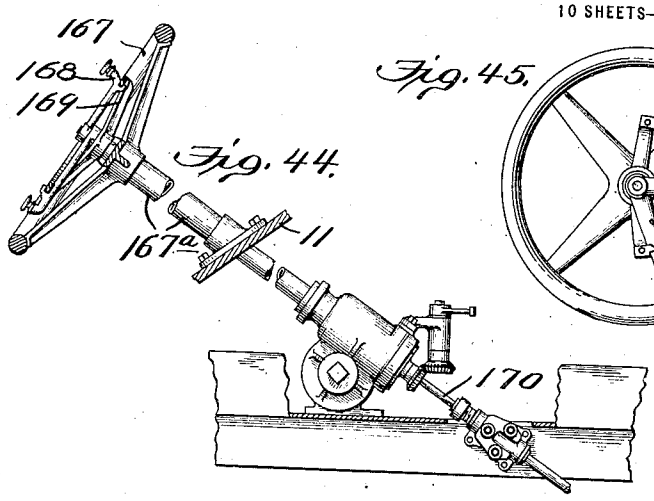


Fig. 44.

Fig. 45.

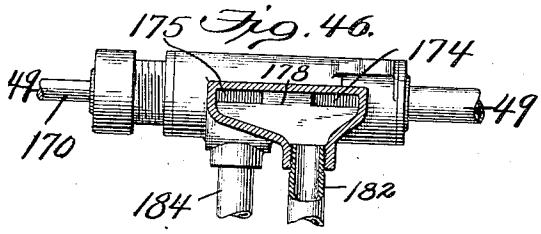


Fig. 46.

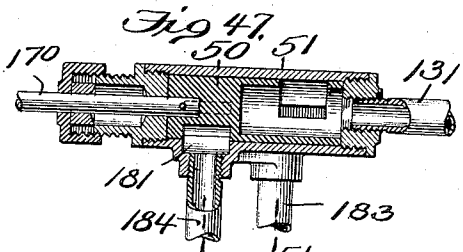


Fig. 47.

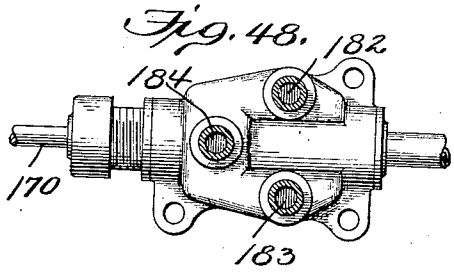


Fig. 48.

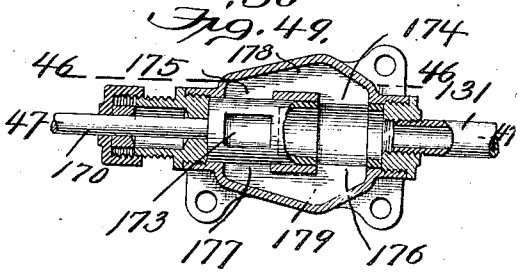


Fig. 49.

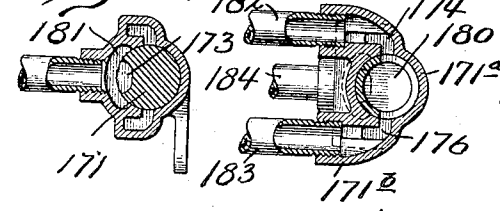


Fig. 50. Fig. 51.

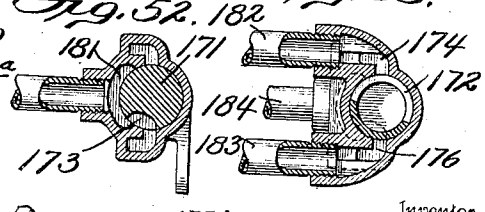


Fig. 52. Fig. 53.

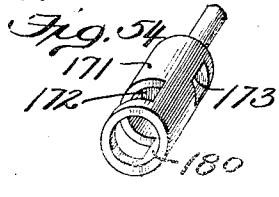


Fig. 54.

Witnesses

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AUTOMOBILE DRIVING MECHANISM.

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1,203,450.

Patented Oct. 31, 1916.

10 SHEETS—SHEET 10.

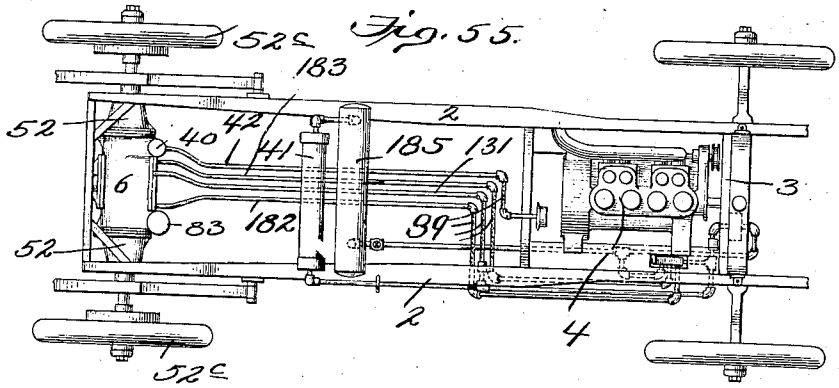


Fig. 55.

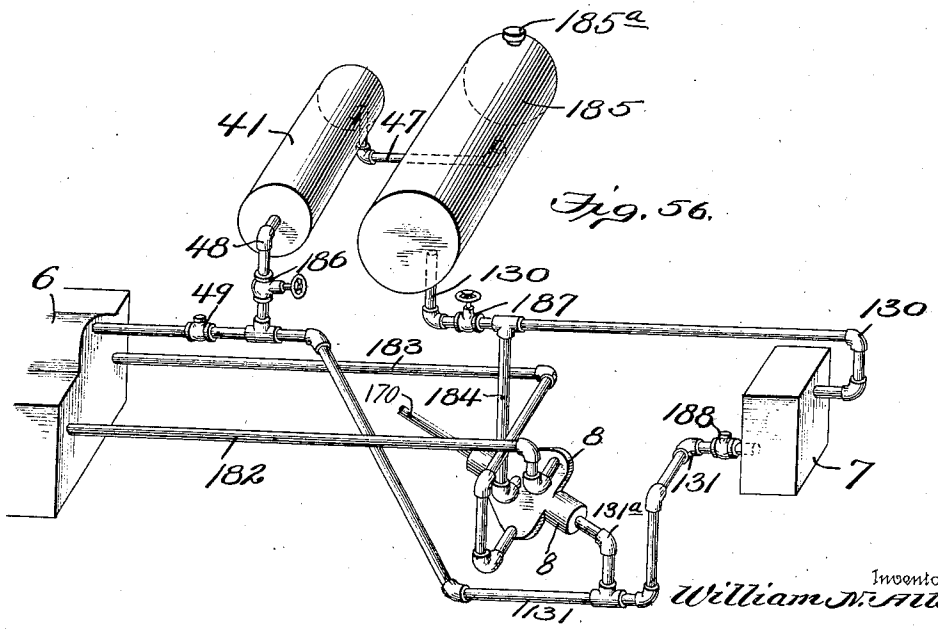


Fig. 56.

Witnesses

C. E. Kessler

Chas. S. Hoyer

Inventor

William N. Allan

by James L. Norris,

Attorney

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UNITED STATES PATENT OFFICE.

WILLIAM N. ALLAN, OF SAN ANTONIO, TEXAS.

AUTOMOBILE DRIVING MECHANISM.

1,203,450. Specification of Letters Patent. Patented Oct. 31, 1916.

Application filed August 22, 1914. Serial No. 858,154.

To all whom it may concern:

Be it known that I, WILLIAM N. ALLAN, a citizen of the United States, residing at San Antonio, in the county of Bexar and State of Texas, have invented new and useful Improvements in Automobile Driving Mechanism, of which the following is a specification.

This invention relates to driving mechanism for automobiles and the like, and the primary object of the invention is to dispense with the usual form of transmission gearing and differential and to substitute for these well known mechanisms power devices relatively coacting through the medium of a suitable liquid, preferably oil, maintained at a predetermined volume within the several parts and completely filling the chambers of the devices replacing the usual transmission gearing and differential as well as the conveying means for said devices, so that the least modification or change or pressure at one point will be instantly applied through the transmission of the column or quantity of oil with relation to the remaining part or parts without lost motion or variation in the power applied to the respective parts.

A further object of the invention is to provide a noiseless operating mechanism of the class specified and under complete control of the chauffeur or driver as to starting and stopping operations, the substitute mechanisms in the present instance being coördinated with the rear axle or shaft of the vehicle.

A further object of the invention is to provide substitute mechanisms or organizations for the usual transmission gearing and differential having conveying or pipe connecting means and controlled as to transmission of motion or power from one organization to another by a predetermined quantity of oil which may be properly termed a static column, which is automatically maintained at a uniform pressure, the improved organization being readily capable of reverse movement, and the substitute for the usual differential mechanism is so arranged as to accommodate the variation of speed on the two sides of the vehicle when steering in either direction, or when the one rear wheel, for instance, moves faster than the other in traveling over curves or around corners or other places.

The mechanism which will be hereinafter disclosed embodies an improved development of that disclosed by my pending application Serial No. 786,640, and the features of construction of said application with which the improved features coöperate have been brought forward and associated with their coöperating improved parts. As hereinbefore noted, the improved mechanisms including the secondary power generating or circulating organization in this instance are in coöperation with the rear axles or shafts, thereby distinguishing the same from the mechanisms of the application above specified wherein the secondary power generating or circulating organization is disposed at the front portion of the vehicle or automobile close to the prime power generating means or motor. This essential difference in organization together with other features hereinafter disclosed render the present improvement distinct with relation to my prior structures, but the present invention is virtually a continuation of the earlier invention.

