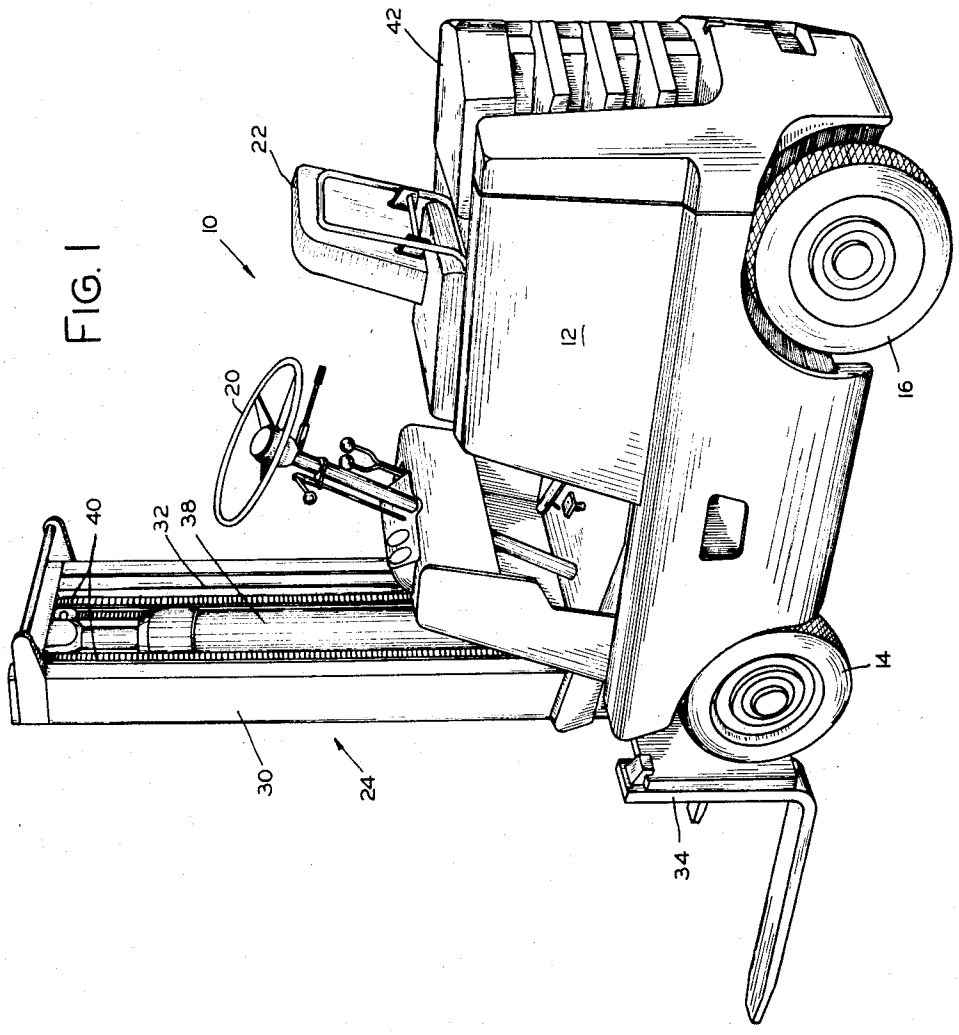
Feb. 9, 1960 C. J. COOK 2,924,296

DRY MUFFLER AND MOUNTING MEANS THEREFOR

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FIG. 1



INVENTOR.
CHARLES J. COOK
BY J. Frederick Becktel
ATTY.

