Nov. 21, 1950 P. C. McLEMORE 2,530,894

FLAME CULTIVATOR

Filed June 30, 1945 3 Sheets-Sheet 1

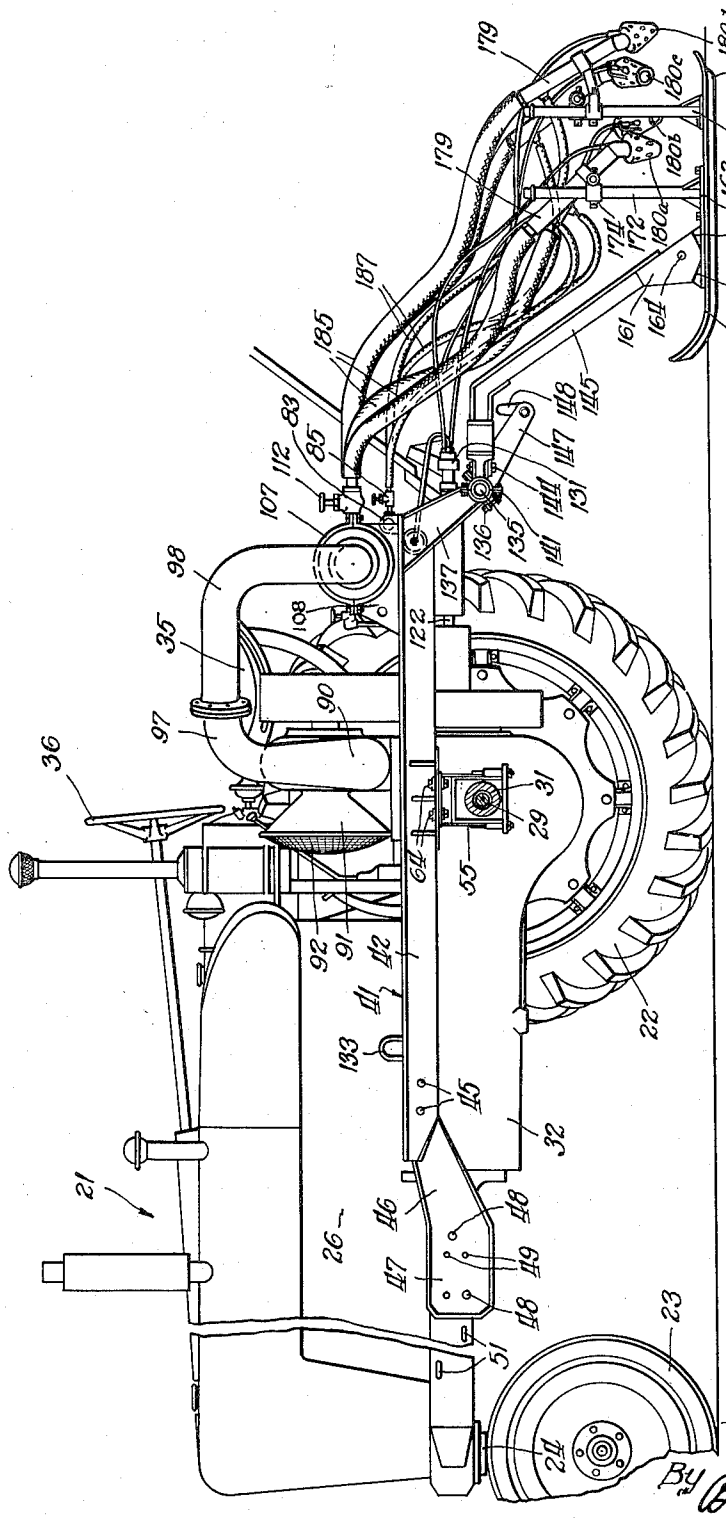


Fig. 1.