The invention consists, therefore, in the construction and arrangement of parts which will be more fully hereinafter described and claimed in preferred form and subject to such modifications and variations as fairly fall within the scope of the invention.

In the drawings: Figure 1 is an enlarged top plan view showing portions broken away and removed. Fig. 2 is a cross-sectional view through the upper portion of the vehicle illustrating the dashboard in rear side elevation and showing the positions of the controlling means, indicator and pressure gage. Fig. 3 is a longitudinal vertical sectional view of the pressure cylinder and portions of the pipe connections therefor in elevation. Fig. 4 is a detail sectional view, on an enlarged scale, of a check valve with a by-pass forming part of the mechanism. Fig. 5 is an enlarged front elevation of the indicator and part of the operating mechanism coöperating therewith. Fig. 6 is a longitudinal vertical section on the line 6—6, Fig. 1, and showing in addition the indicator in transverse section and the pressure gage in elevation and turned to fully expose the same. Fig. 7 is a horizontal section taken through the rear mechanism in the plane of the line 7—7, Fig. 11. Fig. 8 is a detail perspective view of the shifting speed controlling means with the two front packing strip holders removed. Fig. 9 is a de-

tail perspective view of a portion of the shifting speed controlling means with the front plate removed. Fig. 10 is a detail perspective view of one of the packing strip holders of the shifting speed controlling means. Fig. 11 is a longitudinal vertical section through the rear mechanism taken in the plane of the line 11—11, Fig. 6. Fig. 12 is a transverse vertical section taken in the plane of the line 12—12, Fig. 7. Fig. 13 is a transverse vertical section taken in the plane of the line 13—13, Fig. 7. Fig. 14 is a detail side elevation of one of the rotor slides. Fig. 15 is a detail end view of one of the rotor slides shown broken away to illustrate fastening means for the parts thereof. Fig. 16 is a detail perspective view of the central metal member of one of the rotor slides. Fig. 17 is a cross-section taken in the plane of the line 17—17, Fig. 7, and showing the neutral valve and by-pass valve partially in section. Fig. 18 is a transverse vertical section of the rotor or pump and taken in the plane of the line 18—18, Fig. 7. Fig. 19 is a transverse vertical section taken in the plane of the line 19—19, Fig. 7. Fig. 20 is a top plan view of the shifting speed controlling means shown partially broken away. Fig. 21 is a detail section taken in the plane of the line 21—21, Fig. 19. Fig. 22 is a plan view of a portion of the machine showing the relation of the operating or controlling means for the neutral valve and brakes. Fig. 23 is a side elevation of the portion of the machine shown by Fig. 22, the near wheel being removed and the adjacent portion of axle and boxing and housing illustrated in cross-section. Fig. 24 is a detail plan view showing a catch for a foot pedal controlling the operation of portions of the mechanism. Fig. 25 is a detail sectional elevation taken in the plane of the line 25—25, Fig. 22, showing the positions of parts when the neutral valve is closed. Fig. 26 is a detail sectional elevation taken in the plane of the same line as Fig. 25 and of a part of the same devices, showing the positions of the said parts when the neutral valve is open. Fig. 27 is a detail sectional plan view taken in the plane of the line 27—27, Fig. 26. Fig. 28 is a detail cross-section taken in the plane of the line 28—28, Fig. 22. Fig. 29 is a cross-section taken in the plane of the line 29—29, Fig. 30, particularly showing the structure of the neutral valve. Fig. 30 is a front elevation of a portion of the rear mechanism particularly showing the mechanism for controlling the operation of the neutral valve. Figs. 31, 32 and 33 are detail views of the active parts of the neutral valve. Fig. 34 is a side elevation showing a part of the prime motor or engine and frame and illustrating the position of an automatic pressure pump and driving mechanism. Fig. 35 is a front elevation showing the automatic pressure pump and safety device in dotted lines to prevent cranking prime motor or engine while neutral valve is closed. Fig. 36 is a horizontal section of the automatic pressure pump taken in the plane of the line 36—36, Fig. 37. Fig. 37 is a vertical section of the automatic pressure pump taken in the plane of the line 37—37, Fig. 36. Fig. 38 is a transverse vertical section taken in the plane of the line 38—38, Fig. 37. Fig. 39 is a side view, broken away and partially in cross-section, of the wooden rotor slides of the automatic pressure pump. Fig. 40 is an end view of the slides shown by Fig. 39. Figs. 41, 42 and 43 are detail views of the rotor of the automatic pressure pump with the slides removed. Fig. 44 is an elevation of the steering mechanism and a part of the frame in section showing the means for operating the control valve. Fig. 45 is a detail plan view of the steering wheel. Fig. 46 is a horizontal section of the control valve taken in the plane of the line 46—46, Fig. 49. Fig. 47 is a horizontal section of the control valve taken in the plane of the line 47—47, Fig. 49. Fig. 48 is a side elevation of the control valve with the pipes thereof in cross-section. Fig. 49 is a longitudinal section of the control valve taken in the plane of the line 49—49, Fig. 46. Fig. 50 is a transverse section taken in the plane of the line 50—50, Fig. 47, showing the valve in neutral position. Fig. 51 is a transverse section taken in the plane of the line 51—51, Fig. 47, showing the valve in neutral position. Fig. 52 is a transverse vertical section taken in the same plane and on the same line as Fig. 50 and showing the valve open. Fig. 53 is a transverse vertical section taken in the same plane and on the same line as Fig. 51 and showing the valve open. Fig. 54 is a detail perspective view of the control valve. Fig. 55 is a plan view of the machine particularly showing the arrangement of the oil pipes and control valve. Fig. 56 is an enlarged perspective view showing the arrangement of the oil pipes and control valve.

The numeral 2 designates the frame or chassis of the machine having cross-bars or supports 3 and braced and otherwise generally constructed similarly to the usual automobile or motor vehicle frame or chassis. A motor or engine 4 is mounted on the front part of the frame and constitutes the prime power generator or generating means for actuating the remaining essential mechanisms and their coacting parts. From the motor or engine 4 a shaft 5, see Fig. 6, extends rearwardly in the center of the frame to the rear mechanical organization 6 cooperating with the rear axle or drive shaft and comprising a secondary power generator or pump and other devices which will replace the usual transmission and differential,

as will be more fully hereinafter described. An automatic pressure pump 7, speed shifting or control valve 8, the usual gears 9 and a muffler 10 are also located at the front extremity of the frame, and the said pump 7 and valve 8 will be hereinafter more particularly explained. As shown by Figs. 2, 5 and 6, the dashboard 11 and adjacent part of the bed have a pressure gage 12, an indicator 13 to show the position of the speed shifting block of the secondary power generator or pump, a foot pedal 14 controlling the neutral valve and foot-brake, a foot pedal 15 for controlling the emergency brake, a foot pedal 16 for controlling the gasolene feed, steering gear supporting means or brackets 17, an oil sight feed 18, and a switch 19 supported and arranged thereon for convenience in operation and inspection, and the immediately foregoing parts will also be presently defined in connection with the mechanisms and devices with which they are directly coördinated.

Surrounding the shaft 5 is a casing 33, and between the forward extremity of the shaft 5 and the prime power generator or motor or engine 4 is the usual form of universal joint 32, the function of the said universal joint being readily understood. In the front extremity of the shaft casing 33 an adjustable ball-bearing 34 is supported, and in the rear extremity of the casing is a roller bearing 35 for the shaft 5. The rear end of the shaft 5 is journaled in a suitable end thrust bearing 36 which also embodies a roller bearing 35^a similar to that in the rear extremity of the casing 33. On the rear extremity of the casing 33 a stuffing box flange support 37 is connected and is adjustably mounted on the stuffing box 39 projecting centrally and forwardly from the rear organization 6, the exterior of the box 39 and the interior of the flange 37 being interiorly screw-threaded, as clearly shown by Fig. 6, and between a shouldered portion 38^a of the flange support 37 and the forward end of the stuffing box 39 a gland 38 is disposed and abuts against the shouldered portion 38^a. The rear portion of the stuffing box 39 is also provided with a roller bearing 35^b similar to the roller bearings 35 and 35^a.

From the foregoing it will be seen that the shaft is provided with means for causing the same to run free and easy and at the same time a tight inclosure therefor is provided particularly adjacent to and including that portion thereof which extends through the stuffing box 39. The rear organization 6 as hereinbefore referred to embodies end plates or cylinder heads 51 having hollow end supports 52 projecting outwardly therefrom and converged toward their outer extremities. Also extending outwardly from the central portions of the end plates or cylinder heads 51 are stuffing boxes 53 which are formed with exterior screw-threads adjustably engaged by stuffing box caps 54, each stuffing box having a seat 56 at the inner portion thereof bearing against a shoulder 56^a in the center of each end plate or cylinder head 51. A floating axle 55 extends outwardly through each roller bearing 35^c, stuffing box 53 and cap 54 and continues on outwardly through the center of the outer end of the end support 52 which is continued in the form of a tubular extension or elongated fixed collar 52^a, within which is a tubular sheathing or guard 52^b extending to the hub of a rear driving wheel 52^c. Each floating axle 55 is a duplicate of the other and similarly mounted and operated and extends inwardly to and has bearing in the center of an inner head plate 71 provided with a roller bearing 35^d and also with an inner cap plate 72 against which abuts the inner end of the floating axle. Between the inner portions of the end plates or cylinder heads 51 is a shell or casing 51^a which provides upper and lower oil chambers 57 and 58 and tightly incloses the several operating mechanisms comprised in the substitutes for the usual transmission and differential. Within the center of the shell or casing between the plates 71 a secondary power generator or circulator is disposed, and the shaft 5 extends into and through the center thereof, the said secondary power generator or circulator embodying a sliding speed controlling block or pump element 90 which is adapted to strike at opposite ends against the inner caps 72, the latter for this purpose serving as bumpers for the said speed shifting or changing block 90.