Feb. 9, 1960 C. J. COOK 2,924,296

DRY MUFFLER AND MOUNTING MEANS THEREFOR

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FIG. 2

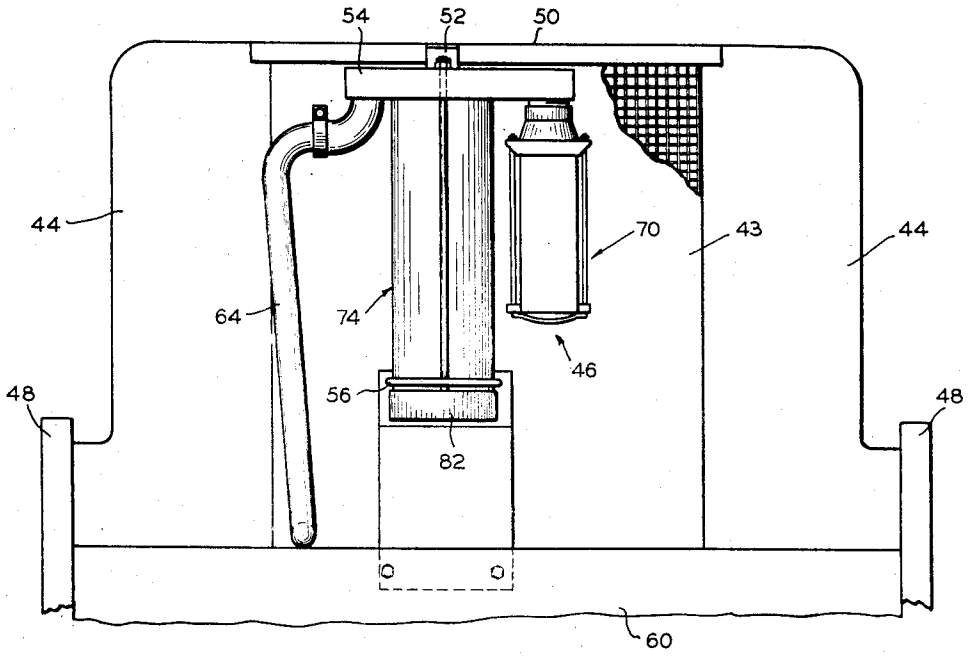


FIG. 3

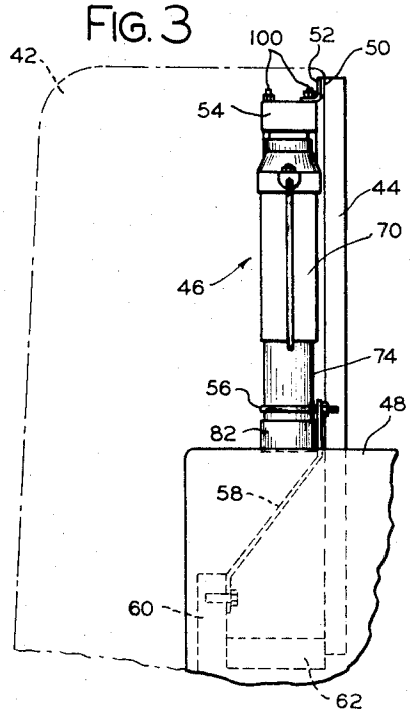
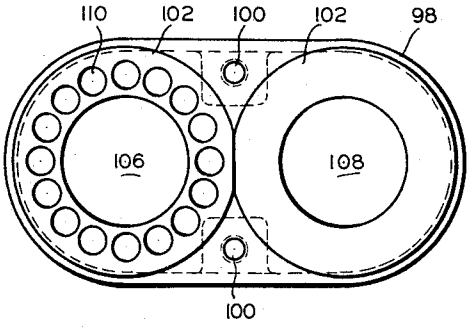


FIG. 6



INVENTOR.
CHARLES J. COOK
BY J. Frederick Bechtel
ATTY.

