

April 23, 1963

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3,086,465

OIL WELL FIRE CONTROL VEHICLE

Filed May 9, 1960

5 Sheets-Sheet 1

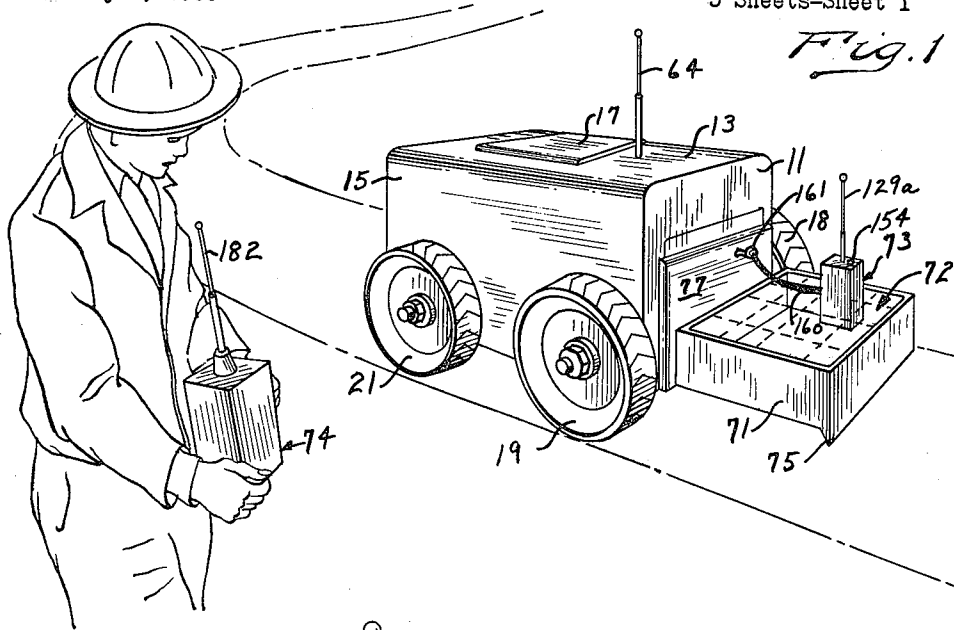
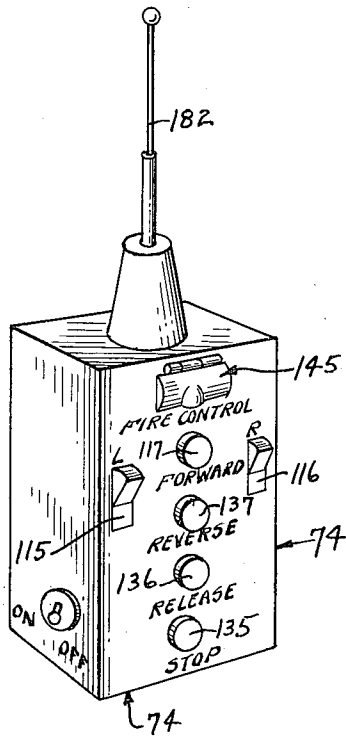