The distance between the caps 72 is materially greater than the maximum length of the block 90 so that the latter may be readily shifted between the said caps and the plates 71, and to maintain the block in positive position and also to guide the same in its movement, inwardly projecting housings or bearing extensions 71^a are provided and form a part of the casing 51^a, see Figs. 11 and 18, suitable packing strips 90^a being mounted on the block 90 adjacent to the opposite ends thereof to form a tight joint with the surfaces of the bearing extensions 71^a. In view of the fact that the distance between the caps 72 and plates 71 is greater than the length of the block 90, chambers will be alternately formed between the opposite ends of the block and the said caps and plates, as at 69 and 70. The dimensions of the chambers 69 and 70 vary in accordance with the position of the block 90, and the block is held out of contact, so far as its full end area is concerned, relatively to the plates 71 and will also be cushioned at its ends and prevented from engaging the plates 71 so that there will always be open spaces formed at the ends of the blocks for admis-

sion of oil from the inlet ports. The block 90 is formed with a chamber or is hollowed out, as at 90[b], and has opposite arcuate walls 90[c], the block being open at top and bottom or the chamber thus formed is fully open into the upper and lower oil chambers 57 and 58, and fixed on the shaft 5 is a rotor or rotating pump element 59 which is structurally lightened by coring out the same, as at 64 and 66, the front and rear ends of the rotor being contiguous to the heads of the block 90, as shown by Figs. 6, 7 and 11, with cam grooves 64[a] formed therein and engaged by rollers 64[b] on the front and rear ends of blades 63 which radially move in slots in the rotor. The cam grooves 64[a] are eccentric with relation to the shaft 5, and by this means the blades 63 are caused to be projected to engage either of the arcuate walls 90[c] in accordance with the adjustment of the block 90 and the direction of movement of the machine or vehicle as an entirety. The block 90 is freely slidable on the shaft 5 by the formation of suitable slots 64[c] in the heads of the block 90 and which are respectively located at the front and rear portions of the said block.

Each of the blades 63 is composed of a metallic center plate 63[a] having bosses 63[b] secured thereto adjacent to the inner edge thereof, and from the bosses 63[b] the rollers 64[b] project; and fitted over the opposite side of the metal plate 63[a] are wooden plates or sheathings 73 having fastenings or rivets 74 extending therethrough and through the plate 63[a] at intervals to provide a compact composite blade. The wooden plates or sheathings 73 are preferably constructed of lignum vitæ and have their outer surfaces flush with the bosses 63[b], as indicated by Fig. 15. By the use of the wooden plates or sheathings 73 constructed of lignum vitæ, antifriction rollers on the sides of the blades are dispensed with and the said blades are rendered very durable by the use of the hard wood plates or sheathings, and, moreover, as lignum vitæ does not swell or expand by reason of liquid contact therewith, each blade is given a greater wearing quality than would ensue if metal was used, and, furthermore, the blades by their particular structure are adapted to have an easy movement in the rotor without any tendency to binding action.

Adjacent to the ends of the speed shifting block 90 and consequently on opposite sides of the secondary power generator or circulator, motors 60 embodying rotors are mounted on the floating axles 55, the rotor of each motor 60 embodying a cylinder 65 which is cored out and has an inner hub 67 which is also cored out. Blades 79 are radially disposed and movable in the cylindrical body 65 and have rollers or trunnions 61 at their opposite ends adjacent to the inner edges and movably engaging cam grooves 75 in the end plates or heads 51 and 71. The cam grooves 75 are of the form illustrated by Fig. 13, and between the dotted lines 80 the blades 79 have no action, or in other words each cam groove between the points 80 is concentric with relation to the floating axle 55. This construction of the cam groove is very important as it permits the elimination of antifrictional rollers in connection with the blades 79 and at the same time said blades have an equal amount of pressure surface between said points which results in a steady movement of the automobile or dispenses with any tendency to vibration, which is present in other similar organizations wherein the cam grooves are irregular or have a varying area. It will also be seen in Fig. 11 that the hub 67 provides two members which project inwardly toward each other to give ample securement to the floating axle, and these hubs are adjacent to the roller bearings 35[c] and 35[d], and hence the axles and the blades 79 of the rotors of the motor 60 have a very sensitive movement or operation. It will be understood that the cam grooves 75 insure a regular projection and retraction of the blades 79 to the best advantage with respect to the circulating oil moving from the chamber 57 to the chamber 58 or vice versa, in accordance with the direction of movement of the automobile. The rotors of the motor 60 are disposed and operate in chambers 69[a] and 70[a] which open into the chambers 57 and 58, and between the secondary power generator or pump in the center and the rotors of the motor 60 a compact and large smooth passageway is formed which allows a very low velocity in the flow of the oil, with materially less friction than would be the case if the oil had to engage resisting divisions or partitions and seek its way around through openings in circulating in order to become effective with relation to the rotors of the motor 60.

It is proposed to construct the blades 79 in any preferred manner, and they may be of a composite nature similar to the blades 63 of the secondary power generator or circulator so as to reduce the friction and increase the durability thereof. The shell or casing 51[a] is provided at its lower portion with drain openings 51[b] normally closed by removable screw-plugs 51[c] and whereby the chambers within the said shell or casing may be completely relieved of their contents and the inclosure as an entirety cleaned when found necessary. The shifting block 90 is clearly shown by Figs. 8, 9 and 10 and located at extremities thereof are inwardly projecting opposing hubs 90[d] forming portions of the rotor 59 and through which the shaft 5 extends, as clearly shown by Fig. 7. The packing strips or packing material 90[a] are held in grooves 190 in the upper and

lower sides of the block, the said grooves being formed without the usual spring organization, and the packing strips themselves are formed either of dry soft wood or dry leather strips which will expand and form a perfectly tight joint when coming in contact with the oil. These packing strips 90^a prevent the oil in the chambers 69 and 70 from leaking out of the latter chambers and mingling with the oil under pressure in the chambers 57 and 58. At the front and rear ends of the block 90 packing strip holders or plates 190^a are removably secured in recesses 190^b, and in these packing strip holders or plates packing strips similar to those at the top and bottom of the block are disposed and adapted to engage the front and rear plates 81 and 82, see Fig. 6, forming part of the inclosure or casing for the rear organization and also constituting the front and rear walls of the chamber in which the block is disposed, the plates 71 forming the side walls for said chamber which is located between the upper and lower chambers 57 and 58. As shown by Figs. 6, 8, 19 and 20, the top edge of the front wall of the block 90 is provided with a rack 29 continually engaged by a pinion 28 on the rear end of a shaft 30 extending through a stuffing box 26 having a gland 27, the pinion 28 being free to rotate in a suitable recess 28^a in the adjacent front portion of the casing. The shaft 30 extends forwardly and has a front squared extremity 30^a and is fitted with a bushing 25 mounted in a bearing 31^a of a bracket casting 31 secured to the cross-bar 4^a. On the front end of the shaft 30 a crank-arm 22 is secured and has a connecting rod 24 attached to the outer end thereof and also to a crank-arm 21 of a short shaft 23 on which is fixed an indicator hand 20 forming part of the indicator 13, the shaft 23 having bearing in a bearing sleeve 23^a projecting rearwardly from the frame of the indicator 13 through an opening 23^b in the dashboard 11. Through the medium of the mechanism just explained the position of the shifting block 90 will always be disclosed through the medium of the indicator 13 to the driver or operator of the machine. In the front of the casing adjacent to the shifting block 90, or in the front plate 81, suitable stuffing boxes and pipe openings will be provided for connection of the pressure pipes which will be hereinafter explained. The stuffing box 39 and the roller bearing 35^b are also supported by the said front plate 81, as clearly shown by Fig. 6.

On the front portion of the shell or casing 51^a of the substitute organization 6 a bypass or safety valve 40 and a neutral valve 83 are mounted on opposite sides of the position of the secondary power generator or circulator and both communicating with the chambers 57 and 58. The bypass or safety valve is provided with a suitable casing or inclosure, as clearly shown by Fig. 12, and is also closed at the upper and lower ends, the casing or inclosure being practically a continuation of the shell or casing 51^a with the upper and lower heads 41^a and 41^b inserted therein and secured by suitable screw-threads. In the upper head or cap 41^a an air vent or cock 41^d is secured in the opening 41^c communicating with the upper portion of the interior of the valve, and seated at its upper and lower ends in the caps 41^a and 41^b is a vertically disposed guide shaft 76 having thereon an intermediately disposed piston 78 which coöperates with an intermediate contracted portion 78^a of the valve chamber and provides a division between the upper and lower portions of the valve. On the upper and lower portions of the guide shaft 76 springs 77 are mounted and engage the caps 41^a and 41^b and the opposite ends of the piston 78, the said springs having a tension sufficient to resist movement of the piston 78 in either direction on the shaft 76 when normal pressure of the oil or fluid in the several parts of the mechanism exists. The upper and lower portions of the neutral valve have large ports 40^a and 40^b respectively opening into the chambers 57 and 58, the use of the guide shaft 76 with the piston 78 thereon as explained permitting the formation of said large ports as the said guide shaft gives ample clearance for the same. Connected to the lower portion of the bypass or safety valve 40 is a pipe 42 also attached to and coöperating with the pressure gage 12 and whereby the chauffeur or driver may be readily informed as to the condition of the pressure in the valve and the several parts of the mechanism as a whole. The air relief cock 41^d permits all the air to be driven out of the mechanism when charging the latter with oil so as to avoid any preliminary false pressure owing to compression of the air within the several parts or elements of the entire mechanism, and after the air has been fully expelled the cock 41^d is closed.