Feb. 9, 1960 C. J. COOK 2,924,296

DRY MUFFLER AND MOUNTING MEANS THEREFOR

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FIG. 4

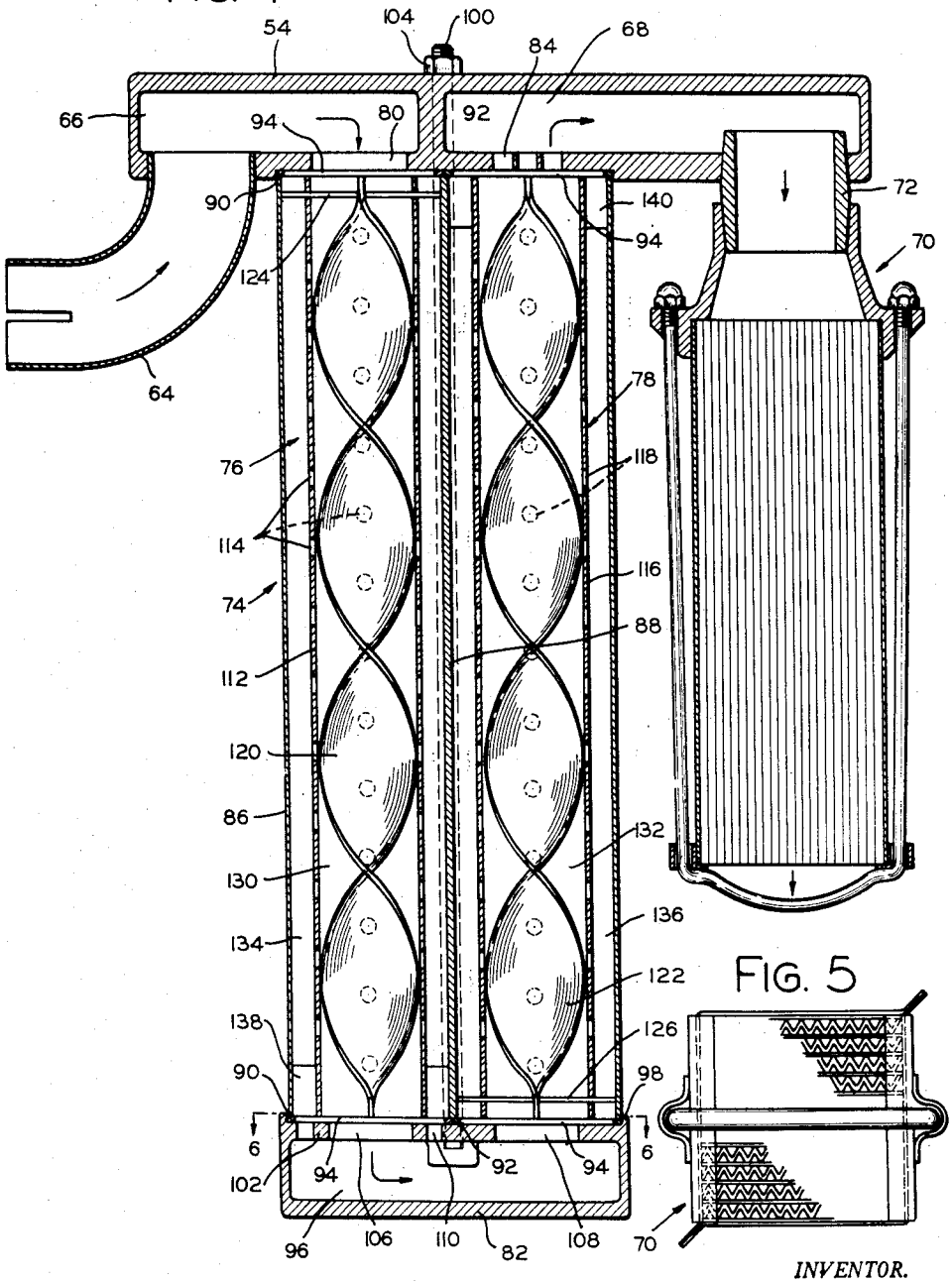


FIG. 5

INVENTOR.
CHARLES J. COOK
BY J. Frederick Bechtel
ATTY.

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2,924,296

DRY MUFFLER AND MOUNTING MEANS THEREFOR

Charles J. Cook, Hickory Corners, Mich., assignor to Clark Equipment Company, a corporation of Michigan

Application July 25, 1957, Serial No. 674,235

3 Claims. (Cl. 183—79)

This invention relates to mufflers and muffler mounting means and more particularly to an improved dry muffler of the spark arresting type which is particularly adapted for use with industrial trucks, it being mountable in such a manner as to minimize the fire hazard of the exhaust gases.