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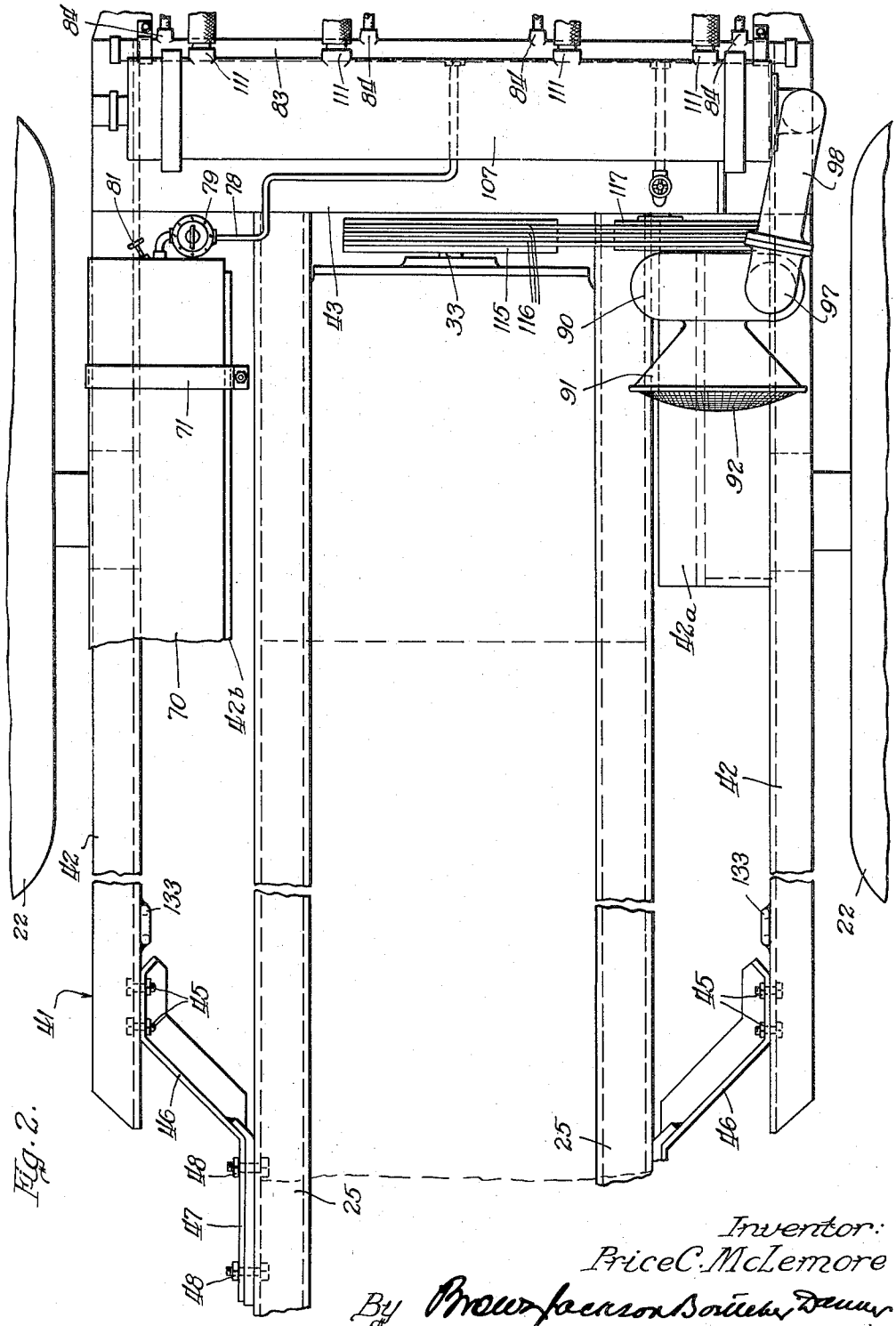


Fig. 2.

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Fig. 3.

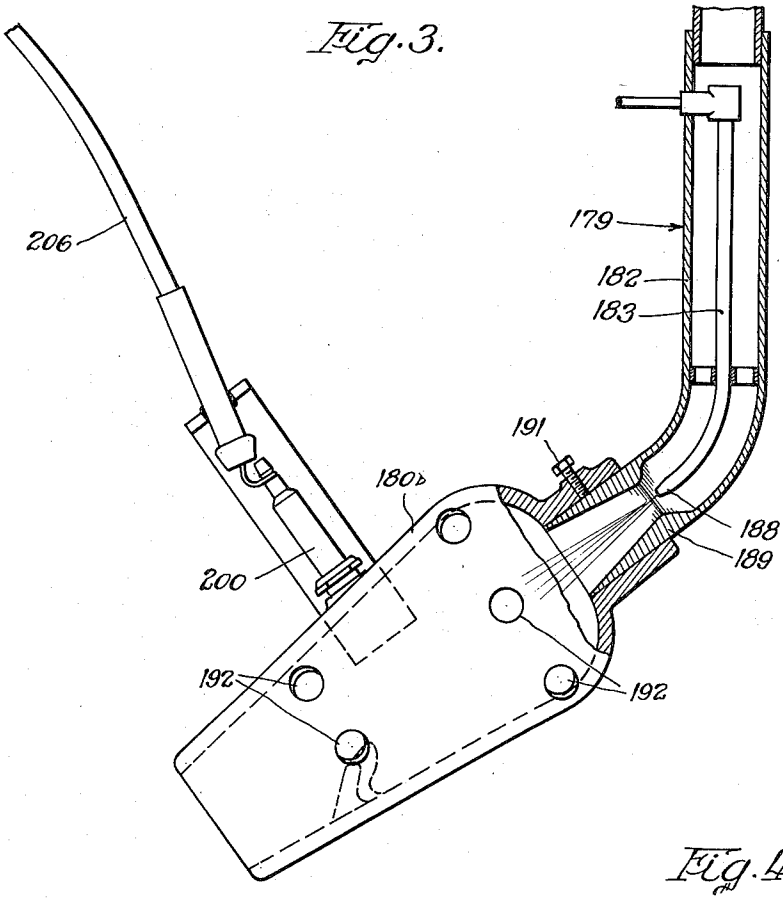
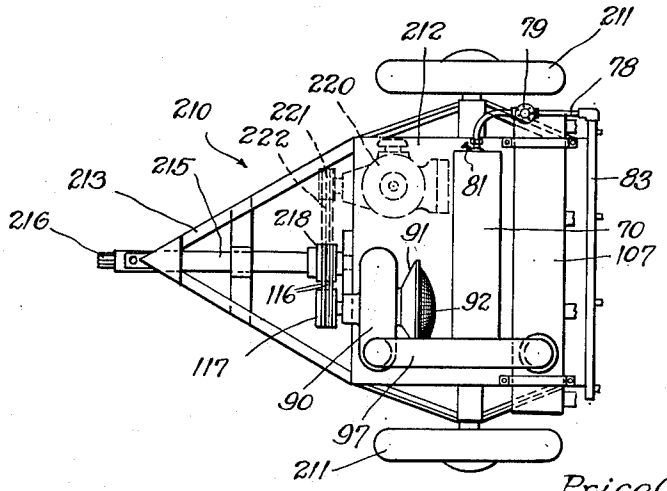


Fig. 4.