The neutral valve 83, particularly illustrated by Figs. 7, 17, 22, 23 and 29 to 33 inclusive, is also inclosed or is formed as a part of the shell or casing 51^a and is disposed in upright position similarly to the bypass or safety valve 40 and has an upper port 83^a and a lower port 83^b respectively communicating with the upper and lower chambers 57 and 58. On the top of the neutral valve a cap 83^c is secured and provided with a stuffing box 86 in which a valve stem 85 is operatively mounted, as clearly shown by Fig. 29. The cap 83^c is also provided with an air cock or vent 87 fitted in an opening 87^a communicating with the interior of the neutral valve for the purpose of relieving the valve and adjacent chambers and parts of the mechanism of accumu-

lated air pressure at the time of charging the parts of the mechanism with oil or other operating fluid. The cock 41[b] of the bypass or safety valve 40 and the cock 87 of the neutral valve 83 are both for the same purpose, and by opening the same the air from the interior of the several parts of the mechanism may be permitted to quickly escape and thus provide for a reliable filling or occupancy of the entire space of the several mechanisms by the oil or operating fluid. The neutral valve embodies a cylindrical valve member 84 open at its upper and lower ends and having intersecting cross-attaching arms 84[a] at its upper end over which is secured the lower slotted end 85[a] of the valve stem 85, the lower end of the said valve stem being formed with intersecting slots or cuts, as shown by Fig. 31, to engage the arms 84[a] of the valve member 84 and firmly secured by suitable set nuts 85[b]. The valve stem 85 has its upper end engaged by the slotted extremity 88[a] of a lever 88 fulcrumed at its outer end on a support 89 rising from the top or cap 83[c], as shown by Fig. 30, and engaging the intermediate portion of the lever 88 is the upper end of a connecting rod 91 provided with a collar 92 and vertically movable through a support 94 projecting from an adjacent portion of the inner end of one of the end supports 52. On the connecting rod 91 between the collar 92 and support 94 a spring 93 is mounted and tends to maintain the connecting rod and lever 88 and valve member 84 in normal elevated position. Also projecting outwardly from the inner end of the adjacent end support 52 is a stud 95 on which is mounted a double bell-crank 98, to one arm 98[a] of which the lower end of the connecting rod 91 is movably secured, the remaining arm 98[b] of the said double bell-crank having a rod 99 secured thereto and extending forwardly within the frame of the machine and secured to the rear end of a shifting plate or member 100 formed with a longitudinal slot 100[a] at its forward extremity through which a counter-shaft 101 extends. The shaft 101 extends across the frame and is mounted at its ends in suitable bearings and carries thereon a bell-crank 102 connected by a rod 103 with a foot pedal 14 movably mounted on a shaft 125 also extending across the frame and mounted in suitable bearings and projecting outwardly beyond the side members of the frame, as clearly shown by Figs. 1, 22 and 23. The foot pedal 14 has a spring 124 connected thereto above the shaft 125 and also to a bracket support 126 held by a portion of the frame, the said spring operating to restore the foot pedal 14 to normal position when released. The shifting plate 100 is increased in width at its forward extremity and the slot 100[a] is above the longitudinal center of the said plate, the intermediate portion of the plate having upper and lower parallel edges 100[b] and 100[c] respectively engaging grooved rollers 108 and 113 to maintain the plate 100 in a straight line or give it a fixed plane of movement relatively to a horizontal plane to insure a positive operation of the double bell-crank 98 and of the rod 91 connected to the one arm 98[a] of said latter bell-crank. The shifting plate 100 at its forward extremity has a bearing shoe 100[d] secured thereto and projecting inwardly therefrom, and the rear edge of the said bearing shoe is formed with a concave bearing surface 100[e] for engagement by a roller 105 carried by a bell-crank 104 also secured on the shaft 101. The hub 104[a] of the bell-crank 104 has one end thereof close to or bearing against the inner side of the plate 100 adjacent to the slot 100[a], and on the outer side of the said plate 100 a spacing sleeve 104[b] is mounted on the shaft so as to hold the said plate 100 against lateral shifting movement on the said shaft 101 and always insure an engagement between the shoe 100[d] and the roller 105. The bell-crank 104 with its roller 105 constitutes the direct shifting means for the plate 100 when the shaft 101 is rotated through its bell-crank 102 and rod 103 by forward movement of the foot pedal 14, and the said roller 105 bears against the concave edge 100[e] and sets up a strong leverage that will overcome any resistance to shifting movement of the plate 100, rod 99 and double bell-crank 98 and the parts interposed between the latter and the valve member 84. The roller 108, as clearly shown by Fig. 28, is mounted on a pin 111 projecting from a bracket 106 secured to one of the side members of the frame of the machine and extending inwardly toward the center of the frame parallel to the shaft 101.

Depending from the pin 111 and also secured thereto outside of the position of the roller 108 is a supporting arm 107 in which is fixed an inwardly extending pin 112 forming the bearing for the roller 113. Between the spacing sleeve 104[b] and the adjacent side of the frame a crank arm 114 is also mounted on the shaft 101 and has a cross-pin 116 which engages slots 109[a] of the elongated head 109 of yoke form, the free end of the crank arm 114 carrying the cross-pin 116 moving between the members of this yoked head 109, as clearly shown by Fig. 22. The movement of the pin 116 in the slots 109[a] of the yoked head 109 is proportionate to the movement of the roller 105 of the bell-crank 104, or the pin 116 shifts longitudinally in the slots 109[a] simultaneously with the movement of the roller 105 by reason of the fact that the shaft 101 simultaneously controls the operation of the crank arm 114 and the

bell-crank 104 through the actuation of the pedal 14 and the connecting rod 103. A rod 110 is secured to the rear end of the yoked head 109 and projects rearwardly and is movably attached to a crank arm 115 on a brake shaft 115[a], see Fig. 30, suitably supported by a bracket bearing 115[b] and extending outwardly to the central portion of the adjacent drive wheel 52[c], and by this means the brake of the usual band type, as at 115[d], may be actuated relatively with the actuation of the neutral valve 83. The rod connection 110 together with the yoked head 109 and crank arm 114 is duplicated on opposite sides of the machine, and likewise the crank arm 115, brake shaft or support 115[a], and brake band 115[d] are also used in connection with each drive wheel 52[c], as clearly shown by Fig. 1, and by this means the brake bands 115[d] may be simultaneously and with equal force and braking power applied to the said drive wheels. The pedal 14 is movable through a suitable opening in the dashboard 11, as shown by Fig. 28, and at the top of this opening on the front of the dashboard a shoulder 123 is secured. The head or foot engaging member 204 of the pedal 14 is movably connected to the latter and has a rod 122 pivoted thereto and also to the rear extremity of a sliding catch 117 having a hook or catch shoulder 117[a] at the inner end thereof adjacent to the front end to engage the shoulder 123 on the dashboard 11. The sliding catch 117 moves on the upper side of the forwardly projecting portion of the pedal 14 and is formed with a rear longitudinal slot 121 engaged by a headed stud 120 projecting upwardly from the adjacent portion of the pedal. The forward extremity of the sliding catch 117 is formed with an inwardly extending diagonal slot 118 which is engaged by a headed stud 119 also projecting upwardly from the adjacent portion of the pedal 14. When the operator applies pressure through the foot on the head 204 the plate 117 is shifted on the portion of the pedal 14 which it engages and the front slot 118 causes the said catch to move inwardly at an angle relatively to the portion of the pedal engaged thereby and at the same time the rear portion of the catch plate slides on the headed stud 120 and also laterally swings on the latter, the object of this movement being to expose the hook or shoulder 117[a] for engagement with the shoulder 123 on the dashboard 11 and hold the pedal 14 in a partial forwardly pressed position against the resistance of the spring 124 attached to the pedal to hold the neutral valve open prior to or without applying the brake when it is desired, for instance, to coast. The normal position of the bell-crank 104 is rearward at a downward angle of inclination, and the forward movement of the pedal 14 correspondingly draws on the rod 103 and shifts the bell-crank with its roller 105 first to the position shown by Fig. 25 and then to the position shown by Fig. 26, the roller 105 gradually moving over the convex bearing edge 100[e] of the shoe 100[d] and thereby forcing the shifting plate 100 longitudinally between the rollers 108 and 113, and as the roller 105 begins to engage the convex bearing edge 100[e] the cross-pin 116 of the crank-arm 114 will have engaged the forward portion of the wall of the slot 109[a] of the yoked head 109 by further pressure on the pedal 14, and by this means the brakes or the brake bands 115[d] will be applied to the drive wheels 52[c] relatively to the shifting movement of the valve member or controlling valve 84 of the neutral valve, the operation of the pedal and the shifting plate 100 as just explained causing the valve member 84 to move downwardly from the position shown by Fig. 29 so as to open communication through the said valve member between the lower portion of the valve and the port 83[a]. When the valve member or controlling valve 84 of the neutral valve is in normal elevated position as shown by Fig. 29, the port 83[a] is shut off from communication with the lower portion of the neutral valve. When the pedal 14 is released after being forwardly projected or moved, and which is accomplished by releasing the hook or shoulder 117[a] from the shoulder 123, the spring 124 acts to repel the lower portion of the pedal and at the same time the spring 93, which has been compressed, also forces the connecting rod 91 upwardly to normal position and through the medium of these springs the several parts of the neutral valve and the coacting brake means as well as the pedal are restored to normal position, as shown by Figs. 28, 29 and 30.

The emergency brake attachment or operating means is also included in the machine organization and embodies a foot pedal 15 also mounted on and secured to the shaft 125 together with connecting rods 127 attached at their forward ends to crank arms or bell-cranks 128 on the outer ends of the shaft 125, the said connecting rods 127 running backward to crank arms or bell-cranks 129 also mounted on the brake shafts 115[a] at each side and connected to the brake bands 115[d] by the usual connections, as at 127[a].