Various types of dry mufflers have been used heretofore but have been found unsatisfactory for industrial truck usage in certain operations, such as in cotton warehouses and the like, because of the fire hazard heretofore inherent in the use of such mufflers. Various attempts have previously been made to solve the problem of eliminating the hazard of fire in the use of such mufflers. Until my invention, however, none were successful.

I have devised an improved spark arresting muffler and means for mounting same in a novel manner on a vehicle which has proven wholly satisfactory for usage in such places as cotton warehouses, where the danger of fire is always a serious problem.

It is therefore a primary object of this invention to provide a dry muffler and mounting means therefor which minimizes the hazard of fire in the use thereof.

Another object of this invention is to provide a spark arresting muffler mountable in a manner which aids in eliminating or minimizing any fire hazard which might otherwise result from the exhausting of relatively hot gases therefrom.

Other objects and advantages of this invention will be apparent from the description which follows below.

In carrying out my invention I provide a double-pass reverse centrifugal flow dry muffler so constructed and arranged as to separate and trap any glowing or hot particles of carbon, which are normally entrained in the exhaust gases from the engine, so that they cannot be ejected into the atmosphere. I provide a known type of flame arrester device downstream of the gas flow through the double-pass dry muffler, and additionally provide means for mounting the entire muffler assembly in downwardly depending relation to a vehicle with which same is associated such that the exhaust of gases to the atmosphere will be directed toward the vehicle supporting surface. The vehicle supporting surface is, of course, normally earth, concrete or some equally fire resistant substance which will be unaffected by hot gases coming into contact therewith.

Heretofore, the manner of mounting the ejector end of mufflers has been such that the gaseous flow is generally parallel to the vehicle supporting surface, whereby, particularly in industrial truck usage, a truck which may be backed into a position immediately adjacent combustible material would create a serious fire hazard inasmuch as the ejection of hot gases would be directed into the combustible material.

In the drawings:

Figure 1 illustrates generally an industrial truck for which the muffler of my invention is adapted;

Figure 2 is a partial rear view in elevation of the vehicle shown in Figure 1 with the counterweight member removed and disclosing the manner of mounting and general arrangement of the muffler and associated parts;

Figure 3 is a side view of Figure 2;

Figure 4 is a cross-sectional view of the muffler assembly of my invention;

Figure 5 is a bottom view in elevation of a flame arrester device which is connected at the exhaust end of the muffler assembly; and

Figure 6 is a cross-sectional view taken along line 6—6 of Figure 4.

Referrnig now to the drawings, and first to Figure 1, the numeral 10 indicates generally an industrial lift truck. This vehicle includes a body portion 12 which is mounted on four wheels in the usual manner. In the truck illustrated, the front wheels 14 are drive wheels and operated by prime mover means such as an internal combustion engine located within body portion 12. The rear wheels 16 are dirigible wheels and are connected to an operator's steering wheel 20 by means of a conventional linkage for steering the vehicle. The operator's station, of which the steering wheel 20 is a part, includes also a seat 22.

At the front end of the body portion of the truck is located a vertically disposed telescopic mast structure indicated generally by the numeral 24. The mast structure 24 includes an outer guideway formed by a pair of channel members 30 and an inner slide structure 32. The load supporting carriage 34 is arranged to be moved upwardly and downwardly relative to the mast structure in a conventional manner by an hydraulic motor means 38 and chain and sprocket mechanism 40.

Truck 10 also includes at the rear end thereof a counterweight 42 which ordinarily is made of metal and is secured at the rear end of the truck to counterbalance loads which are carried on the fork tines at the front of the truck. The counterweight 42 is removable; mounted forwardly of the counterweight adjacent the rear end of the engine is a radiator 43.

In Figure 2, wherein the muffler assembly is generally indicated by the numeral 46, the counterweight 42 is removed in the interest of clarity and the view taken from the rear of the truck with that portion only of the truck chassis to which the muffler assembly is connected being illustrated. Figure 3 is a side view of the arrangement of Figure 2, but with the counterweight 42 illustrated in phantom view.