Fig. 2



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5 Sheets-Sheet 2

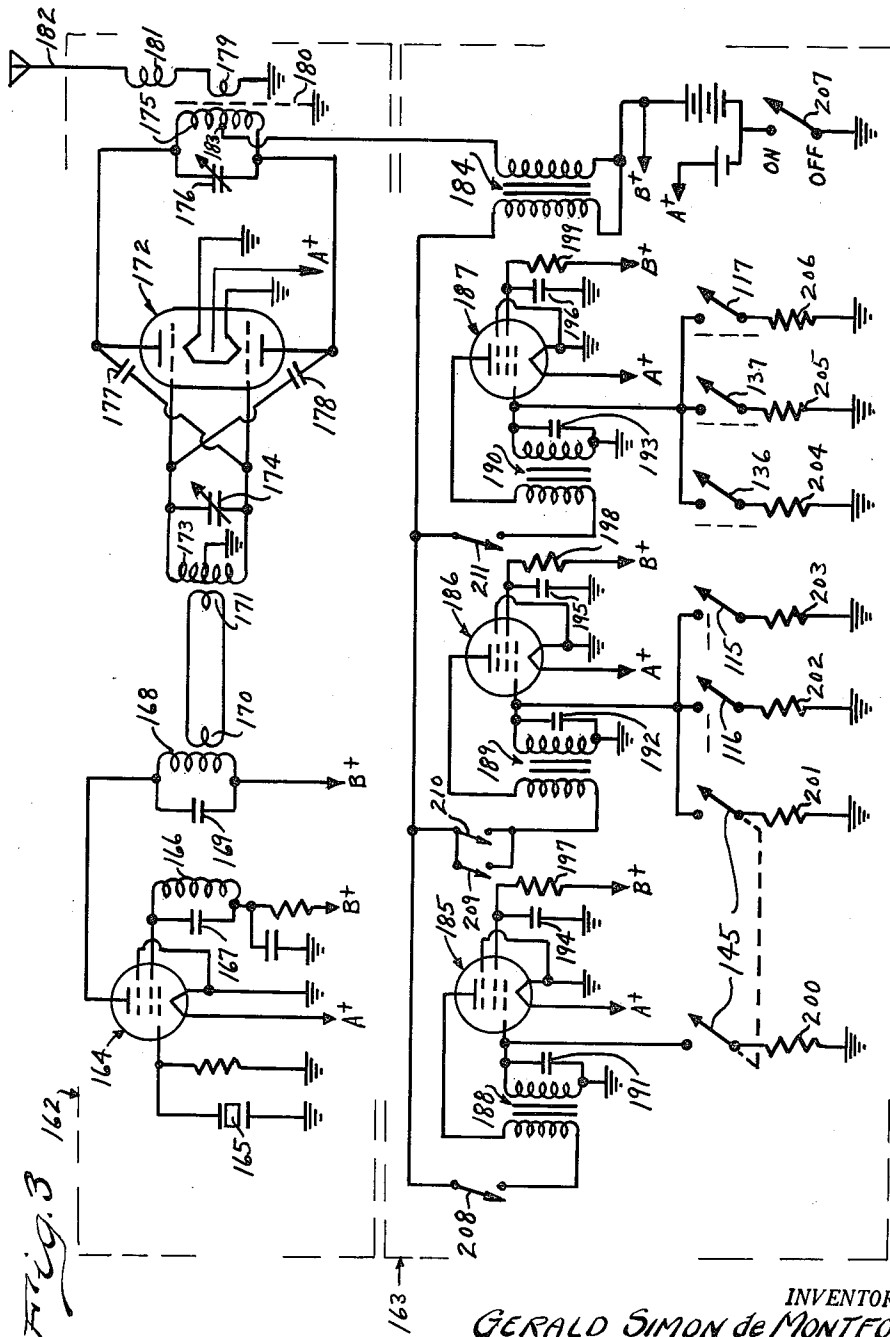


Fig. 3 162

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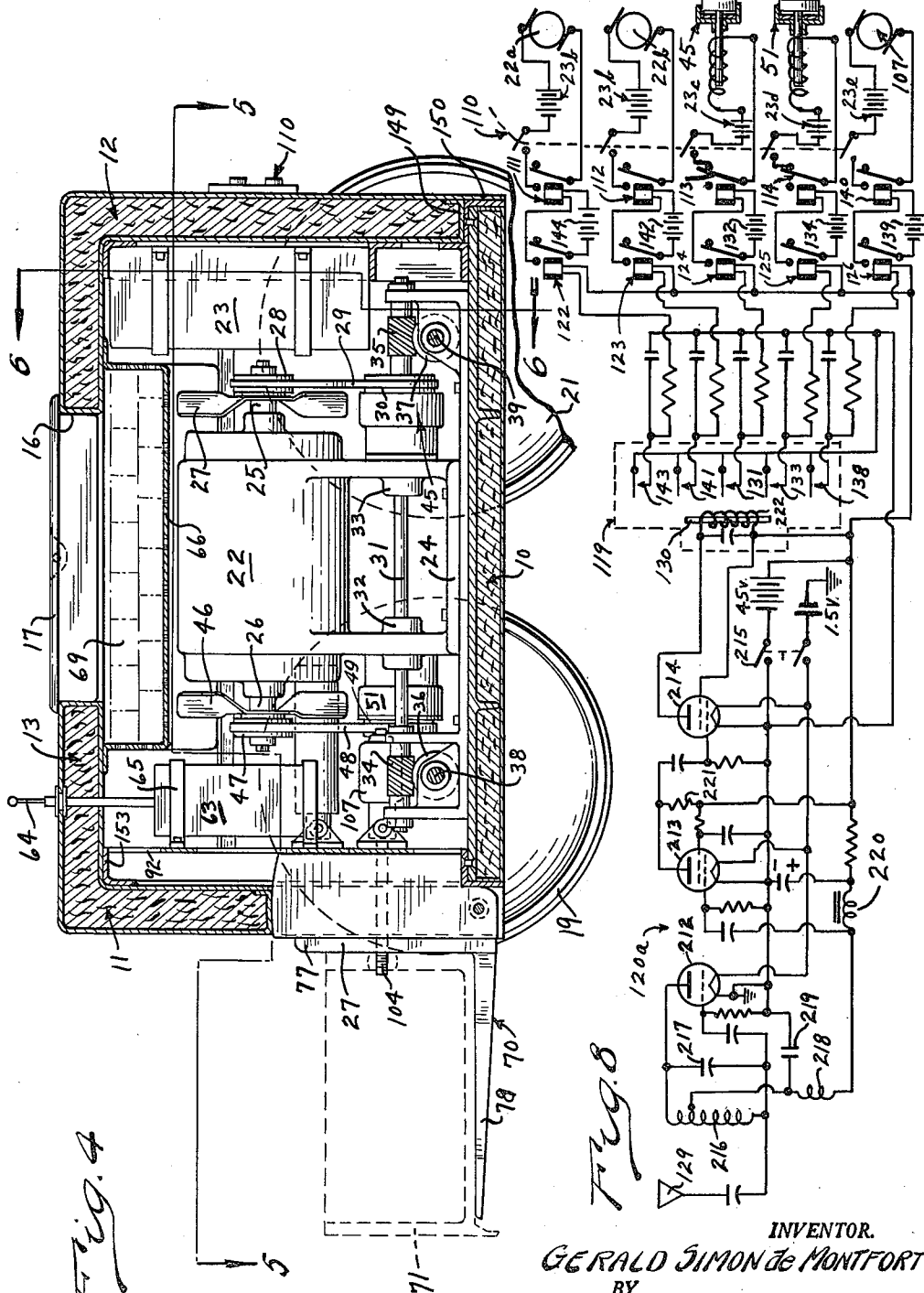
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5 Sheets-Sheet 3