In the present organization an automatically operating pressure regulator is used similar to the organization disclosed in my pending application Serial No. 786,640, hereinbefore referred to, and coöperates with the secondary power generator or circulator comprising the rotary pump 59, the said pressure regulator, as shown in detail by Fig. 3, consisting of a cylindrical casing or shell 41 having opposite heads or caps 42[a]

and also a spring 43ª which is mounted therein between the said caps. In the cylinder 41 a piston 44 is disposed and is engaged by the forward end of the spring 43ª, the piston in the present instance having an eye 45 for conveniently removing the same. The spring 43ª at its rear extremity is held by a support 46 secured to the rear cap 42ª, and the forward extremity of the spring fits within the rearwardly projecting shell-like body of the piston 44, as clearly shown. A pipe 47 connects with the lower rear portion of the cylinder or casing 41 to relieve the cylinder of leakage past the piston 44, and also connected to the center of the front head 42ª is a pipe 48 leading to a pressure pipe line 131, as clearly shown by Figs. 55 and 56, and between the said pressure regulator and the pressure pipe line in the pipe 48 a cut-off valve 186 is interposed. The pressure pipe line 131 has a check valve 49 therein, shown in enlarged section by Fig. 4, and constructed and operating in all respects similar to the valve disclosed in my aforesaid application, the valve proper 49ª of this check valve being provided with a bypass 50. The pressure pipe line 131 is angularly bent and shaped to adapt the same for various connections and is attached at its front extremity to the automatic pressure pump 7, a check valve 188 being interposed in the pressure pipe line 131 adjacent to the said pressure pump. The pressure pipe line 131 constitutes an outlet pipe relatively to the automatic pressure pump, and the latter has an inlet pipe 130 connected to the opposite portion thereof and also to an oil reservoir 185, the pipe 130 being provided with a cut-off valve 187. The pipe 47 of the pressure regulator also connects with the reservoir 185, and through the medium of a branch pipe 131ª the pressure pipe line 131 is attached to one extremity of the control valve 8 which has pipes 182 and 183 connected to different portions thereof and also to the chambers 69 and 70 at opposite ends of the slidable block 90 of the secondary power generator or circulator, and a further pipe 184 also connects with another portion of the control valve 8 and the inlet pipe 130.

The detail construction of the control valve 8 is clearly shown by Figs. 46 to 54, inclusive, and the application of the valve is illustrated by Fig. 44. The control valve 8 has a casing which is of the shape shown to accommodate the various connections and details of construction which will be presently explained, and is secured on the inner portion of one side of the frame adjacent to the prime motor or engine 4 and is arranged at an angle of inclination corresponding to the position of the steering wheel 167 and its post 167ª. A rod 170 extends through the steering post 167ª, the center of the steering wheel 167 and the steering gear, and the upper end thereof is exposed at the center of the steering wheel and has a hand-lever 168 secured thereon and in engagement with a segmental rack 169. The lower end of the rod 170 is connected to a rotary valve 171 which is partially tubular or has a lower tubular portion and an upper substantially solid portion, the said valve being mounted in a cylindrical seat 171ª forming a part of the casing 171ᵇ of the control valve 8. The valve or valve member 171 is freely rotatable in opposite directions in the seat 171ª and is formed with a recess or bypass in the upper solid portion thereof which opens through the side of the valve, and the lower portion of the valve is rendered tubular by forming a chamber 180 therein which opens through the bottom of the valve and has a lateral port 172 below the recess or bypass 173. The valve casing 171ᵇ has opposite chambers 178 and 179 with which the pipes 182 and 183 connect, and the valve seat 171ª is located between these chambers, and between the lateral port 172 of the valve 171 and the chamber 178 is a port 174, and opposite the latter port a port 176 is located to set up communication between the lateral port 172 or chamber 180 and the chamber 179. The valve casing also has a chamber 181 formed therein adjacent to the point of communication of the pipe 184 therewith, and the recess or bypass 173 is adapted to fully open into this chamber 181 or connect the same with the other chambers through the medium of ports 175 and 177 formed in the valve seat and respectively setting up communication with the chambers 178 and 179 so that the valve 171 when turned in opposite directions may be caused to establish communication between the bypass 173 thereof with either of the chambers 178 and 179. The pipes, as shown by Fig. 55, including the pipe 42 connecting with the pressure gage 12, may all have flexible hose connections 89 to withstand the vibration of the rear axle, such flexible hose connection having been found to be advantageous though not absolutely necessary.

The pressure pump 7 is a duplicate in many structural features of the secondary power generator or circulator and is driven from the prime power generating means or motor or engine 4. This pump is shown in detail by Figs. 34 to 43 inclusive, and as hereinbefore described has an inlet pipe 130 and an outlet pipe 131. This pressure pump 7 comprises a casing 134 having therein a shiftable block 135 disposed between upper and lower chambers 136 and 137. The pipe 131 connects with the lower chamber 137 and the pipe 130 with the upper chamber 136, and the shiftable block embodies a circular or cylindrical chamber 135ª. Communication between the chamber 135ª of the block

135 and the upper and lower chambers 136 and 137 is established through the medium of ports 138 and 139 respectively located in the upper and lower portions of the block 135, as clearly shown by Figs. 36, 37 and 38; and within the chamber 135ª is a rotor 140 which is radially slotted, as shown by Figs. 41 and 43, to receive intersecting sliding blades 145 preferably constructed of wood and held in contact with the wall of the cylindrical chamber 135ª at their outer ends through the medium of springs 147 disposed on rods or pins 146 engaging recesses or seats 146ª opening out through the inner edge portions of the blades and of sufficient length to compensate for the movement of the blades against the resisting action of the springs. The rods or pins 146 of the intersecting blades, as shown by Figs. 39 and 40, are disposed in planes at right angles to and between each other, and the amount of inward depression of the blades will, of course, depend upon the eccentricity of the rotor 140 relatively to the chamber 135ª of the block 135 and depending upon the adjustment of the latter block. The rotor 140 has at one end a guide and support washer 158 which is fitted in the outer side of the center of the casing, as shown by Fig. 38, and a shaft 140ª is connected to the opposite end of the rotor by integrally constructing the shaft and rotor from a single piece of material. The support washer 158 engages recesses or countersinks 159 in the opposite ends of the rotor 140 to make a flush fitting with the end of the latter. Between opposite ends of the block 135 and the adjacent end walls 141ᵇ and 141ᶜ and front and rear side walls 154 and 155 of the pressure pump casing 134, chambers 151 and 152 are provided and respectively have communication with the chambers 136 and 137 through ports 149 and 150 at the upper and lower portions of the said block 135, and by this means the oil is admitted to the upper chamber 136 from the reservoir, and then delivered into chamber 137 under pressure to cause an automatic operation of the block in a manner which will be hereinafter explained. The block 135 is maintained under automatic adjustable spring tension through the medium of a spring 160 mounted in a tube 141 secured at its inner end to a boss 141ª at one end of the casing 134 and having an enlarged screw-threaded opening 141ᵈ to receive the end of tube 141 and to admit the inner end of the spring 160 which extends into chamber 151 and bears directly against the block 135. The outer end of tube 141 is screw-threaded to receive a cap 142 in which an adjusting screw 143 is mounted and provided with a suitable set-nut 144. A plate 153 is interposed between the inner end of the screw 143 and outer end of the spring 160, and by means of the screw the tension of spring 160 may be modified at will and the resistance to movement of the block positively regulated to insure movement of the block only after a predetermined maximum pressure in the entire apparatus is reached and is effective in the chamber 152 against the end of the block 135 opposite that engaged by the spring 160. The shaft 140ª of the pressure pump 7 has bearing at its inner end in a lower portion of the prime power generator or engine 4, as shown by Fig. 34, and on an intermediate portion of the said shaft 140ª a sprocket wheel 140ᶜ is fixed, see Fig. 35. On the cam shaft 133 of the prime power generator or engine 4 a small sprocket wheel 133ª is keyed or secured, and trained over the sprocket wheels 133ª and 140ᶜ is a chain belt 132. Therefore, it will be seen that the rotor 140 of the pressure pump 7 is driven or operated by the prime power generator or engine 4 in proper timed relation to the remaining mechanisms actuated by the said latter generator or engine and particularly in consonance with the rotor 59 of the secondary power generator or circulator which also operates as a pump. As structural incidentals contributing to the completeness of the pump 7, the front side wall 154 of the casing 134 has a central hollow seat 154ª for the boss 158ª of the guide and support washer 158, and the rear side wall 155 has an outwardly projecting stuffing box 156 with a gland 157 for the shaft 140ª.

A flat bell-shaped guard 161 is pivotally connected at its upper extremity by pin 165 to the front of the prime generator or engine casing, and is adapted to drop between engine crank handle 225 and the usual engine crank shaft to prevent the engine from being cranked while the neutral valve 83 is closed to avoid danger by such operation when the speed changing block 90 is off center. Attached to said guard 161 is a rod 162 connected to a bell-crank 166 supported by a portion of the machine frame, and the bell-crank 166 is in turn connected by a rod 163 to a crank arm 164 secured on the counter-shaft 101. When the neutral valve 83 is closed the guard 161 is automatically drawn to the right and interposed between the end of the crank 225 and the engine crank shaft by the operation of closing said valve. When the counter shaft 101 is turned forty-five degrees, crank arm 164 will move or shift the rod 163, thereby correspondingly moving the bell-crank 166 and pushing the guard 161 to the left and clearing the ends of the crank and crank shaft for engagement one by the other.

The reservoir or tank 185 and the pressure regulating cylinder 41 are adjacent and disposed transversely in parallel relation across the frame, as shown by Fig. 55, and it will be observed that the front portion

of the machine adjacent to the rear portion of the prime generator or engine 4 is materially free of mechanism as compared to the usual type of automobile or motor vehicle embodying transmission gear. The usual reversing and coasting operations can be as readily effected as in the ordinary type of automobile, and the speed may be changed or modified without liability of stripping the teeth of gears and in a much simpler and easier manner through the means carried by the steering wheel.