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Patented Nov. 21, 1950

2,530,894

UNITED STATES PATENT OFFICE

2,530,894

FLAME CULTIVATOR

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Application June 30, 1945, Serial No. 602,545

5 Claims. (Cl. 126—271.2)

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The present invention relates to flame cultivators such as are disclosed in my prior patents: 2,327,204, issued August 17, 1943, 2,369,154, issued February 13, 1945, and reissued October 15, 1946, No. 22,803, and in my prior applications: Serial No. 364,140, filed November 4, 1940, now Patent 2,408,328, dated September 24, 1946, Serial No. 588,564, filed April 16, 1945, Serial No. 591,117, filed April 30, 1945, now Patent 2,487,353, Nov. 8, 1949, and in the prior application of myself and Valdemar Knudsen: Serial No. 471,858, filed January 9, 1943, now Patent 2,391,027, dated December 18, 1945 and reissued January 28, 1947, No. 22,836.

In the present application I have disclosed an improved flame cultivator adapted to the use of "bottled gas" for supplying fuel to the cultivator burners. This bottled gas is widely distributed in the form of high pressure containers of butane gas or propane gas, such being extensively used for domestic cooking and lighting purposes in rural localities where there are no public service facilities for supplying gas.

One of the objects of the present invention is to provide an improved flame cultivator utilizing bottled gas as the fuel for the burners.

Another object of the invention is to provide such a flame cultivator utilizing bottled gas which is further characterized by an improved construction and arrangement of air supply means for supplying air to the burners burning this bottled gas. In using this type of fuel, it is frequently desirable to give additional drive to the burner flame, other than that afforded by the pressure of the gas itself. This is important for obtaining a sufficient length of flame to extend from the mouth of the burner to or through the base portion of the plant row. With certain types of plants, or at later stages of the plant growth, it may be necessary to position each burner a substantial distance from the plant row for clearing the lower portions of the plants. Under these circumstances, it may be necessary to project a relatively long flame, possibly as long as two or three feet. This flame should have sufficient drive or velocity so that it remains fairly flat, and hence does not curl up into the lower foliage of the plants. Also, as the high pressure container of gas approaches the empty stage, the drop of pressure may reach the point where it is desirable to use air velocity at the burners to give the desired drive to the flame. To give this added drive or velocity to the flame when using bottled gas, my improved cultivator employs a blower which supplies a substantial

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volume of air to each of the burners at sufficient pressure and volume to give the desired additional drive or velocity to the gas flame. This blower need not be operated at all times, but its operation is preferably made optional so that it may be brought into operation whenever the operating conditions indicate that more drive or length to the burner flames would be desirable. In prior flame cultivators in which I have employed kerosene, fuel oil, or other like liquid fuels for the burners, I preferably employ an air compressor for supplying air under relatively high pressure to the burners for producing an atomizing action on the liquid fuel for breaking it up into fine particles, this high pressure air also giving a blast action to the burners for producing the desired length of flame. These air compressors have usually supplied air to the burners at pressures in the neighborhood of 50 pounds per square inch. When burning bottled propane or butane gas, there is no need for such pressures because there is no need for any atomizing action in the case of a gaseous fuel and because the fuel gas itself has pressure for producing a substantial length of flame. Accordingly, when using this bottled propane or butane gas, I preferably dispense with the air compressor and employ a blower or other rotary type of air displacing unit. A satisfactory blower unit adequate for this type of service does not cost as much as a compressor, and also has a lower maintenance cost. Furthermore, a blower unit in this situation does not require as high a power input as does the air compressor of my prior cultivators.

Referring now to the accompanying drawings in which I have illustrated two preferred embodiments of my invention:

Figure 1 is a fragmentary side view showing my improved flame cultivator mounted on a conventional make of tractor, the adjacent rear wheel of this tractor being cut away in this view to show the mounting of the blower unit and the mounting of the cultivator parts to better advantage;

Figure 2 is a plan view, somewhat diagrammatic, showing the mounting of the high pressure container of fuel gas on the tractor, the mounting of the blower unit on the tractor, and one manner of establishing fuel supply and air supply to the burner rigs;

Figure 3 is a fragmentary sectional view illustrating one embodiment of burner which may be employed for burning bottled gas in conjunction with air supplied from a blower unit; and

Figure 4 is a diagrammatic plan view of a sulky

type of trailer representing another embodiment of my invention, this trailer being horsedrawn or towed behind any other power vehicle, and carrying the high pressure container of fuel gas, the blower unit, and propelling the burner rigs.

Referring first to the tractor mounted embodiment of my invention, as shown in Figures 1 and 2, a conventional tractor of well known make is indicated at 21, this tractor comprising rear driving wheels 22 and front steering wheels 23. The steering wheels 23 may be of the widely spaced type or of the narrowly spaced type as desired, the illustrated embodiment being of the narrowly spaced type with these two front wheels having steering motion around the axis of a vertical steering post 24 disposed centrally of the front end of the tractor. The tractor frame is indicated generally at 25, and the power plant at 26, the latter being provided with the conventional speed regulating governor. The power plant transmits a drive through a conventional selective speed transmisson, and thence through a differential mechanism to the axle shafts 29 extending outwardly to the rear wheels 22. These rear axles 29 project outwardly through axle housings 31 which extend laterally from the sides of the main housing 32 which encloses the selective speed transmission, clutch, differential mechanism, etc. Projecting from the rear end of the housing 32 is a power take-off shaft 33 (Figure 2) from which I derive power for driving the blower unit of my flame cultivator, as will be presently described. The operator's seat on the tractor is indicated at 35, and the tractor steering wheel at 36, this driver's position having the conventional controls for the clutch, selective speed transmission mechanism, etc. All of the foregoing details of the tractor 21 are old and well known, being typical of the popular make of tractor illustrated in Figure 1. The rear driving wheels can be shifted outwardly to different degrees of row spacing along their respective axle shafts 29. In the case of a two-row flame cultivator such as is illustrated, these rear wheels 22 would be spaced to span two plant rows, in which case the flame cultivator assembly would employ three cultivator rigs comprising a central rig to travel between the two plant rows, and right and left rigs to travel along the outer sides of the plant rows.