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5 Sheets-Sheet 4

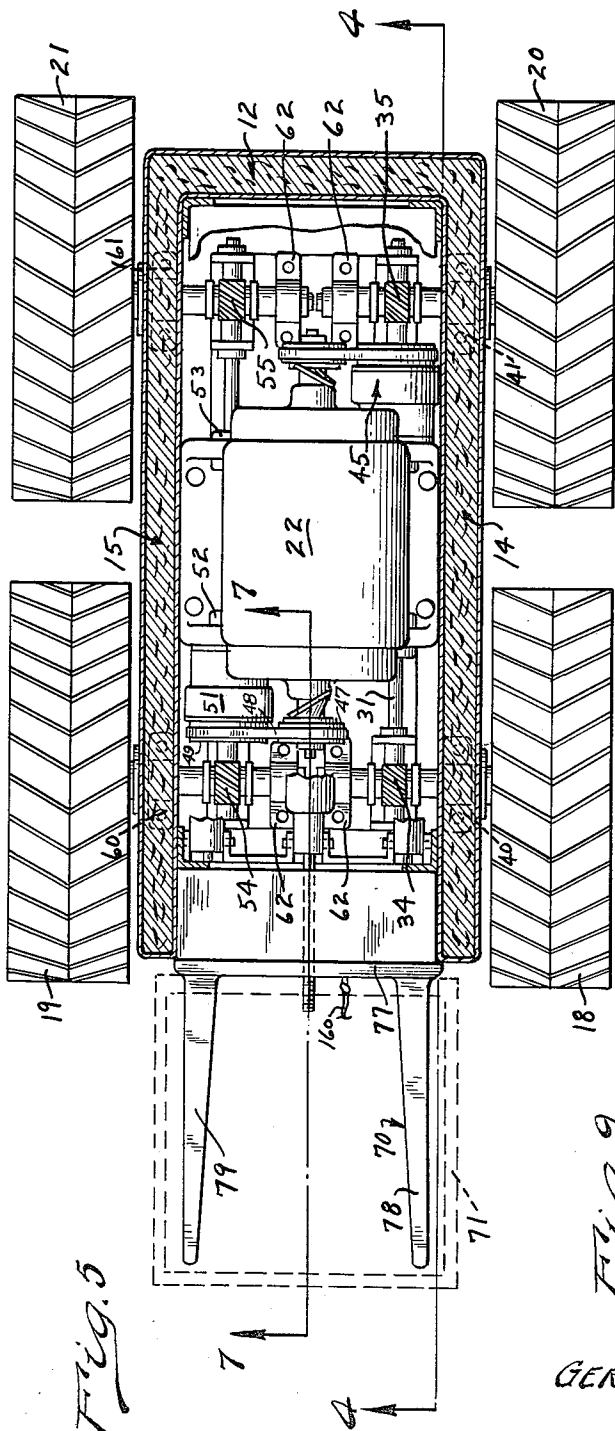


Fig. 8

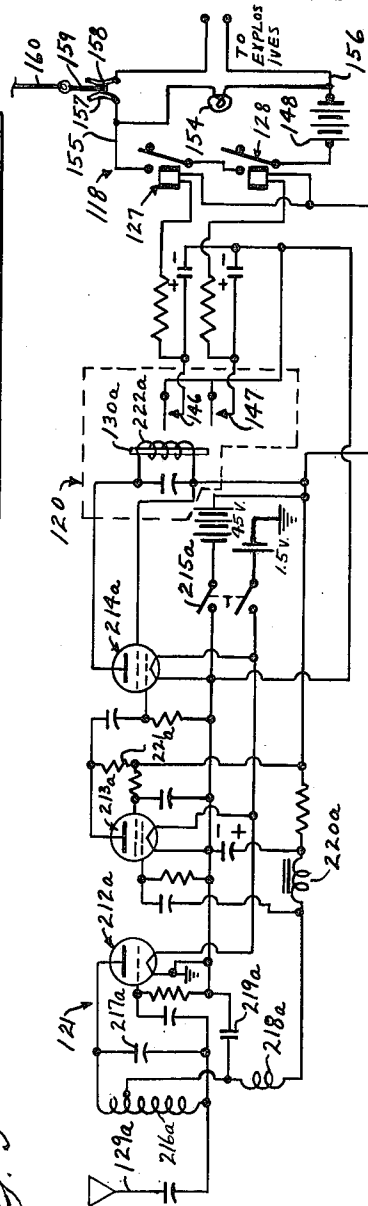


Fig. 9

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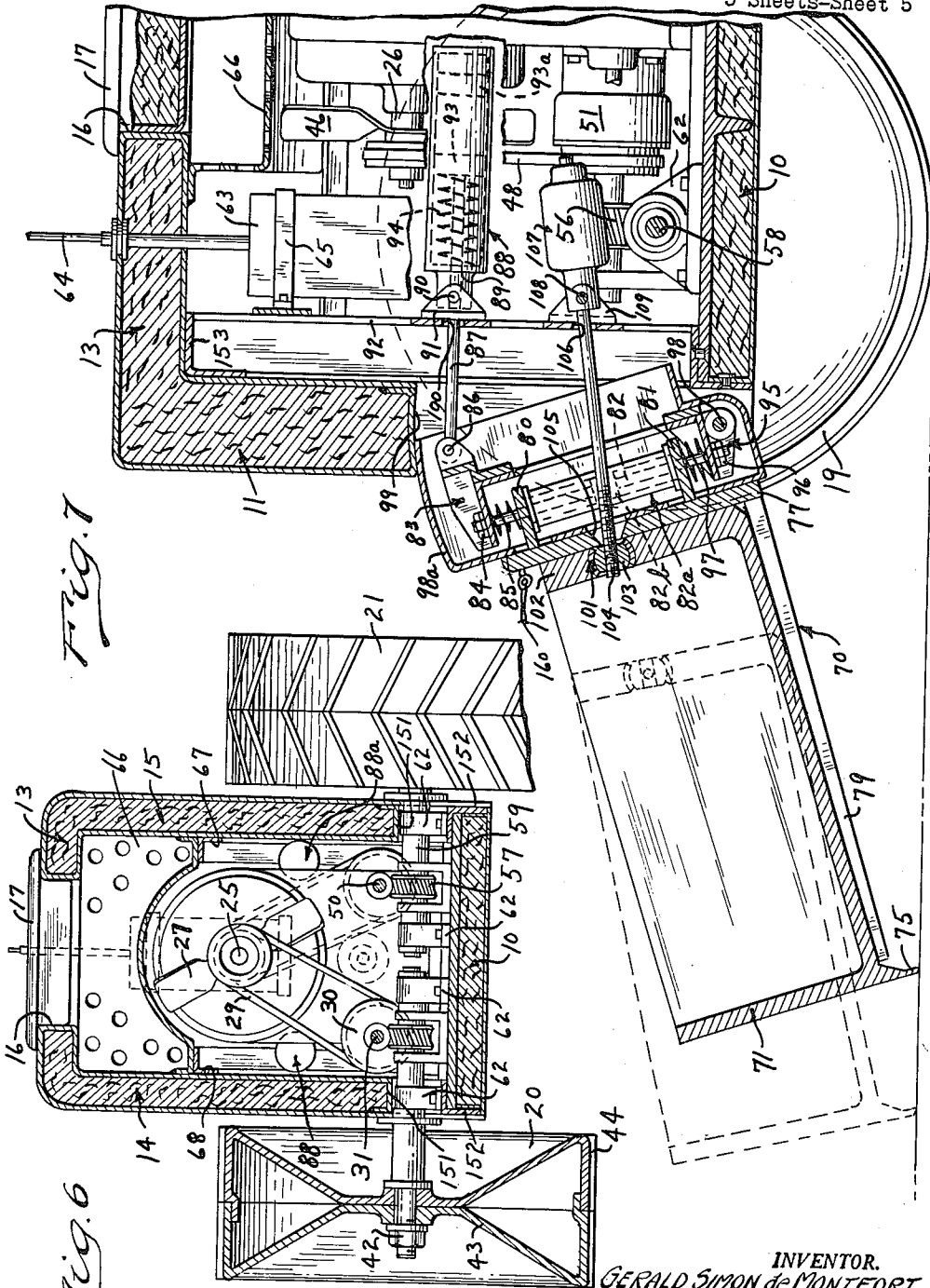
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OIL WELL FIRE CONTROL VEHICLE

Filed May 9, 1960

5 Sheets-Sheet 5



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1

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OIL WELL FIRE CONTROL VEHICLE
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Filed May 9, 1960, Ser. No. 27,757

7 Claims. (Cl. 102—22)

This invention relates to a novel remote controlled vehicle for controlling oil well fires and the like.

It is common practice in combating oil well fires to employ explosives to extinguish the fire. This method of combating oil well fires requires the placing of an explosive, such as nitroglycerin, adjacent the burning oil well and providing means for detonating the same. In carrying out this method of extinguishing oil well fires, the personnel involved are subjected to dangers such as the intense heat of the fire and premature detonation of the explosives. Accordingly, it is the primary object of the present invention to provide a radio controlled vehicle capable of placing high explosives in close proximity to a burning oil well and which is then capable of returning to a safe area to permit the explosives to be detonated by a radio control means whereby the personnel that would ordinarily carry out this operation may remain at a safe distance from the oil well.