The usual automobile shifting and reversing levers are eliminated, and in lieu thereof the lever 168 on the steering wheel 167 may be conveniently and quickly operated to adjust the control valve 8 which reliably and positively modifies the position of the block 90 of the secondary power generator or circulator used to replace the usual form of transmission gearing and in the present instance directly operating the two motors 60 on the floating axles 55 and forming the substitutes for the usual differential. Preliminarily the reservoir or tank 185 is filled with oil or other liquid through an inlet 185ª by any suitable means. As oil has been found to be the most effective in its operation, it will be hereinafter referred to exclusively as the operating medium, but it should be understood that other liquids may be used and the invention is not confined to any particular liquid in successfully performing its desired functions. The capacity of the reservoir or tank 185 in practice will be greater than the capacity of the combined mechanisms through which the oil circulates or flows after a full filling of all the mechanisms has been effected, and at any time found necessary the contents of the reservoir may be replenished, or the reservoir may be recharged. The spring 160 of the pressure pump 7 is set or adjusted to give the block 135 a normal resistance to movement relatively to a predetermined maximum pressure, and the prime power generator or engine 4 is started and in turn the rotor 140 of the pressure pump is actuated or rotated through the shaft 140ª and the connections with the cam shaft 133 of the generator or engine 4. The rotor 140 revolves in but one direction, and after valve 187 is opened the said rotor draws the oil through pipe 130 into the upper chamber 136 of pump 7 and then forces the oil down through ports 138, rotor chamber 135ª and ports 139 into the lower chamber 137 under pressure. During the operation of the rotor 140 the blades 145 move outwardly and inwardly relatively to the rotor slots in view of the eccentric position of the rotor in the chamber 135ª, the springs 147 tending to force the said blades outwardly and causing them to tightly impinge at their outer ends against the wall of the chamber 135ª to prevent leakage of the oil between the blades and chamber wall. The rotor 140 runs at a very low speed, not exceeding one hundred revolutions per minute and thereby causing very little centrifugal force and obviating the necessity of having the oil under pressure in chamber 136. From the chamber 137 the oil is forced out through check valve 188 and pipe 131, in which said check valve is located, and then through pipe 48 to the pressure regulator or regulating cylinder 41, the valve 186 being necessarily open at such time, forcing piston 44 back against and compressing the spring 43ª and establishing pressure in the pipe 131. The oil also passes through check valve 49 in pipe 131 and through opening 87 into the upper chamber 57 over the rotor 59. The air vents or cocks 41ᵈ and 87 respectively of the by-pass or safety valve 40 and the neutral valve 83 will be open at the time the oil is forced into the several parts of the rear substitute mechanism, and the pressure pump 7 will continue to act until all the parts or chambers of said mechanism are filled and the spring 43ª has been compressed to set up the maximum pressure desired in the mechanism.

It will be understood that after all of the air has been driven out of the several parts of the mechanism the vents or cocks 41ᵈ and 87 will be closed, said closure being effected prior to the establishment of the maximum pressure within the parts of the mechanism or when the oil has filled all of the chambers and is in practically a static column throughout the whole apparatus. The pressure of the spring 43ª in the pressure regulator 41 produces a corresponding pressure in the pipe 131, and as the pressure in the pressure regulator and in pipe 131 increases it will likewise increase in chamber 137 and the oil is forced through port 150 in the block 135 of the pressure pump 7 into the chamber 152, and when the pressure reaches a certain degree sufficient to overcome the pressure of the spring 160 against the block 135, said block is forced against the spring or the tension of the spring is overcome and the block 135 shifts until the space around the rotor 140 is equally divided, or the rotor occupies a position centrally with relation to the chamber 135ª, and when the rotor is in this position the pressure pump will stop pumping action and may be started again only when pressure is lowered in the chamber 152, and allowing the spring 160 to force the block in an opposite direction and cause the pump to again carry the oil from the chamber 136 to chamber 137. As hereinbefore indicated, the pressure on the oil circuit that may be desired is obtained by adjusting the screw

143 to modify the tension of the spring 160. One main advantage of this particular construction of automatically operating pressure pump is that when pressure becomes high enough to stop its action the power utilized in operating the pump is no greater, practically speaking, than in running the pump without pressure, as would be the case in a reciprocating pump and by-passing the oil at a given pressure. The pressure pump being automatic in its operation permits a considerable reduction in the size of the pressure cylinder 41 as hereinbefore indicated.

In the present improved construction the shifting movement of the block 90 is accomplished through the operation of the control valve 8, which may also be termed a four-way speed shifting valve. The oil under pressure is fed into the lower end of the valve casing, as clearly shown by Fig. 56, through the medium of pipe 131[a] and enters the chamber or tubular portion 180 in the lower end of the valve 171. The chambers 179 and 178 of this control valve are connected to the rear organization, including the secondary power generator or circulator and the rotors on the floating axles by pipes 182 and 183 connected to the openings 85 and 86 and respectively communicating with the chambers 69 and 70 at opposite ends of the block 90. The chamber 181 of the valve 8 is connected through the medium of pipe 184 to the pipe 130 just ahead of the valve 187. If the block 90 is located exactly on center of the chambers 69 and 70, or if the latter chambers are of the same dimensions, the rotor 59 will necessarily be on the center and have spaces on each side thereof of the same dimensions. In this position of the block 90 and the rotor 59 the automobile or machine will be neutral or in condition to start the same, and as the rotor always runs to the right it will be necessary to shift the movable block 90 to the right. Therefore, presuming that the lever 168 is in the position shown by Fig. 45, the valve 171 would then be in the position shown by Fig. 51, or the chamber 180 would be open to communication with the chambers 174 and 176 and as a consequence the oil in both pipes 182 and 183 and in chambers 69 and 70 would be under the same pressure as exerted by the spring 43[a] in the pressure cylinder 41, the pressure being exerted through pipe 48, valve 186, pipe 131 and from the latter pipe into the chamber or hollow portion 180 of the valve 171 and out through ports 174 and 176 into pipes 182 and 183. In order to shift the block 90 to the right and cause the rotor 59 to pump oil from chamber 57 to chamber 58, lever 168 is turned to the left from the central position shown by Fig. 45, and through the rod 170 the valve 171 will be correspondingly rotated until it occupies the position shown by Fig. 53, or to shut off the port 176 and set up communication between the chamber 180 and the port 174 and chamber 178, and by this means the pressure would be still maintained in pipe 182 and in chamber 69, and at the same time the by-pass or port 173 would be moved to the position shown by Fig. 52 and thereby connect the chamber 179 with the chamber 181 and the pipes 183 and 184 through the said chambers, thus permitting the oil to pass from the chamber 70 to the pipe 183 into chamber 179, through by-pass or port 173 into chamber 181, and by pipe 184 to the reservoir 185, the oil being forced out of chamber 70 by the oil under pressure in chamber 69. The different speeds are regulated by the amount of oil let out and the consequent position of the rotor 59 relatively to the vertical center, for instance, of the chamber in which it operates and which is controlled by the position of the block 90. To force the block 90 in the opposite direction, the lever 168 is moved to the right from the position shown by Fig. 45 instead of to the left, thereby causing a reverse effect.

The by-pass or safety valve 40 operates in a manner similar to the corresponding construction embodied in my application hereinbefore noted, and the purpose of this valve is to provide for an equalization of excessive pressure that may be suddenly generated within the circulating system and due to abnormal pressure that may arise from a sudden stop of the secondary power generator or circulator or of the motor of the automobile, as in reversing the movement of the latter or from any other cause, and thus relieving the chambers 57 and 58 and the parts to which they are connected as well as the remaining parts of the mechanism of undue strain that might without relief result seriously or effect a breakage or fracture of the said parts. Should this excessive pressure occur in either of the chambers 57 or 58 the valve 78 will be moved in a corresponding direction against the resistance of the spring 77 opposing such direction of movement, and the shifting movement of the valve 78 would open up communication between the ports 40[a] and 40[b] and the chambers 57 and 58, or if the valve 78 be moved downwardly against the lower spring 77, communication will be established between upper port 40[a] and chamber 57 and the lower port 40[b] and chamber 58, and conversely if the excessive pressure is in the lower chamber 58 the valve 78 will be reversely moved and open up communication with the upper port 40[a] and chamber 57, when immediate relief will ensue without strain on the several mechanisms and a counter-cir-

culation established in either direction through the valve in accordance with the primal cause of the excessive pressure. Under normal conditions the springs 77 hold the valve 78 in central position, as shown by Fig. 12, or so that the valve will be closed, the said springs having such normal tension as to resist movement of the valve by the ordinary or normal pressure of the liquid or oil circulating in the mechanism. The condition of the pressure of this safety or by-pass valve may always be ascertained through the medium of the pressure gage 12 connected by pipe 42 to the lower portion of the safety valve.