Referring now to the high pressure gas container and the blower unit, Figure 2 illustrates a typical or preferred mounting of these two units on the above described tractor 21. The high pressure gas container is indicated in its entirety at 70, and the blower unit is indicated in its entirety at 90. The high pressure cylinder 70 is preferably extended lengthwise along one side of the tractor between the power plant and the adjacent rear wheel. Figure 2 illustrates the rear portion of this gas cylinder fragmentarily, the cylinder being rigidly held in mounted position by clamping bands or the like 71. To effect a more even distribution of weight of the flame cultivator parts on the tractor, the blower unit 90 is preferably mounted at the opposite side of the tractor. The high pressure cylinder 70 and the blower unit 90 may be given any type or construction of mounting on the tractor that may be desired, depending upon whether it is desired to be able to remove these two units when putting the tractor to other types of work, and also depending upon the construction and available space on the tractor, the permissible expense of the mounting, etc. In one rather developed form of

the invention illustrated in Figures 1 and 2, I have placed gas container 70 and blower unit 90 upon an attachment frame which is quickly attachable to and attachable from the tractor as a unit assembly. The cultivator rigs can also be secured to this attachment frame. Such frame is indicated in its entirely at 41, and is of U-shaped outline (Figure 2) comprising the two forwardly extending side arm portions 42, 42 and the transversely extending rear portion 43. Secured to the front ends of the side channels 42 by bolts 45 are inwardly converging attachment plates or brackets 46 which converge inwardly and then extend forwardly to form apertured bolting pads 47 for attachment by bolts 48 to the adjacent side frame bars of the tractor frame 25. A plurality of bolt holes 49 are provided in the bolting pads 47 for adapting the bolting attachment to different makes of tractors. The side frame bars of the tractor frame are also usually provided with several bolting holes or slots 51 therein to facilitate the bolting of different implement attachments to the tractor frame, and these bolting slots, where available, can also be utilized for securing the fastening brackets to the tractor frame. Adapter plates may also be interposed between the bolting pads 47 and the tractor frame parts for adapting the attachment to different makes of tractors. In lieu of the bolting pads 47 and bolts 48, these forwardly extending side arms of the attachment frame might be connected with the tractor by a detachable chain or cable connected to the arms and extending under the power plant of the tractor. With reference to the mounting of the attachment frame 41 on the axle housing 31, it will be seen from Figure 1 that a convertible or replaceable axle seat 55 is disposed between each side bar 42 of the attachment frame and the associated axle housing 31. This axle seat or frame support pad 55 may be of one construction for one make or model of tractor, and may be of another construction for another make or model of tractor, whereby in adapting the attachment frame to different models or makes of tractors it is only necessary to substitute different axle seats or frame support pads 55. The details of these interchangeable axle seats or support pads 55 are fully disclosed in my aforementioned pending application Serial No. 591,117, filed April 30, 1945, and attention is directed to that application if a better understanding of these axle seats or support pads is desired. Suffice it to say here that when the fastening bolts 64 are released, the side bars 42 of the attachment frame 41 can be lifted straight up from the axle seats or support pads 55.

The high pressure butane or propane cylinder 70 is shown as being secured to the attachment frame 41 by the clamping bands 71, whereby a fresh cylinder of gas may be quickly substituted for the old cylinder when the supply of gas in the old cylinder has become substantially exhausted. The clamping bands 71 can be arranged to clamp the cylinder 70 to an auxiliary platform or trough shaped mounting saddle 42b extending inwardly from the adjacent side frame bar 42 of the attachment frame 41. The blower unit 90 has its mounting base bolted or otherwise secured to an auxiliary platform or supporting bar 42a extending inwardly from the adjacent side bar 42 of the attachment frame (Figure 2). It will thus be seen that when the attachment frame 41 is detached from the trac-

tor, the high pressure gas container 70 and the blower unit 90 are removed with the attachment frame, all as a unitary assembly.

The butane or propane gas flows from the cylinder 70 through supply line 78 in which is interposed a pressure reducing or pressure regulating valve 79. A suitable shut-off or control valve 81 is also provided to control the flow of gas from the cylinder 70 to the supply line 78, the cylinder being connected to the supply line through a quickly releasable coupling connection (not shown) which enables a fresh cylinder of gas to be quickly substituted for an old exhausted cylinder. Where the flame cultivator employs a plurality of burners, as in the exemplary embodiment herein shown, the fuel supply line 78 preferably extends to a transverse fuel header 83 from which branch connections lead to each of the separate burners. This transverse fuel header 83 may consist of a section of pipe or tubing extending transversely across the rear end of the attachment frame 41 and suitably secured to this transverse rear frame portion 43 by any suitable form of mounting brackets. Projecting rearwardly from the fuel header 83 at spaced points are outlet nipples or bosses 84, one for each of the fuel burners. Fuel regulating valves 85 (Figure 1) receive the gaseous fuel through each of these outlet nipples 84, these control valves 85 being connected with their respective fuel burners through flexible hose lines, as I shall presently describe. It will be noted that the valve 81 serves as a master valve for shutting off the fuel supply to all of the burners.