It is another object of the present invention to provide a wheeled vehicle capable of withstanding high temperatures and adapted to be operated from a remote position by means of suitable radio control means.

It is a further object of the present invention to provide a remote controlled vehicle for putting out oil fires, which is provided with a novel explosive carrier member on the front end thereof, which is adapted to be controlled from a remote position by a radio control means whereby the operator may dispose a high explosive at any desired point adjacent a burning oil well.

It is still another object of the present invention to provide a remote controlled vehicle for extinguishing oil well fires which is rugged and compact in construction, efficient in operation and which provides maximum safety for personnel engaged in combating oil well fires.

Other objects, features and advantages of this invention will be apparent from the following detailed description and appended claims, reference being had to the accompanying drawings forming a part of the specification wherein like reference numerals designate corresponding parts of the several views.

In the drawings:

FIG. 1 is a perspective view of a wheeled vehicle made in accordance with the principles of the invention, and showing an operator controlling the vehicle from a remote position;

FIG. 2 is a fragmentary elevational perspective view of the control board of a transmitter means employed in the invention;

FIG. 3 is an illustrative embodiment of a transmitter circuit which may be employed in the invention;

FIG. 4 is an elevational sectional view of the structure illustrated in FIG. 5, taken along the line 4—4 thereof and looking in the direction of the arrows;

FIG. 5 is a horizontal sectional view of the structure illustrated in FIG. 4, taken along the line 5—5 thereof and looking in the direction of the arrows;

FIG. 6 is an elevational sectional view of the structure illustrated in FIG. 4, taken along the line 6—6 thereof and looking in the direction of the arrows;

FIG. 7 is a fragmentary central elevational sectional view of the wheeled vehicle structure of the present invention;

FIG. 8 is an illustrative embodiment of a control system

2

for operating the vehicle, including an illustrative receiver circuit; and

FIG. 9 is an illustrative embodiment of a detonator receiver circuit for use in the invention.

Referring now to the drawings, and in particular to FIGS. 1, and 4 through 7, an illustrative embodiment of the invention is shown as comprising a vehicle having an enclosed body including a bottom wall 10, a front wall 11, a rear wall 12, a top wall 13, a left side wall 14 and a right side wall 15. Each of the vehicle walls are hollow and are filled with any suitable insulation material as foam plastic, glass wool or the like. Each of the vehicle walls is preferably formed with an outer and inner surface made from any heat resistant material as, for example, 16 gauge steel. As shown in FIGS. 4 and 6, the vehicle is provided with an inlet opening 16 for inserting Dry Ice, and this opening is enclosed by the cover 17.

The vehicle is rollably supported by means of the front wheels 18 and 19 and the rear wheels 20 and 21. The vehicle wheels are all driven by means of the electric motor 22 shown in FIGS. 4 and 5. The motor 22 is adapted to be driven by a bank of suitable 12 volt batteries, generally indicated by the numeral 23, and mounted in the rear end of the vehicle. The motor 22 is provided with the base 24 which is suitably secured to the bottom wall of the vehicle 10 by any suitable means. The drive wheels 18 and 20 on the left side of the vehicle are adapted to be driven by the rear output shaft 25 of the motor 22, and the right wheels 19 and 21 are adapted to be driven by the front output shaft 26 of the motor 22.

As shown in FIGS. 4 and 5, the motor output shaft 25 has fixedly mounted thereon the fan 27 and the pulley 28 which drives the belt 29. The belt 29 drives the pulley 30 which is fixedly mounted on the left drive shaft 31. The drive shaft 31 is operatively journaled in the bearing members 32 and 33. The shaft 31 is provided with the front and rear worm gears 34 and 35 which meshably engage with and drive the worm gears 36 and 37 on the wheel axles 38 and 39, respectively. The wheel axles 38 and 39 are suitably journaled in the bearing means 40 and 41 in the side wall 14, and they have fixedly mounted on the outer ends thereof the wheels 18 and 20, respectively, by any suitable means, as by the lock nut 42 illustrated in FIG. 6. As shown in FIG. 6, the wheels of the vehicle are provided with inwardly tapered side walls as 43 to form a substantially hollow construction with the peripheries thereof being provided with transversely disposed steel lugs 44, which may be formed in any suitable traction pattern. The wheels are preferably of steel construction to withstand the high temperatures encountered when the vehicle is operated to extinguish an oil well fire. As shown in FIGS. 4 and 5, the drive pulley 30 is releasably connected to the drive shaft 31 by means of a suitable electro-magnetic clutch, generally indicated by the numeral 45. The detailed operation of clutch 45 will be explained more fully hereinafter.

As shown in FIGS. 4 and 5, the drive motor 22 is provided with the fan 46 and drive pulley 47 on the front output shaft 26. The pulley 47 drives the belt 48 which in turn drives the pulley 49. The pulley 49 is adapted to drive the right wheel shaft 50 through the interconnecting electro-magnetic clutch 51. The shaft 50 is suitably journaled in the bearing members 52 and 53 and has fixedly mounted on the front and rear ends thereof the worm gears 54 and 55, respectively. The worm gears 54 and 55 mesh with and drive the worm gears 56 and 57 which are fixedly connected to the front and rear drive wheel shafts 58 and 59, respectively. The wheels 19 and 21 are fixedly secured to the shafts 58 and 59 in the same manner as described hereinbefore for the wheels 20 and 21. The wheel shafts 58 and 59 are suitably journaled

in the side wall 15 by means of the bearing members 60 and 61, respectively. As shown in FIG. 5, the inner ends of all of the wheel shafts are suitably journaled in bearing members as indicated by the numerals 62.

The numeral 63 in FIG. 4 generally indicates the remote control radio receiver means for controlling the vehicle, and its antenna is indicated by the numeral 64. The radio receiver means 63 is fixedly secured in place in the vehicle by means of suitable brackets as 65. It will be seen that the antenna 64 extends upwardly through the upper wall 13. As shown in FIGS. 4 and 6, a removable pan 66 is carried on the brackets 67 and 68 in a position above the motor 22, and this pan may be used to carry a quantity of Dry Ice, indicated by the numeral 69, for cooling purposes. It will be understood that the Dry Ice 69 and the fans 27 and 46 will provide some cooling effect during the time when the vehicle is in close proximity to a fire source and is subjected to intense heat radiation.