The neutral valve 83 also operates in the present improved construction similarly to that embodied in my pending application hereinbefore noted, but is much simplified and more effective, and it will be observed that essentially in the present instance this valve is practically one tube working inside of another. The oil enters from the bottom of the valve casing through the port 83^b into the valve inclosure and through the valve member 84 when the latter is opened or is moved downwardly from the position shown by Fig. 29 through the operation of the mechanism hereinbefore explained. After the oil passes upwardly through the valve member 84 it enters the port 83^a and passes into the upper chamber 57, when the valve member is lowered or opened through the actuation of the valve stem or rod 85 by the lever and shifting mechanism therefor, as fully explained in the foregoing description. When the valve member 84 is closed the upper end thereof engages the lower side of the cap 83^c and no oil can pass therethrough, and it will be observed that when the valve member 84 is closed as shown by Fig. 29, the port 83^a fully encircles the same and provides means for giving a balanced effect and eliminates any friction due to the operation of the same and which would be present if the port was only on one side of the valve. This neutral valve takes the place and performs the same function as the clutch mechanism in the usual construction of automobiles or motor cars, and by actuating the foot pedal 14 or pressing forwardly on the said pedal the neutral valve is opened and held open, while during further movement of the said pedal the brake is applied; or in other words, the valve is first opened before the brake is applied and, conversely or when it is desired to close the neutral valve the brake must first be released and the valve subsequently closed. This operation is accomplished by pushing forwardly on the pedal 14 to move the rod 103 connected to the crank 102, thereby rotating the shaft 101 which in turn moves the bell-crank 104 and carrying the roller 105 forwardly against the shoe 100^d to effect a pulling action on the rod 99 for the purpose of correspondingly moving the bell-crank 98 and drawing downwardly on the rod 91, causing the lever 88 to exert a downward force on the stem 85 and thereby open the neutral valve member 84. Supposing that the bell-crank 102 has a movement of ninety degrees, the first operation will be accomplished in the first forty-five degrees of movement thereof and the bell-crank 104 carrying the roller 105 will then be at about a point indicated by the reference character 200 in Fig. 26. The inner concaved or arcuate edge of the shoe 100^d will then be on a true radius with the center of shaft 101 and the bell-crank 104 carrying the roller 105 will be permitted to move through the remaining forty-five degrees without causing any movement of the head 100, but when the roller 105 is at the point indicated by dotted lines in Fig. 26, the bell-crank 114 which is attached to counter-shaft 101 will also move forty-five degrees and pin 116 will have moved to the forward end of slot 109^a and the remaning forty-five degrees of movement of the shaft 101 will cause the brake to be applied without effecting movement of the head 100. The slide plate or catch 117 is adapted to hold the foot pedal 14 in position caused by a movement of forty-five degrees of shaft 101, or in other words if it is desired to coast, the said catch 117 is set or caused to engage the shoulder 123 and in this position of the parts the neutral valve will be opened without application of the brake. The emergency brake is applied by foot pedal 15 coöperating with the shaft 125 connected up as hereinbefore explained, and the foot pedal 14 movably engages the said shaft 125. Therefore the movement of the foot pedal 15 does not interfere with the movement of the foot pedal 14 or vice versa.

It will be understood that the oil circulates through the rear mechanism or in the chambers 58 and 57 when the machine is normally operating or running in a forward direction, and that such circulation of the oil is established by the operation of the rotor 59 and operatively affects the motors 60 on the floating axles 55, and as a consequence the drive wheels 52^c are operated to propel the machine. When the machine is reversed the oil will circulate in a reverse direction and correspondingly operate the rotors 60 and the speed of the said rotors 60 will depend upon the amount of liquid or oil pumped or circulated by the rotor 59. The rotor 59 will cause a circulation of the oil downwardly and upwardly through the chambers 57 and 58, and in view of the compactness of arrangement of the several parts in the rear organization and the large smooth passageway around the rotor 59 to the rotors or motors 60, a very low velocity in the flow of oil will ensue, with materially less friction and consequently the said mov-

ing parts will be more sensitive to operation and effective in driving the axles 55. It will also be seen that the axles 55 are free to run faster or slower relatively to each other in making turns, as the difference in rotation will be taken up and counter-balanced within the chambers 57 and 58, and, moreover, by adjusting the neutral valve to set up a circulation therethrough, coasting may be accomplished without resistance.

The position of the block 90 may be readily determined at all times by the operator or driver through the medium of the indicator 13 and as well the pressure in the safety or by-pass valve 40 through the pressure gage 12. It will also be noted that the improved mechanism is applied to the usual form of automobile or motor car engine without modifying the latter or materially changing the general organization of the frame except in so far as the position of the substitutes for the usual transmission and differential requires, and one of the great advantages of the present construction is the disposition of the main control operating mechanisms relatively to the floating axles or shafts 55 locally at the rear of the machine and the operation of the control valve 8 through the steering wheel and the elimination of all levers and additional accessories ordinarily employed. The additional w ight imposed upon the rear of the machine or in connection with the floating axles or shafts 55 will be beneficial in the operation of the drive wheels 52^c.

It will be understood that such supports and attaching devices as may be necessary for mounting the several parts will be employed as found necessary and need not be particularly described, as for instance the shaft casing 33 is held by a cross-support, as at 33^a, secured to the frame and one of the cross-bars 4^a. Modifications, however, will be adopted in the support of the several parts as may be desired to insure their strength and durability, and also braces and incidental structural features will be adopted where found necessary.

The purpose of the check valve 49 in the pressure line is to check or stop the liquid or oil from being forced out of chamber 57 into pressure tank or cylinder 41 when the block 90 is in position to pump the liquid or oil out of chamber 58 into chamber 57 or vice versa. The small opening or port 50 is to relieve the excessive pressure in the organization due to the expansion of the liquid or oil resulting from friction ensuing from movement thereof, but the said opening or port 50 is so reduced in size as to obstruct the passage therethrough of a large quantity of liquid or oil and thereby avoid trouble in the practical operation of the liquid or oil, particularly when backing the vehicle or car.

What is claimed is:

1. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of independently rear floating axles having the rear drive wheels thereon, a secondary power generator or circulating organization and driving means for the axles and all located at the rear of the automobile and comprising a chambered inclosure, rotors engaging the said axles and a pump embodying a shifting block between said rotors, the chambered inclosure being filled with a liquid under a predetermined pressure, and means also engaged by the liquid under pressure and connected to opposite portions of the secondary power generator or circulating organization for shifting said block to modify the speed and direction of movement of the automobile.

2. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of independently rear floating axles having the rear drive wheels thereon, a secondary power generator or circulating organization and driving means for the axles and all located at the rear of the automobile and comprising a chambered inclosure, rotors engaging the said axles and a pump embodying a shifting block between said rotors, the chambered inclosure being filled with a liquid under a predetermined pressure, safety and neutral valves filled with liquid under pressure and coöperating with the chambered inclosure and circulating organization and rotors, and means also engaged by the liquid under pressure and connected to opposite portions of the secondary power generator or circulating organization for shifting said block to modify the speed and direction of movement of the automobile.

3. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of independently rear floating axles having the rear drive wheels thereon, a secondary power generator or circulating organization and driving means for the axles and all located at the rear of the automobile and comprising a chambered inclosure, rotors engaging the said axles and a pump embodying a shifting block between said rotors, the chambered inclosure being filled with a liquid under a predetermined pressure, safety and neutral valves filled with liquid under pressure and coöperating with the chambered inclosure and circulating organization and rotors, a pressure regulator having the liquid under pressure therein and connected to the said inclosure and sustaining the predetermined pressure in the entire set of devices, an automatically operating pressure pump connected to the pressure regulator and having a supply reservoir also connected thereto,

and a control valve also under the same liquid pressure influence and located between the pressure pump, pressure regulator and secondary power organization or circulator.

4. A driving mechanism for an automobile and the like comprising a prime power generating motor having a shaft, independently rotatable rear floating drive axles having rear drive wheels thereon, a secondary power generating or circulating organization embodying a shiftable pumping element connected to said shaft of the prime motor and rotors located at the rear of the automobile and independently and directly coöperating with the said axles, the secondary power generating or circulating organization being between said rotors and at right angles thereto, and means for controlling the position of the shiftable pumping element by changing the pressure at opposite ends thereof to modify the direction and speed of movement of the automobile, the secondary power generator and rotors being engaged by a liquid under pressure which also coöperates with said means.

5. A driving mechanism for an automobile or the like comprising a prime power generating motor having a shaft, independently rotatable rear floating drive axles having rear drive wheels thereon, a secondary power generating or circulating organization embodying a shiftable pumping element connected to said shaft of the prime motor and rotors located at the rear of the automobile and independently and directly coöperating with the said axles, the secondary power generator or circulating organization being between the said rotors, neutral and safety valves coöperating with the circulating organization and rotors, and means for controlling the position of the shiftable pumping element by modifying the pressure applied to opposite ends of said element, the secondary power generator and rotors being engaged by a liquid under pressure which also coöperates with said means.

6. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of independent rear axles having the drive wheels thereon, a secondary power generator or circulating organization connected to the prime power generating organization and rotors on each side thereof directly connected to the axles and engaged by liquid under pressure, and means for controlling the liquid under pressure to modify the circulating movement of said organization.

7. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of independent rear axles having the drive wheels thereon, a secondary power generator or circulating organization connected to the prime power generating motor, rotors on each side of said organization directly connected to the axles and engaged by a liquid, and means for automatically giving the liquid a predetermined pressure and for automatically maintaining said pressure.

8. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of independent rear axles having the drive wheels thereon, mechanisms embodying a pumping organization connected to and operated by said motor or engine and rotors all closely associated with said axles and engaged by liquid under pressure, and means for modifying the speed and direction of movement of the pumping organization and rotors through the liquid under pressure.

9. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of independent rear axles having the drive wheels thereon, mechanisms embodying a circulating pumping organization connected to and operated by the said motor or engine and rotors all closely associated with said axles and engaged by liquid maintained under a predetermined pressure, and means for automatically compensating and rectifying excessive pressure and restoring the pressure to normal condition.

10. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axle means, mechanisms embodying a circulating pump with a shiftable element to regulate the speed and connected to and operated by the said motor or engine and rotors all closely associated with said axle means and engaged by liquid under pressure, and a neutral valve means connected to and coöperating with said circulating pump and rotors and also engaged by the liquid under pressure and operable to short-circuit the liquid under pressure.

11. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axle means, mechanisms embodying a circulating pump with shiftable speed changing means and connected to and operated by said motor or engine and rotors on opposite sides of the pump all closely associated with the said axle means and engaged by liquid under pressure, a safety valve communicating with one side of the said mechanisms and automatically operating to compensate and rectify excessive pressure in the said mechanisms, and a neutral valve means communicating with the opposite sides of said mechanisms and operable to short-circuit the liquid under pressure.