Referring now to the blower unit 90, I have shown a blower of the centrifugal type, but, as hereinafter set forth, other types of blowers or rotary air displacing devices may be employed in lieu of a centrifugal blower. The air intake to the blower unit is indicated diagrammatically at 91, this air intake being shown as equipped with a screen or other air cleaning instrumentality 92 at the front end of the air intake 91. Because of the absence of reciprocating pistons and other sliding surfaces in most of these blower units 90, there is not the need for cleaning the air as thoroughly when employing one of these blower units as is necessary when employing a conventional air compressor. Accordingly, a filtering screen 92 may suffice for the air intake, although it will be understood that a more elaborate air cleaner or air filter may be employed for cleaning or filtering the incoming air, if desired. From the outlet side of the blower, the air is discharged through discharge manifold 97 which is connected with pipe 98 leading to the air supply header 107. This header 107 extends transversely of the rear end of the attachment frame, being mounted on suitable attachment brackets 108 bolted or otherwise secured to the rear portion of the attachment frame. It may be desirable to employ a distributor conduit within the air supply header 107 for maintaining substantially the same effective pressure and the same rate of flow at different points of the header 107, this being disclosed in more detail in my aforementioned copending application Serial No. 591,117. Discharge nipples or bosses 111 project rearwardly from the header 107 for establishing connection with air control valves 112 which connect through flexible hoses with the burner heads, as I shall presently describe.

Referring now to the power transmitting drive leading from the power take-off shaft 33 of the tractor to the blower unit 90, it will be seen from Figure 2 that the power take-off shaft 33 is provided with a belt pulley 115 for transmitting power through a belt drive 116 to a belt pulley 117 mounted on one end of the blower shaft. This belt drive is preferably of the multiple V-belt type, in the illustrated construction three of these V-belts being employed, and the two belt pulleys 115 and 117 having a corresponding number of peripheral grooves for receiving these three V-belts 116. This belt drive is preferably enclosed within a protective housing or housings (Figure 1) to prevent any possibility of the operator being caught in or injured by the belt drive. If desired, an idler pulley arrangement may be employed for taking up and paying out slack in the V-belts 116, this feature of employing slack in the V-belts, to be taken up by a shiftable idler pulley, serving the twofold purpose of enabling the V-belts to be released more freely from their pulleys when detaching the flame cultivator from the tractor, and also of adapting the blower unit drive to different makes of tractors in which the power take-off shaft 33 may be situated at higher or lower points with respect to the horizontal plane of the blower shaft. This arrangement of adjustable idler pulley for such purposes is fully disclosed in my aforementioned application Serial No. 591,117. Figure 1 illustrates one instance of where this idler pulley is employed, the shaft 122 of such idler pulley also serving to drive the distributor which distributes the high voltage current to the different spark plugs of the different burner heads. This distributor is indicated at 131 in Figure 1, the rotary element of the distributor being connected directly to the idler pulley shaft 122 so as to rotate therewith at all times. It is conventional in all of these farm tractors to interpose a control clutch in the drive to the power take-off shaft 33 for stopping and starting the power take-off device, and this enables the farmer to drive the blower 90 or not, depending upon operating conditions, the length of flame desired, etc.

From the description thus far, it will be seen that my improved construction affords a unit assembly of flame cultivator parts all mounted on the attachment frame 41, these parts including the high pressure gas containing drum 70, the fuel gas header 83, the blower unit 90, and the air header 107. When the farmer desires to remove the flame cultivator from the tractor he releases the front attachment bolts 45, and also releases the rear attachment bolts 64 from the axle housing brackets 55, and disconnects the belt drive 116. Thereupon, the entire unit assembly of attachment from 41, together with high pressure gas cylinder 70 and blower unit 90 and their respective headers, can be lifted vertically from the tractor, and the tractor driven out from under this unit assembly. The front portions of the frame side bars 42 are preferably provided with U-bolts or eye bolts 133 to which a block and tackle or other hoisting rig can be readily connected. Such a hoisting rig can also be connected to the rear portion of the attachment frame 41, preferably around or adjacent to the transverse rear draft bar 135. Thus, the entire unit assembly can be lifted entirely free of the tractor, and the tractor then driven out from under the assembly. Conversely, in mounting the flame cultivator back on the tractor, the latter can be backed in under the unit assembly and the latter lowered into place down

upon the tractor for attachment thereto by a reversal of the steps pointed out above.