A pair of vertically extending and laterally spaced frame members 44 are secured at their lower ends to longitudinally extending members 48 of the truck chassis and are adapted to support the muffler assembly 46 adjacent the upper end thereof by means of a transversely extending bar 50 which is secured at its opposite ends to the frame members 44, a bracket member 52 being secured in the center portion of the bar member 50 and secured as by bolting to a casting 54 of the muffler assembly 46. The lower end of the muffler assembly is secured by means of a U-bolt 56 to a downwardly and rearwardly extending bracket 58 which is secured to a transversely extending member 60 of the truck chassis; member 60 is secured at its opposite ends to the longitudinal members 48. A frame member 62 is connected between the transverse member 60 and the vertical members 44.

An engine exhaust pipe 64 extends from the exhaust manifold of the engine, not shown, through the radiator section adjacent the lower side thereof and thence upwardly into the left end of the member 54 of the muffler assembly. Member 54 is constructed to define inlet chamber 66 and outlet chamber 68, a flame arrester unit 70 being connected to the outlet chamber 68 by means of an adaptor 72. The flame arrester may be of the general type disclosed in United States Patent 2,772,537, issued to C. Lisciani on December 4, 1956. The construction

and function of the flame arrester 70 is described in that patent. I claim no invention in the flame arrester 70 per se.

A double pass dry muffler and spark arrester assembly 74 depends downwardly from the center portion of member 54 and connects chambers 66 and 68; it comprises generally a first section 76 and a second section 78, said first section being adapted to receive the influx of exhaust gases from chamber 66 through an opening 80 in member 54 and said second section being adapted to receive the flow of gases from the first section 76 through a trap 82 and to discharge the same through an opening 84 which connects said second section to the discharge chamber 68. The first and second sections 76 and 78 of the muffler and separator portion extend vertically within a tubular member 86 and are separated from each other by a vertically extending wall 88 which extends centrally transversely of the tubular housing 86, it being connected to said housing along the edges thereof. Ring shaped members 90 are connected to the upper and lower extremities of housing 86 and include transversely extending members 92 centrally thereof which form with said ring members upper and lower openings 94 at the opposite ends of both said first and second sections for connecting said first section with chamber 66 and with a chamber 96 in trap 82, and for connecting said second section with chambers 68 and 96. Muffler section 76 is thus effectively separated from muffler section 78 except as connection therebetween is afforded through chamber 96.

The trap 82 comprises a hollow disc-shaped member closed along three sides thereof for forming the chamber 96 and being removably connected to the cylindrical housing 86 by means of an annular lip 98, which is registrable with the lower end of the housing 86, and a pair of laterally spaced elongated studs 100 which pass through longitudinally extending openings in plate member 88 and which threadingly engage the upper side 102 of trap 82, said studs being held in position by nuts 104 and, in turn, maintaining in sealed abutting relation the lower side of the housing 86 and the upper side of the trap 82. The upper side 102 of the trap defines a plurality of openings 106, 108 and 110 for a purpose to be described.

Within the tubular housing 86 to the left of wall 88, as shown in Figure 4, is located a vertically extending tubular member 112 having a plurality of vertically and peripherally spaced perforations 114 in the wall thereof. Likewise, a tubular member 116 is located within the right hand side of housing 86 on the opposite side of wall member 88 and includes a plurality of similarly located perforations 118 therein. A generally screw-shaped member 120 extends longitudinally of and within the perforated tube 112 and a similar member 122 extends longitudinally of and within the member 116, said members being formed, for example, by securing opposite ends of a strip of sheet metal, or the like, and twisting said ends in opposite directions. A transversely extending member 124 is connected to the upper end of the wall 88, to the wall of housing 86 and to the members 112 and 120 for securing same in fixed longitudinal position, and a similar member 126 is secured between the various parts adjacent thereto at the lower end of section 78 for holding members 116 and 122 in a fixed location. The member 120 forms a spiraling chamber 130 within the cylindrical member 112 and the member 122 forms a spiraling chamber 132 within the member 116. A generally annular chamber 134 is formed between the walls of members 112, 86 and 88, and a like chamber 136 is formed between the walls of members 116, 86 and 88. Hollow spacer members 138 are secured between the walls 86, 88 and 112, and members 140 between the walls 86, 88 and 116 for aiding in maintaining proper positions of the tubular members 112 and 116.