As shown in FIGS. 4, 5 and 7, the vehicle is provided on the front end thereof with a carrier means, generally indicated by the numeral 70, which is adapted to carry a box 71 for carrying the explosive, generally indicated by the numeral 72 in FIG. 1. As shown in FIG. 1, a radio detonator receiver means 73 would be packed in the box with the explosives for detonating the explosives upon reception of a signal from a remote control radio transmitter as 74. The carrier member 70 is adapted to be normally held in the position shown in FIG. 4 and to be tilted downwardly to the position shown in FIG. 7 for unloading the box 71, at any desired point. As shown in FIG. 7, the box 71 is provided with a downwardly extended vertical lip 75 along the front edge thereof for engagement with the ground, indicated by the numerals 76, whereby when the vehicle is backed away from the fire, the lip 75 will engage the ground and box 71 will slide off of the sloping carrier member 70.

The carrier member comprises the vertical plate 77, to the lower end of which is fixedly connected by welding the two horizontal laterally spaced apart carrier forks 78 and 79. The plate 77 is carried by the following described structure so as to tilt the plate forwardly and backwardly for unloading purposes. As shown in FIG. 7, plate 77 is provided with a pair of vertically spaced apart inwardly projected arms 80 and 81 along the right side thereof, through which is mounted the piston rod 82. The upper end of the rod 82 is secured to the upper bracket 83 by means of the nut 84. A spring 85 is interposed between the bracket 83 and the supporting arm 80 and surrounds the piston rod 82. The lower end of the piston rod 82 is secured to the lower carrier bracket 95 by means of the nut 96. A spring 97 is interposed between the bracket 95 and the support arm 81 and surrounds the lower end of the piston rod 82. Interposed between the arms 80 and 81 is the hydraulic dashpot cylinder 82a through which the piston rod 82 extends. A centrally disposed piston 82b is formed on the piston rod 82. It will be seen that the hydraulic cylinder 82a and piston 82b function as a shock absorbing means for the load carrier means 70. The bracket 83 is hingedly connected by means of the pin 86 to the outer end of the cylinder rod 87. The other end of the rod 87 extends into the spring loaded hydraulic cylinder, generally indicated by the numeral 88, which is hingedly supported by means of an arm member 89 and pin 90 on the bracket 91 which is carried on the inner wall 92. The inner end of the piston rod 87 is fixedly connected to the piston 93 which is normally biased by means of the spring 94 to the dotted line position indicated by the numeral 93a. The lower carrier bracket 95 is pivotally mounted on a suitable transverse shaft 98 which is fixedly mounted by any suitable means on the lower front end of the vehicle. It will be understood that the left end of the plate 77 is similarly swingably mounted by identical structure. The left cylinder is indicated in FIGS. 5 and 6 by the numeral 88a. It will be seen that when the carrier member 70 is not loaded, the spring

loaded cylinders 88 and 88a will function to normally maintain the carrier member in the retracted position shown in FIG. 4. The aforesaid hinged mounting structure for the carrier plate 77 is covered by the housing 98a which is open on the inner side thereof and which is adapted to be nested within the opening 99 in the vehicle front wall 11. It will be understood that the cylinder rods 87 extend through suitable holes, as 100, in the inner wall 92.

As shown in FIG. 7, the box 71 for carrying explosives is provided with a ball joint 101 in the rear wall 102 and at a central position therein. Threadably mounted through the ball member 103 is one end of the rod 104 which extends through the opening 105 in the plate 77 and through the opening 106 in the wall 92. The inner end of the shaft 104 is threadably engaged by the electric motor 107 which is hingedly connected by means of the pin 108 and bracket 109 at a central position on the inner wall 92 near the lower end thereof. It will be seen that when the box 71 is loaded with explosives, the screw rod 104 will be threaded inwardly of the front end of the vehicle so as to hold the carrier member 70 in the raised position shown in FIG. 4. When the vehicle has been moved to the desired spot adjacent the fire, the motor 107 is actuated to thread the shaft or rod 104 outwardly so as to disengage the same from the ball 103. The carrier member 70 will then pivot by gravity to the position shown in FIG. 7 and upon withdrawal of the vehicle, the box 71 will slide off of the forks 78 and 79 by gravity and the carrier member 70 will be pivoted back to the position shown in FIG. 4, by action of the spring loaded cylinders 88 and 88a, after the box 71 has slid off of the forks 78 and 79.

In the use of the vehicle of the present invention, the box 71 would first be mounted on the forks 78 and 79 and the shaft 104 manually threaded in place in the ball 103 so as to secure the carrier member 70 in the position shown in FIG. 4. The box 71 is then loaded with the explosive 72 and the detonator radio receiver 73. The operator then closes the main switch 110, which is preferably located on the rear side of the vehicle as shown in FIG. 4, and which functions to close the circuits energizing the electro-magnetic clutches 45 and 51 and their respective batteries 23c and 23d, as shown in FIG. 8. The closing of main switch 110 also connects the drive motor forward and reverse windings 22a and 22b with the normally open relays 111 and 112. It will be seen that the switch 110 functions as a battery terminal cut-off switch which would be in the off position until the vehicle is ready for use. When it is turned on, the magnetic drive clutches are automatically engaged by means of the normally closed relays 113 and 114 which stay engaged until the turn control switches 115 and 116 are operated or until the main switch 110 is turned off.

The operator next presses the "forward" switch 117 on the remote radio control transmitter 74 in order to send a control signal to close the relay 111 whereby the forward winding 22a of the drive motor 22 is energized and the vehicle will move forwardly.

The transmitter shown in FIG. 3 is illustrative of a suitable transmitter which may be used and is a crystal controlled unit operating on the frequency of 27.255 mc. The transmitter of FIG. 3 and the radio receivers 120a and 121 of FIGS. 8 and 9 are of a common variety of transmitters and receivers that may be employed for sending and receiving signals to operate the drive motor 22, the clutch 45 and 51, and the motor and the detonator circuit 118. The reed bank decoders 119 and 120 are also of the conventional type used in remote control systems, as in many model airplane control circuits.

The transmitter of FIG. 3 operates on a carrier frequency which is 27.255 mc. and on that carrier frequency is superimposed seven audio frequencies which in turn operate the relays 122, 123, 124, 125 and 126 shown in FIG. 8, and the relays 127 and 128 shown in FIG. 9. The

5

transmitter operates as a continuous wave transmitter and when any of the control switches shown in FIG. 2 are depressed, the particular audio frequency controlled by the switch will also be sent out mixed with the carrier frequency. The receivers 121 and 120a are of the super-regenerative type which receive the signal, detect it, and amplify it and pass it through the reed banks 119 and 120. Upon reception of the audio frequencies to which the reeds are individual tuned, the reeds are operated to close a battery circuit carrying out a control function, as explained hereinafter.