Referring now to the burner rigs, these rigs may have any suitable attachment to the tractor so as to be propelled along the plant rows by the tractor, my aforementioned patents and prior applications illustrating different arrangements of these burner rigs relatively to the tractor. However, in the preferred or exemplary construction illustrated, I have shown these burner rigs as coupled to the quick detachable attachment frame 41 so that the burner rigs will also be removed from the tractor, along with the attachment frame 41, when the unit assembly of attachment frame, fuel cylinder, blower unit, and headers are removed from the tractor. In this illustrated embodiment, each of the burner rigs has draft attachment to a transverse rock tube 135 which serves the combined functions of a draft tube and also of a lifting tube for rocking the burner rigs up to their elevated positions, clear of the ground, when turning the implement at the ends of the field or when travelling to and from the field. This transverse rock tube 135 is rotatably supported in bearings 136 mounted at the lower ends of diagonal bracket arms 137 extending outwardly and downwardly from the rear end of the attachment frame 41. Each burner skid rig has draft attachment to the draft tube 135 through the medium of a split draft coupling 141 which is always free to swivel or rotate freely on the draft tube 135 in order to permit free rising and falling movement of the burner rig. A pair of vertically spaced ears or lugs project rearwardly from each draft coupling 141, and a companion pair of lugs or ears project forwardly from the burner rig, these two pairs of ears or lugs being pivotally connected together by the pivot bolts or pivot pins 144 which establish a substantially vertical pivotal axis around which the burner rig can swing freely to right or left. The details of this pivotal connection are fully disclosed in my prior application Serial No. 591,117. Each burner rig is pulled and guided through an upwardly inclined draft arm 145 having a forwardly bent front end portion from which extend the lugs which establish the vertically aligned pivotal connection 144. The lifting of all of the rigs to inoperative positions is effected by a rocking movement of the draft and lifting tube 135. Lifter arms 147 are welded to the tube 135 at spaced points across the length of the tube, and the lower ends of these lifter arms are provided with holes in which is welded a tubular lifter bar 148 extending transversely across the entire width of the rig assembly. When the tube 135 is rocked in a counterclockwise direction, the lifter arms 147 carry the lifter bar 148 upwardly into engagement with the lower edges of the horizontally bent front ends of the draft arms 145. Thus, all of the burner rigs are caused to swing up substantially simultaneously to their inoperative positions by such rocking motion of the tube 135. When the lifter arms 147 and lifter bar 148 have been restored to their lower positions the burner rigs are in direct contact with the ground and are free to rise and fall with a considerable latitude without having the bent portions of the draft arms 145 strike against the lifting bar 148. Rocking motion is transmitted to the tube 135 for lifting the rigs by the manipulation of a suitable jack or other lifting device which can be actuated by the driver while seated on the tractor seat 35. One conventional form of jack or lifting device for actuating the tube 135 rotatively is shown in my aforementioned application Serial No. 591,117.

Referring now more particularly to the burner rigs, each draft arm 145 is preferably of T-shaped cross section, and has a pair of spaced plates 161 welded to the web portion of the T on each side thereof. These plates embrace a pivot ear 162 which extends upwardly from an attachment plate 163 fastened to the burner skid. A pivot pin 164 passes through the plates 161 and pivot ear 162 for establishing a horizontal pivot axis around which the burner skid can swing relatively to the draft arm 145. The lower edge of each plate 161 is cut with a sloping shoulder 165 extending upwardly and forwardly from a point approximately below the pin 164. These inclined edges 165 form stop surfaces against which the top surface of the attachment plate is adapted to abut when the rig is swung upwardly to its inoperative position. With the attachment plate abutting these stop surfaces 165, the skid is held in a more or less horizontal position, thereby avoiding the rear end of the skid dragging along the ground or striking obstructions on the ground. The attachment plate 163 is fastened by screws to a mounting plate which, in turn, is welded to the top side of the skid 170. The skid is preferably constructed of a flat plate having a pronounced upward curvature at its front end and an upwardly deflected rear end, this inclined rear end preventing the skid from digging into the ground in the event that the rigs are backed a short distance. A downwardly extending fin or runner 171 is welded to the under side of the plate 170 to extend longitudinally of the plate in the median line thereof, this fin assisting in causing the runner to track in a straight direction, and to minimize said slipping on slopes.

The right and left, or outer rigs, each have a tubular standard 172 rising vertically therefrom at a point approximately mid-way back of the length of the runner, and the central rig has a like tubular standard 172c which preferably rises from its skid or runner at a point closer to the rear end of the skid. Mounted on all three tubular standards are adjustable clamps 174 having split sections which can be frictionally gripped to the tubular standards, this friction clamp portion 174 being adjustable vertically along the standard and also being adjustable rotatively around the axis of the standard. Each adjustable clamp 174 carries a substantially horizontal mounting arm which is adjustable relatively to the clamp 174, and such mounting arm, in turn, supports the air tube or standard 179 which carries the burner. The tube or standard 179 is adjustable relatively to the horizontal mounting arm, and the entire arrangement is such that the burners 180a, 180b, 180c, and 180d can be adjusted to different heights relatively to the ground, to different angles relatively to the ground, to different distances laterally toward and away from the plant rows, to different fore and aft angles, and to different degrees of fore and aft offset, so that the flames from opposing burners do not impinge against each other. This arrangement of adjustments is disclosed in my prior application Serial No. 591,117.

Referring to Figure 3, each fuel and air standard 179 is formed with a concentric assembly of outer air pipe 182 and inner fuel pipe 183. The upper end of each air pipe 182 has suitable connection with a flexible hose 185 which leads to a

corresponding one of the air control valves 112 connecting with the air header 107. The upper end of each inner fuel tube 183 has suitable connection either at a point above the upper end of the air tube 182, or out through the side wall of the air tube 182, with a flexible hose 187 leading up to a corresponding one of the fuel regulating valves 85. The primary purpose of the valves 85 and 112 is to establish the proper proportions of fuel gas and air for securing the desired flame at each of the burners.