In operation, the hot exhaust gases from the engine enter the pipe 64 from the exhaust manifold and thence pass to the atmosphere by way of chamber 66, opening 94, chamber 130, openings 94 and 106, chamber 96, openings 108 and 94, chamber 132, openings 94 and 84, discharge chamber 68, and a plurality of vertical passages in flame arrester 70. As gases pass through the spiral-like chamber 130 of section 76 a swirling motion is imparted thereto. As a result, any hot glowing carbon particles which are entrained in the exhaust gases are propelled radially outwardly by centrifugal action; the vast majority of such particles pass through the perforations 114 and into chamber 134. These particles then drop downwardly in chamber 134 by gravity action through one of the openings 110 into chamber 96. The exhaust gases pass through the chamber 96 and reverse flow upon entering the second section 78 wherein the swirling motion is again imparted thereto by the element 122. Any particles remaining entrained in the gas are thrown outwardly as above described and pass through one of the perforations 118, following which they fall downwardly through annular chamber 136, being trapped in the bottom thereof by side 102 of trap 82. After the exhaust gases have passed through sections 76 and 78, they then flow through chamber 68 and flame arrester 70 wherein a large percentage of any heat remaining in the gas is removed. As pointed out hereinbefore, the now relatively cool gases are ejected vertically downwardly from the flame arrester 70 so that any heat remaining therein will not be absorbed by any combustible materials which may be located immediately adjacent to the rear of the truck.

From the above it will be seen that I have invented a centrifugal type dry muffler of unique and compact construction which is particularly adapted for use with industrial vehicles of various types, and which is mountable upon such a vehicle in a manner to eliminate or minimize the hazards of fire.

Although I have disclosed but one embodiment of my invention, it will be apparent to persons skilled in the art that modifications in the construction of the various parts may be made without departing from the scope of the invention as defined in the claims appended.

I claim:

1. A dry muffler device for use with vehicles having an upwardly extending rear portion, comprising generally downwardly extending muffler and spark arresting means, an engine exhaust member connected adjacent the upper end of said muffler means at the inlet side thereof, flame arrester means connected adjacent the upper end of the muffler means, and means defining inlet and discharge chambers extending transversely of said muffler means at the upper end thereof for interconnecting the engine exhaust member and the flame arrester means therewith, said muffler means including a pair of essentially vertical side by side gas flow conduits connecting said inlet and discharge chambers, and said flame arrester and muffler means being mounted so as to depend downwardly from and essentially parallel to the said rear portion of the vehicle, whereby exhaust gases are ejected downwardly from said flame arrester means.

2. A spark arrester and muffler device comprising a cylindrical housing member, wall means extending longitudinally and centrally of the cylindrical member and dividing said cylindrical member into two sections, a longitudinally extending perforated tubular member having a diameter which is less than the radius of said cylindrical member and extending longitudinally of the cylindrical member in each of said sections for forming a longitudinal gas flow conduit within each tubular member and a particle flow conduit on each side of said wall means radially outwardly of the tubular members, a spiral-like member extending axially of each of said tubular members for imparting a swirling motion to gas flow therethrough, and particle trap means interconnecting the one ends of said sections, whereby gas flows into the opposite end of one section, thence through said trap means and in

a reverse direction through said other section being discharged from the opposite end thereof, entrained particles in such gas being thrown outwardly into the particle flow conduit through the perforations in each of said tubular members.

3. A dry muffler and spark arresting device comprising a two-section reverse fluid flow conduit, inlet and discharge chamber defining means connected to one end thereof, a trap chamber defining member connected to the other end thereof, each section of the muffler device comprising a longitudinally extending spiral-like member, a perforated tubular member enclosing said spiral-like member and forming a chamber therewith through which fluid flows in a swirling motion, and means forming with said perforated member a longitudinally extending chamber outwardly thereof for trapping particles which are injected thereinto through the perforations in said tubular means, the fluid flowing first into one end of one of said sections, thence through the chamber in said

trap means and reversely through the second section for ejection at an end adjacent the inlet end of the first section.

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