If it is necessary to turn the vehicle to the right or left during the travel of the vehicle to the desired discharge point, it is merely necessary to depress the momentary contact switches 115 and 116 carried by the transmitter means 74. The depressing of the switches 115 and 116 will de-activate the magnetic clutches 45 and 51 alternately, leaving the one set of drive wheels operating and the other set inoperative, whereby a turning moment is created. For example, if it is desired to turn the vehicle to the left, the switch 115 would be depressed whereby a signal of an audio frequency of, for example, 325 cycles per second is superimposed on the carrier frequency entering the antenna 129 of the receiver 120a. The aforementioned signal is then rectified and filtered in the usual manner and decoded by means of the solenoid 130 and the reed member 131. The reed member 131 closes the relay 124 which closes a circuit through the battery 132 which in turn actuates the relay 113. The relay 113 which is normally closed is thus opened whereby the circuit through the battery 23c and the clutch 45 is broken and the left drive wheels will be inactive. When the power to the left drive wheels 18 and 20 has thus been broken, the right drive wheels would still function and the vehicle would naturally pivot about the left drive wheels to create a turning action to the left. The switches 115 and 116 on the control panel of the control member 74 are of the momentary contact type and as soon as they are released the respective magnetic clutch controlled thereby would go back into normal operation, and with power then being transmitted to both sides of the vehicle it would again travel straight ahead. If it is desired to turn the vehicle to the right the switch 116 would be depressed and the signal initiated thereby would be decoded by the reed 133 which would operate the relay 125 to close the circuit connecting the battery 134 with the relay 114 for opening of the same to de-energize the magnetic clutch 51. The power remaining on the left drive wheels will cause the vehicle to then swing to the right.

When the vehicle has reached the desired location, the operator presses the stop button 135 of the control member 74 and this switch mechanically releases the release switch 136, the reverse switch 137 and the forward switch 117. The last three switches are of the type that remain depressed until a mechanical release means, as the stop switch 135, is operated or until another button of the group 117, 136 or 137 is depressed. The operator then presses the release button 136 and the signal initiated thereby is decoded by the reed 138 which actuates the relay 126 to close the circuit through the relay 140 and battery 139. The closing of the relay 140 completes the circuit through the battery 23e and the motor 107 for turning the threaded shaft 104 outwardly to permit the carrier member 70 to be pivoted downwardly as shown in FIG. 7. When the shaft 104 is completely threaded out of the ball 103, the reverse button 137 is depressed whereby the release button is returned to the inoperative position to de-energize the motor 107 and a signal is transmitted to operate the reed 141. The reed 141 actuates the relay 123 which closes the circuit through the battery 142 to close the relay 112. The closing of the relay 112 completes the circuit through the battery 23b and the reverse winding 22b of the drive motor 22 and the vehicle will be retracted from the oil well. As the vehicle is retracted, the box lip 75 engages the ground and the

6

forks 78 and 79 will be slid from under the box 71. After the box 71 has slid off of the forks 78 and 79, the cylinders 88 and 88a operate to pivot the carrier member 70 back to the horizontal transporting position shown in FIG. 4. The vehicle may again be actuated for forward movement by pressing the forward control button 117 which actuates the reed 143 which in turn closes the relay 122 to complete the circuit through the battery 144 and the relay 111. The closing of the relay 111 completes the circuit through the battery 23a and the forward winding 22a of the motor 22.

The side, end and top walls are formed as an integral removable unit. As shown in FIG. 4, the base portion 149 of the rear wall 12 is adapted to be seated on the top of the bottom wall 10 with a depending flange portion 150 overlapping the rear end of the bottom wall 10. As shown in FIG. 6, the side walls 14 and 15 are provided with the cut-out portions 151 and 152 adjacent each of the side walls to provide for the outward extension of the drive axles of the drive wheels. As shown in FIG. 4, the front end of the vehicle is provided with the cross support member 153 upon which the front end of the top wall 13 is adapted to rest. The removable housing formed by the walls of the vehicle provides easy access to the interior of the vehicle for maintaining the operating parts thereof.

As shown in FIGS. 1, 4 and 7, the vehicle is provided with a safety light and arming device which functions to arm the receiver shown in FIG. 9 after the explosives have been placed at the place where they are to be detonated. A lamp 154 is connected between the leads 155 and 156 of the battery circuit for detonating the explosives 72. The lead 155 which is connected to the explosives is adapted to be maintained in a normally open position by means of the spring contacts 157 and 158 which are normally separated by a dielectric spacer tongue 159. The spacer tongue or member 159 may be made from Bakelite or any other suitable nonconductor material. The tongue 159 is connected to one end of the cable 160 which is provided for pulling the tongue out from between the contacts 157 and 158 to complete the circuit through the lead 155 to the explosives, when desired. The other end of the cable 160 is connected to an eye bolt member as 161 which may be attached to any suitable position on the vehicle whereby when the explosive box 71 is deposited and the vehicle withdrawn, the cable 160 will automatically pull the spacer tongue 159 from between the contacts 157 and 158 so as to arm the explosive circuit. The cable 160 may be made to any desired length. It will be seen that the provision of the arming means 157-161 and the test light 154 provides a means whereby the explosive circuit can be tested before it is hooked up to the explosive to make sure that the receiver system of FIG. 9 is working.

The explosive may be detonated at any desired time by pressing the fire control switch 145 on the control board of the transmitting device 74 to send a signal comprising two frequencies, as 255 and 240 cycles per second, which are received by the receiver 121 as shown in FIG. 9. The two signal frequencies are decoded by the reeds 146 and 147 which operate the relays 127 and 128 to close the circuit through the explosives and the battery 148. It will be understood that the transmitter and receiver circuits shown are merely illustrative of circuits which may be employed for those purposes.

The transmitter illustrated in FIG. 3 consists of two basic units, namely the RF carrier and radiating section 162 and the tone modulating section 163. The RF section consists of tube 164 and the associated circuitry which function as a Pierce electron-coupled oscillator. The oscillator is crystal controlled and operates at a frequency of 27.255 megacycles. The crystal 165 is an overtone operated crystal and establishes the operating frequency in the Citizens' Band of electro-magnetic frequencies. The screen grid of tube 164 functions as a plate

and inductance 166 and capacitance 167 are tuned to 27.255 megacycles.

Inductance 168 and capacitance 169 are parallel resonant in the plate circuit of tube 164 and RF energy is coupled from the plate tank via link coupling inductances 170 and 171 to the grid of push pull RF amplifier 172. Inductance 173 and capacitance 174 resonant at the operating frequency and RF voltage is impressed on the grids of amplifier 172 in push pull operation. Inductance 175 and capacitance 176, the tank circuit of amplifier 172, resonant at the operating frequency and the circuit of amplifier 172 is neutralized to prevent self oscillation by capacitance 177 and capacitance 178.

RF energy is coupled from inductance 175 to antenna coupling coil 179 by magnetic induction. Even order harmonics are suppressed by the push pull mode of RF output and odd harmonics are suppressed by the Faraday shield 180. Coil 181 is an antenna loading coil to provide operation for the antenna 182 which is shorter than one quarter wave length. Antenna 182 is the radiating element.