The gaseous fuel and the air from the blower are mixed in each burner unit by any suitable arrangement of fuel jet and air passageway. Figure 3 illustrates one exemplary arrangement in which the gaseous fuel pipe 183 terminates in a fuel jet 188 arranged to discharge substantially at the throat of a venturi 189 through which the air is discharged to the burner shell. The burner shell, indicated at 189b, is secured in any suitable manner, such as by a set screw 191, to the venturi portion 189 of the air tube 182. This burner shell may also be provided with a plurality of apertures 192 for permitting an induction flow of atmospheric air. Each burner shell carries a spark plug 200 which has its sparking terminals within the shell in proximity to the flow of fuel and air passing through the burner shell. A conductor 206 extends from this spark plug to a corresponding terminal on the distributor 131, where the plurality of spark plugs for the several burners intermittently receive sparking potential by the rotary movement of the rotating distributor contact. This distributor also includes a make and break vibrator or circuit interrupter coacting with a conventional ignition coil which receives energy from the battery of the tractor 21. This electrical ignition system is disclosed in complete detail in my aforementioned copending application Serial No. 591,117.

It will be seen from the foregoing description that the butane or propane gas, or such other gaseous fuel as may be stored within the high pressure container 70, is conducted through the gas header 83 and flexible hoses 187 to the fuel jets 188 of each of the burners. The discharge of gaseous fuel to each burner can be controlled through the valve 85 for regulating the volume of fuel supplied to the burner. Simultaneously with the discharge of gaseous fuel to the burners, the blower unit 90 is supplying a relatively large volume of air to the air header 107, which is transmitted out through the flexible hoses 185 to the air ports 189 opening into the burners. This air has sufficient velocity and volume to substantially increase the effective length of the flame issuing from the burner shell so that the desired additional length and velocity of flame are obtained. The flexible hoses 185 which conduct air to the burners are of relatively large internal diameter so as to reduce as much as possible the internal friction on the flow of air through these tubes.

Referring now to the modified embodiment of my invention illustrated in Figure 4, all of the component parts of the flame cultivator are mounted on a trailer cart 210, preferably of the two wheeled sulky type. The two wheels 211 support a platform 212 from which extends a draft frame 213 adapted for draft connection to any towing vehicle. Mounted on the platform 212 are the high pressure fuel gas container 70, the fuel header 83, the blower unit 90, and the air header 107. The fuel supply system embodies the previously described arrangement of supply pipe 78, pressure reducing or control valve 79, and shut-off valve 81. The air supply system also embodies the previously described arrangement of manifold conduit 97 leading from the outlet of the blower 90 and communicating with the air header 107. The intake of the blower unit 90 may be provided with the same general arrangement of filtering screen 92 or other suitable air cleaning or filtering device. The burner rigs have substantially the same mounting across the rear of the sulky vehicle 210 as has been described above in the case of the tractor 21. The fuel header 83 is connected thru the same arrangement of valves 85 and flexible tubes 187 with each of the burners; and, similarly, the air header 107 is also connected thru the air control valves 112 and flexible tubes 185 with each of the burners. This trailer sulky may be provided with the same general lifting arrangement for lifting the burner rigs to inoperative positions.

The blower unit 90 may be arranged to be driven from a power take-off on the towing vehicle, or it may be arranged to be driven from a power plant mounted directly on the trailer vehicle. For example, a drive shaft 215 may be mounted in suitable front and rear bearings carried by the draft frame 213 and platform 212, the front end of this shaft being provided with any suitable coupling device 216 for establishing a coupled connection with the power take-off on the tractor. The rear portion of the shaft 216 carries a drive pulley 218 over which belts 116 extend for transmitting a drive to the belt pulley 117 of the blower unit. With this driving arrangement the entire power of the power take-off device on the tractor or other towing vehicle is available for driving the blower unit 90. For other situations where the towing vehicle does not have a power take-off, a separate power plant 220 is mounted on the platform 212 of the sulky vehicle, this separate power plant being typically represented by any one of numerous constructions of internal combustion engines particularly adapted to this type of duty. The crank shaft of this engine transmits a drive to a driving pulley 221 over which drive belts 222 may be extended to the driving pulley 117 of the blower unit. The operation of this sulky or trailer embodiment of the invention will be apparent from the preceding description of the tractor embodiment.

The blower unit 90 in each of these embodiments is conventionally illustrated as a single stage centrifugal blower capable of delivering a relatively large volume of air at pressures ranging up to approximately one or two pounds per square inch. Because there is no need of effecting any atomization of the fuel when burning bottled gas, there is not the necessity for high air pressures that there is when burning liquid fuel. However, it may be desirable to employ a blower capable of producing higher pressures, in order to obtain a longer flame at the burner, or to reduce the internal diameters of the flexible hoses 185, valve connections 112, etc. In that event, the blower 90 might be made of the multistage type having a plurality of successive centrifugal stages capable of generating pressures up to approximately five pounds per square inch (typically represented by a Spencer "turbo-compressor"). Still another type of rotary air displacing unit which may be employed is a "Connersville" blower in which two coacting rotors of 8-shaped outline produce a substantially positive displacement of air at pressures ranging up to 7 or 8 pounds. Still another rotary type of air

pumping or feeding unit which might be used is a positive displacement rotary vane type frequently referred to in the trade as a "rotary compressor," this type of device being capable of producing pressures higher than those above stated. All of the above mentioned rotary air displacing units are free of the lubrication problems and the temperature problems of a typical reciprocating air compressor. Air of relatively high dust content can be handled by the rotary units without objectionable abrasion or wear, and this minimizes or eliminates the problem of cleaning the air. These rotary units have a lower maintenance cost, and in most instances they would also have a lower initial cost than a reciprocating compressor.