12. In a driving mechanism for an auto-

mobile, the combination with the prime power generating motor or engine, of rear drive wheels having axle means, mechanisms for the usual transmission gearing and differential and embodying a circulating pump with shiftable speed changing means and connected to and operated by said motor or engine and rotors on opposite sides of the pump all closely associated with the said axle means and engaged by liquid under pressure, and devices communicating with opposite sides of the mechanisms to automatically compensate for and rectify excessive pressure in the said mechanisms and for short-circuiting the liquid under pressure.

13. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axle means, mechanisms for the usual transmission gearing and differential and embodying a circulating pump with shiftable speed changing means and connected to and operated by said motor or engine and rotors on opposite sides of the pump all closely associated with said axle means and engaged by liquid under pressure, devices communicating with opposite sides of the said mechanisms and automatically operating to rectify excessive pressure and also adjustable to short-circuit the liquid under pressure when the shiftable means for the pump is in neutral position, and a control valve connected to said mechanisms and operative to shift the said speed changing means of the pump.

14. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axle means, mechanisms for the usual transmission gearing and differential and embodying a circulating pump with shiftable speed changing means and connected to and operated by said motor or engine and rotors on opposite sides of the pump all closely associated with the said axle means and engaged by liquid under pressure, a neutral valve communicating with the said mechanisms and having a movable valve member operative to short circuit the liquid under pressure when the shiftable means of the pump is in neutral position, brake mechanism coöperating with the drive wheels, and operating mechanism including a pedal connected to the valve member of the neutral valve and the brake means and operable to first open the valve member and then apply the brake and conversely to release the brake and then close the valve member.

15. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axle means, mechanisms for the usual transmission gearing and differential and embodying a circulating pump with shiftable speed changing means and connected to and operated by said motor or engine and rotors on opposite sides of the pump all closely associated with the said axle means and engaged by liquid under pressure, a neutral valve communicating with the said mechanisms and having a movable valve member operative to short circuit the liquid under pressure when the shiftable means of the pump is in neutral position, brake mechanism coöperating with the drive wheels, and operating mechanism including a pedal connected to the valve member of the neutral valve and the brake means and operable to first open the valve member and then apply the brake and conversely to release the brake and then close the valve member, the latter mechanism also having means for temporarily locking the pedal against movement.

16. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axle means, mechanisms for the usual transmission gearing and differential and embodying a circulating pump with shiftable speed changing means and connected to and operated by the said motor or engine and rotors on opposite sides of the pump all closely associated with the said axle means and engaged by liquid under pressure, means for moving the speed changing means of the pump into different positions by varying the quantity of liquid under pressure at opposite sides thereof, means for short circuiting the liquid under pressure when the speed changing means of the pump is in neutral position, brake mechanism for the drive wheels, and mechanism connected to the brake mechanism and the means for short circuiting the liquid under pressure for operating the latter to open the same when the shiftable speed changing means of the pump is in neutral position and then applying the brake mechanism and conversely for releasing the brake mechanism and closing the said short circuiting means.

17. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axle means, mechanisms for the usual transmission gearing and differential and embodying a circulating pump with a shiftable speed changing means and connected to and operated by said motor or engine and rotors on opposite sides of the pump all closely associated with the said axle means and engaged by liquid under pressure, brake devices for the wheels, and mechanism for short circuiting the liquid under pressure relatively to the circulating pump and rotors on opposite sides thereof and applying the brake devices in sequence

and conversely releasing the brake devices and causing the short circuiting operation of the liquid under pressure to cease.

18. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having independent axles, brake devices coöperating with said drive wheels, mechanisms embodying a circulating pump with shiftable speed changing means and connected to and operated by said motor or engine and rotors on opposite sides of the pump all closely associated with the said axles and engaged by liquid under pressure which is the operating medium therefor, a neutral valve having a movable valve member in communication with the said substitute mechanisms and operable to short circuit the liquid under pressure when the shiftable means of the pump is in neutral position, levers and rods connected to the movable valve member and to brake devices, one of the rods having a shiftable head secured thereto provided with a slot, roller guide means engaging the said head, a shaft extending through the slot of the head and having a crank arm carrying a roller, the forward end of the head provided with a shoe for engagement by the roller to shift the said head, a pedal connected to the shaft and having locking means thereon, a crank arm also connected to the shaft and provided with a pin, and a slotted yoked head engaged by the said pin and connected to the brake devices.

19. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axles, mechanisms embodying a circulating pump with a shiftable speed changing means and connected to and operated by the said motor or engine and rotors on opposite sides of the pump all closely associated with the said axle means and engaged by liquid under pressure, a neutral valve having a movable valve member communicating with the said mechanisms and operable to short circuit the liquid under pressure when the shiftable speed changing means of the pump is in neutral position, brake devices engaging the wheels, and mechanism including a pedal and consisting of levers and rods and sliding heads connected to the movable valve member and the brake devices and operative to sequentially actuate the movable valve member and the brake devices, the pedal being provided with means for temporarily locking the same against movement.

20. In a mechanism of the class specified, the combination with a prime power generating motor or engine, of rear drive wheels having independent axles, mechanism for operating the said axles including an inclosure embodying a pump having a shiftable element and engaged by liquid under pressure, the pump being connected to and operated by the prime power generating motor or engine, brake devices for the wheels, a neutral valve having a movable valve member in communication with the said mechanism, the movable valve member having a stem and a lever connected thereto, a spring-actuated rod attached to the said lever, a shifting rod connected to the spring-actuated rod, a head attached to the shifting rod and formed with a slot and also provided with a shoe at its front end having a rear concave edge, a shaft extending through the said slot, a pedal connected to the shaft and provided with a locking means, a rod connected to the brake devices and having a slotted head at its forward extremity, a crank arm connected to the shaft and provided with a pin engaging the slotted head of the rod connected to the brake devices and a crank arm also secured to the shaft and carrying a roller to engage the concave edge of the said shoe.

21. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axles, mechanisms embodying a circulating pump and connected to and operated by the said motor or engine and rotors on opposite sides of the pump all closely associated with the said axle means, a pressure regulator, a liquid reservoir, an automatically operating pressure pump, and pipe connections between the said mechanisms, pressure regulator, reservoir and pressure pump, the pressure pump operating to fill the several parts with the liquid from the reservoir and to establish a predetermined pressure which is maintained by the pressure regulator and when reached automatically stops the action of the pressure pump.

22. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axles, mechanisms embodying devices operable by liquid under pressure, a pressure regulator, a pressure pump, means for feeding the pressure pump with liquid, and pipe connections between the said mechanisms, regulator, pressure pump and said means, the pressure pump automatically operating to fill the several parts with liquid under pressure and to automatically stop when a predetermined maximum pressure is reached in the pressure regulator.

23. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axles, mechanisms operable by liquid under pressure and all closely associated with the said axle means, a control valve connected to the said mechanisms,

steering mechanism having a portion of the control valve operating devices extending therethrough and operative through a part of said steering mechanism, and devices for filling the several parts with liquid under pressure and maintaining the pressure on the liquid.

24. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axles, driving mechanisms all closely associated with the said axle means and operable by liquid under pressure, and an automatically operating pressure pump connected to the said mechanisms and having a shaft driven from the prime power generating motor or engine, the said pressure pump automatically ceasing its pumping action when a certain predetermined pressure is reached without affecting the operation of the remaining parts.

25. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axles, driving mechanisms operable by a liquid under pressure, and an automatically operating pressure pump connected to the said mechanisms and embodying a shiftable block having a rotor therein operatively connected to the prime power generating motor or engine and also provided with an adjustable pressure regulating spring engaging one side of the block, the block being automatically shiftable against the resistance of the said spring to dispose the rotor in a position to deprive it of pumping action.

26. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axles, driving mechanisms operable by liquid under pressure, means for supplying the said mechanisms with liquid under pressure and maintaining the pressure on the liquid, and a control valve connected to said mechanisms and means and embodying a multiple-way construction with corresponding chambers and passages to regulate the operation of said mechanisms.

27. In a driving mechanism for an automobile, the combination with the prime power generating motor or engine, of rear drive wheels having axles, driving mechanisms embodying a circulating pump with a shiftable speed changing means and connected to and operated by the said motor or engine and rotors on opposite sides of the pump all closely associated with said axle means and engaged by liquid under pressure, means for supplying the said mechanisms with liquid under pressure and maintaining the pressure thereof, and a control valve connected to said mechanisms and having a movable valve element provided with operating means whereby the shiftable speed changing means of the circulating pump may be moved to different positions.

28. In a driving mechanism for an automobile, the combination with prime power generating means, of rear drive wheels having axle means, mechanisms associated with the axle means and embodying a circulating pump with a shiftable speed changing means and connected to and operated by the said power generating means, the mechanisms also comprising rotors on the opposite sides of the said pump and all closely associated with said axle means and engaged by liquid under pressure, means for supplying the said mechanisms with liquid under pressure including an automatic pressure pump, and a control valve coöperating with said mechanisms and having a movable element provided with operating means for controlling the actuation of the circulating pump.

29. In a driving mechanism for an automobile, the combination with prime power generating means, of rear drive wheels having axle means, driving mechanisms operable by liquid under pressure and all closely associated with said axle means, a control valve connected to the said mechanisms, a pressure pump connected to said mechanisms and having a shaft driven from the prime power generating means, and devices for filling the several parts with liquid under pressure and maintaining pressure on the liquid.

30. In a driving mechanism for an automobile, the combination with prime power generating means, of rear drive wheels having axle means, driving mechanisms operable by liquid under pressure, means for supplying the said mechanisms with liquid under pressure and maintaining the pressure on the liquid, a neutral valve, a shifting plate having mechanism connected with the neutral valve, and mechanism coöperating with the shifting plate, and including a foot pedal whereby the neutral valve and mechanisms may be controlled.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

WILLIAM N. ALLAN.

Witnesses:
CHAS. S. HYER,
SADIE STANFORD WHITE.