Amplifier 172 is plate modulated by the center tap 183 of inductance 175 and by the action of modulation transformer 184. The mode of transmission is A^2 and the modulation is set at eighty (minimum) percent to hundred (maximum) percent.

The modulating unit 163 consists of three audio oscillators 185, 186 and 187 of the blocking oscillator or Series Armstrong type, and associated circuitry. Transformers 188, 189 and 190 are identical, as are capacitors 191, 192 and 193, and also capacitors 194, 195 and 196 and resistors 197, 198 and 199. The frequency is controlled by the value of resistor 200 for oscillator 185 by resistors 201 or 202 or 203 for oscillator 186 and by resistor 204 or 205 or 206 for oscillator 187. Any oscillator 185, 186 or 187 may oscillate at any one of its selected frequencies at any time and, at the same time, either or both of the remaining oscillators may oscillate at any one of its selected frequencies. Accordingly, a total of three different tones may be transmitted at any one given time.

The plate current of each oscillator tube 185, 186 and 187 must flow through the primary winding of modulation transformer 184. Accordingly, the mixing or complexing of two or more tone signals is done magnetically by induction from primary to secondary in transformer 184. The magnetic induction in transformer 184 causes the voltage to change in the secondary thereof and the change in voltage is applied to inductance 175 and in turn is impressed on RF output tube 172 and, accordingly, tube 172 is amplitude modulated.

Transmission of upper and lower sidebands is allowed so the RF carrier consists of RF energy deviating above and below the carrier frequency by the highest audio frequency. The range of audio tones is from 240 cycles per second for the lowest tone to 375 cycles per second for the highest tone.

Operation of switch 207 to the "on" position supplies filament power to all the tubes and also plate potential to all tubes. This instigates operation of tubes 164 and 172 and after warm-up time, the 27.255 megacycle carrier is radiated by antenna 182. The carrier is unmodulated until the operation of one of the switches 145, 116, 115, 136, 117 is accomplished. The closing of one of these switches completes the grid return to ground of one of the oscillator tubes 185, 186 and 187 and forms a discharge path for electrons on capacitors 191, 192 or 193. The grid return and discharge path is through one of the resistors 200 through 206. When the value of R is smaller the time constant RC is small and the frequency is high, when R is high, frequency is low. Therefore the frequency of the oscillators is fixed by the value of the grid resistor.

Resistor 200 is such that closing of switch 145 causes oscillator 185 to oscillate at 255 cycles per second. Resistor 201 oscillates oscillator 186 at 240 cycles per

second. Resistor 202 oscillates oscillator 186 at 350 cycles per second. Resistor 203 oscillates oscillator 186 at 325 cycles per second. Resistor 204 oscillates oscillator 187 at 375 cycles per second. Resistor 205 oscillates oscillator 187 at 300 cycles per second. Resistor 206 oscillates oscillator 187 at 275 cycles per second.

The two switch parts of dual switch 145 are mechanically arranged to operate simultaneously by means of a key type switch. Key in this sense means that of a locked switch in which a key must be inserted and turned to actuate the dual switch 145. Also, when switch 145 is operated, a mechanical arrangement prevents operation of either switch 116 or 115.

By mechanical arrangement either switch 116 or 115 can be operated but not both at one time. Neither can switch 145 be operated when either switch 116 or 115 is operated.

Switches 136, 137 and 117 can be operated one at a time but no two together, nor can all three be operated simultaneously.

Safety switches 208 and 209 are adapted to be mechanically arranged to close when dual switch 145 is closed. Safety switch 210 is adapted to be mechanically arranged to close when either switch 116 or 115 is closed. Safety switch 211 is adapted to be mechanically arranged to close when either switch 136, 137 or 117 is closed.

Operation of any one or two oscillators 185, 186 and 187 will modulate the output of tube 172 and an amplitude modulate RF signal will radiate from antenna 182 and can be received and detected with suitable apparatus at distances up to five miles.

Higher modulation frequencies may be obtained when two or more tones are transmitted simultaneously, but the sideband excursion is no greater than in any comparable equipment and is easily detected by most compatible receivers. The transmitter is returned to the "off" or silent condition by opening switch 207.

The five tone receiver of FIG. 8 consists of RF amplifier and super-regenerative detector 212, audio amplifier 213, audio output amplifier 214, reed bank 119, relays 143, 141, 131, 133 and 138, and associated circuitry. Switch 215 supplies power to the receiver. 27.255 megacycle signals are induced in antenna 129 and are impressed on the grid of detector 212. Inductance 216 and capacitance 217 resonant at this frequency which is the transmitted signal from transmitter 182. Feedback in inductance 216 provides regeneration and the amplitude modulated signals that may be received at antenna 129 are detected by grid leak action in detector 212. Inductance 218 is an RF choke and provides an RF load for detector 212. RF signals are by-passed by capacitor 219 and do not enter audio choke 220.

Audio voltages developed across audio choke 220 are impressed on the grid of amplifier 213 and receive voltage amplification. The amplified audio signals appear across resistor 221 and are coupled into audio output tube 214.

Tube 214 is a power output stage and relatively strong audio currents are flowing in output coil 222. These currents set up a varying magnetic field about coil 222 whose field strength is a function of current in coil 222 and whose frequency is determined by the audio oscillator circuitry of the transmitter of FIG. 3.

Reed bank 119 consists of five vibrating reeds in the magnetic field of coil 222. The reeds resonant to the five different tones produced in the transmitter, namely 275, 300, 325, 350 and 375 cycles per second. The presence of one or more modulating tones will cause one or more reeds of reed bank 119 to resonant in vibrating mechanical motion.

The vibration of the individual reeds causes the reed to make an interrupted contact with a switch blade member. This member together with the reed constitutes a switch. These switches are labelled 143, 141, 131, 133 and 138 for the 275, 300, 325, 350 and 375 cycles per second tones, respectively.

In series with each switch blade member is a relay of the plate load type. There are five of these relays, one for each of the five modulating tones. An RC filter is provided for each switch blade to maintain a steady current flow through each plate load relay. The plate load relays are designated by the numerals 122, 123, 124, 125 and 126, and the operation of these relays perform mechanical control operations as previously described.

The tone frequencies for the five mechanical functions are as follows:

- (1) 275 cycles per second—forward power
- (2) 300 cycles per second—reverse power
- (3) 325 cycles per second—left turn
- (4) 350 cycles per second—right turn
- (5) 375 cycles per second—release

The operation of the two tone receiver of FIG. 9 is the same as that of the aforescribed five tone receiver and the similar parts have been marked with corresponding reference numerals followed by the small letter "a." The receiver of FIG. 9 functions as the detonator for the explosives 72. The oscillator tubes 185 and 186 of the transmitter are used for generating the pair of signals for firing the explosives. Reeds 146 and 147 must be simultaneously closed by the frequencies of 255 and 240 cycles per second. All other circuit functions are identical to the five tone receiver.