In the average situation employing only one or two flame cultivators, the replenishment of fuel will ordinarily be effected by removing the exhausted fuel container 70 from the vehicle and substituting a fully charged container in its place. In other situations, particularly where a large number of flame cultivators are employed on a single farm or on a collected group of farms, the high pressure container 70 may remain permanently secured to the attachment frame or to the vehicle, and the fuel may be replenished at intervals by connecting this container to a high pressure source of the fuel gas for forcing a replenishing charge of the fuel into this permanently secured container 70, thereby avoiding the necessity of interchanging containers. This high pressure charging supply or equipment may be located directly on the farm, or at a nearby filling station or community charging station. The fuel is usually stored in these containers 70 under pressures ranging up to 200 or 300 pounds per square inch pressure or more, and at these pressures the major portion of the fuel is in liquid form.

While I have illustrated and described what I regard to be the preferred embodiments of my invention, nevertheless it will be understood that such are merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention.

I claim:

1. A flame cultivator attachment adapted to be connected to a tractor comprising a frame having side arm portions and a transverse rear portion, said frame being adapted to be assembled with the tractor with said side arm portions fastened to the sides of the tractor, a plurality of burners of the blast type connected to said frame, a high pressure container of bottled gas mounted on said frame for supplying fuel to said burners, and a power driven blower mounted on said frame for supplying air to said burners, said high pressure container and said blower being removed with said frame as a unit assembly in the detachment of said frame from the tractor.

2. In a flame cultivator adapted to cultivate row crops by the flame method, the combination for mounting on a tractor having a power takeoff of a plurality of burners adapted to be coupled to said tractor so as to be propelled along the plant rows, said burners being arranged to project their flames into or through the plant rows adjacent the base portions of the plants, a container of bottled liquefied gas mounted on said cultivator and connected to feed fuel in gaseous form to said burners, a blower forming a part of said cultivator connected to supply air to said burners, and means for driving said blower from the power take-off of the tractor.

3. In cultivating apparatus adapted to cultivate row crops by the flame method, the combination for mounting on a wheeled vehicle adapted to travel along the plant rows of a plurality of burners adapted to be connected to said wheeled vehicle, said burners being directed diagonally downwardly in a direction substantially crosswise of said cultivating apparatus for causing their flames to strike into or through the plant rows substantially at the base portions of the plants, a high pressure container of bottled gas mounted on said cultivating apparatus and connected to supply fuel in the gaseous state to said burners, a blower constituting a part of said cultivating apparatus and connected to supply supplemental air to said burners, and drive means on said vehicle for driving said blower, said drive means being controllable for stopping or starting said blower whereby said burners may be operated optionally with or without supplemental air from said blower.

4. Flaming attachment for a tractor having a frame and a power takeoff shaft extending longitudinally of the tractor, comprising the combination of a U-shaped frame adapted to be disposed substantially horizontally and having longitudinally disposed side legs and a transverse cross member joining said legs, the side legs being adapted to extend longitudinally along the sides of the tractor frame, a blower having an impeller shaft disposed parallel to said power takeoff shaft and being mounted on one of said legs, an air pressure manifold and a fuel supply manifold both disposed transversely and mounted on the attachment frame at said cross member, a removable fuel supply tank mounted on the other side leg of the attachment frame, a connection including a control valve between the tank and the fuel supply manifold, a connection between the blower and the air pressure manifold, and a plurality of independently movable burner arms connected to the rear of said attachment frame, said burner arms having burners connected to the air pressure manifold and to the fuel supply manifold.

5. A flaming attachment for a tractor comprising the combination of a U-shaped frame adapted to be disposed substantially horizontally and having longitudinally disposed side legs and a transverse cross member joining said legs, the side legs being adapted to extend longitudinally along the sides of the tractor, a fuel supply manifold disposed transversely and mounted on the attachment frame at said cross member, a removable fuel tank mounted on said attachment frame, a connection including a control valve between the tank and the fuel supply manifold, a plurality of independently movable burner arms connected to the rear of said attachment frame, said burner arms having burners mounted thereon, and flexible hoses connecting said burners with said fuel supply manifold.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
659,870	Jones	Oct. 16, 1900
899,404	Iten	Sept. 22, 1908

(Other references on following page)

UNITED STATES PATENTS

Number	Name	Date
1,164,058	Bayne	Dec. 14, 1915
1,390,639	Porter	Sept. 13, 1921
1,436,958	Hebert	Nov. 28, 1922
1,453,552	Fuller, et al.	May 1, 1923
1,500,340	Smith	July 8, 1924
1,515,476	Greenfield	Nov. 11, 1924
1,548,476	Morrison	Aug. 4, 1925
1,581,406	Stebbins	Apr. 20, 1926
1,897,160	Endacott	Feb. 14, 1933
1,925,164	Woolery	Sept. 5, 1933
1,987,603	Claesson	Jan. 15, 1935
2,243,610	Spreng	May 27, 1941
2,327,204	McLemore	Aug. 17, 1943

Number	Name	Date
2,369,154	McLemore	Feb. 13, 1945
2,391,027	McLemore et al.	Dec. 18, 1945

FOREIGN PATENTS

Number	Country	Date
7,360	Australia	May 11, 1928
13,136	Australia	Feb. 5, 1929
16,584	Australia	Feb. 6, 1935
429,940	Germany	June 8, 1926
625,290	France	Apr. 23, 1927

OTHER REFERENCES

Publication Pacific Rural Press, Jan. 9, 1943, page 23, article on weed burners, (copy in Division 1, U. S. Patent Office).