While it will be apparent that the preferred embodiment of the invention herein disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

The reason for employing the pair of series connected relays 127 and 128 in the detonator receiver circuit is to provide a safety feature to prevent any stray signals from activating the circuit. As constructed, both coded signals must be transmitted simultaneously or the detonator circuit will not function and the chances that two stray signals of the design frequencies may accidentally be encountered are thereby eliminated for all practical purposes.

What I claim is:

1. A vehicle for use in combating oil well fires comprising: an insulated heat resistant enclosed body; said body being provided with at least a pair of supporting wheels on the left side thereof and with at least a pair of supporting wheels on the right side thereof; power drive means mounted in said body for driving said wheels; an electro-magnetic clutch means releasably connecting each of said pair of wheels to said power drive means; a load carrier means operatively mounted on said body for supporting a load of explosives thereon and depositing the same on the ground; and, remotely operated control means for controlling the operation of said power drive means and said load carrier means, whereby the vehicle may be operated to deposit a load of explosives beside a burning oil well for detonation by means of a remotely controlled radio signal.

2. A vehicle for use in combating oil well fires comprising: an insulated heat resistant enclosed body; said body being provided with traction means for moving the same; power drive means mounted in said body for selective driving of said traction means; a load carrier means operatively mounted on said body for supporting a load of explosives thereon and depositing the same on the ground; a power operated screw rod operatively connected to said carrier means to hold the carrier means in a level position when loaded and to tilt the carrier means to an unloading position; a spring loaded cylinder means operatively connected to said carrier means and being operative to bias said carrier means to a level position when in an unloaded condition; a shock absorbing means interposed between said load carrier means and said body; and, remotely operated control means for controlling the operation of said power drive means and said

load carrier means and power operated screw, whereby the vehicle may be operated to deposit a load of explosives beside a burning oil well for detonation by means of a remotely controlled radio-signal.

3. An oil well fire combating apparatus for depositing explosive near an oil well fire including, in combination, a vehicle having an insulating heat resistant enclosed body; said body being provided with traction means for moving the same; power drive means mounted in said body for selective driving of said traction means; a load carrier means operatively mounted on said body for supporting a load of explosives thereon and depositing the same on the ground; radio control means in said body for controlling the operation of said power drive means and said load carrier means; radio control means for deposit with the explosives; and remote radio control means to control said radio control means in said body and said radio control means deposited with the explosives to guide the operation of the vehicle and to detonate the explosives, respectively.

4. A vehicle for use in combating oil well fires comprising: an insulated heat resistant enclosed body; said body being provided with at least a pair of supporting wheels on the left side thereof and with at least a pair of supporting wheels on the right side thereof; power drive means mounted in said body for driving said wheels; an electro-magnetic clutch means releasably connecting each of said pair of wheels to said power drive means; a load carrier means operatively mounted on said body for supporting a load of explosives thereon and depositing the same on the ground; remotely operated control means for controlling the operation of said power drive means and said load carrier means, whereby the vehicle may be operated to deposit a load of explosives beside a burning oil well for detonation by means of a remotely controlled radio signal; and, means in said body for carrying a cooling medium when the vehicle is in use to cool the interior of the body.

5. A vehicle for use in combating oil well fires comprising: an insulated heat resistant enclosed body; said body being provided with at least a pair of supporting wheels on the left side thereof and with at least a pair of supporting wheels on the right side thereof; power drive means mounted in said body for driving said wheels; an electro-magnetic clutch means releasably connecting each of said pair of wheels to said power drive means; a load carrier means operatively mounted on said body for supporting a load of explosives thereon and depositing the same on the ground; a power operated screw rod operatively connected to said carrier means to hold the carrier means in a level position when loaded and to tilt the carrier means to an unloading position; a spring loaded cylinder means operatively connected to said carrier means and being operative to bias said carrier means to a level position when in an unloaded condition; a shock absorbing means interposed between said load carrier means and said body; remotely operated control means for controlling the operation of said power drive means and said load carrier means, whereby the vehicle may be operated to deposit a load of explosives beside a burning oil well for detonation by means of a remotely controlled radio signal; and, means in said body for carrying a cooling medium when the vehicle is in use to cool the interior of the body.

6. A vehicle for use in combating oil well fires comprising: an insulated heat resistant enclosed body; said body being provided with at least a pair of supporting wheels on the left side thereof and with at least a pair of supporting wheels on the right side thereof; power drive means mounted in said body for driving said wheels; an electro-magnetic clutch means releasably connecting each of said pair of wheels to said power drive means; a load carrier means operatively mounted on said body for supporting a load of explosives thereon and depositing the same on the ground; a power operated screw rod opera-

11

tively connected to said carrier means to hold the carrier means in a level position when loaded and to tilt the carrier means to an unloading position; a spring loaded cylinder means operatively connected to said carrier means and being operative to bias said carrier means to a level position when in an unloaded condition; a shock absorbing means interposed between said load carrier means and said body; remotely operated control means for controlling the operation of said power drive means and said load carrier means, whereby the vehicle may be operated to deposit a load of explosives beside a burning oil well for detonation by means of a remotely controlled radio signal; means in said body for carrying a cooling medium when the vehicle is in use to cool the interior of the body; and, said remotely operated control means including radio control means in said body for controlling the operation of said power drive means and said load carrier means; radio control means for deposit with the explosives; remote radio control means adapted to control said radio control means in said body and said radio control means deposited with the explosives to guide the operation of the vehicle and to denote the explosives.

7. A vehicle for use in combating oil well fires comprising: an insulated heat resistant enclosed body; said body being provided with at least a pair of supporting wheels on the left side thereof and with at least a pair of supporting wheels on the right side thereof; power drive means mounted in said body for driving said wheels; an electro-magnetic clutch means releasably connecting each of said pair of wheels to said power drive means; a load carrier means operatively mounted on said body for supporting a load of explosives thereon and depositing the

12

same on the ground; remotely operated control means for controlling the operation of said power drive means and said load carrier means, whereby the vehicle may be operated to deposit a load of explosives beside a burning oil well for detonation by means of a remotely controlled radio signal; means in said body for carrying a cooling medium when the vehicle is in use to cool the interior of the body; and, said remotely operated control means including radio control means in said body for controlling the operation of said power drive means and said load carrier means; radio control means for deposit with the explosives; remote radio control means adapted to control said radio control means in said body and said radio control means deposited with the explosives to guide the operation of the vehicle and to detonate the explosives.

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