EXHAUST SYSTEM FOR V-TWIN ENGINES

Inventor: Gar M. Adams, Chilton, WI (US)

Correspondence Address:
BAKER & DANIELS
111 E. WAYNE STREET
SUITE 800
FORT WAYNE, IN 46802

Appl. No.: 10/778,826
Filed: Feb. 16, 2004

ABSTRACT

An exhaust system for V-twin engines having a pair of engine cylinders connected to a crankcase to define a V-space therebetween. Each of the cylinders includes an exhaust port which faces outwardly of the V-space, and a pair of mufflers are attached directly to the exhaust ports of the respective engine cylinders. In this manner, the exhaust ports and mufflers are disposed outside of the V-space to promote the ready dissipation of the heat associated with the exhaust gases to the atmosphere. A common exhaust conduit is connected to both of the mufflers, and carries exhaust gases from the mufflers to a common exhaust outlet.
FIG. 1
EXHAUST SYSTEM FOR V-TWIN ENGINES

CROSS REFERENCE TO RELATED APPLICATIONS


BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to small internal combustion engines of the type used with lawnmowers, lawn and garden tractors, other small working implements, or sport vehicles. In particular, the present invention relates to an exhaust system for such engines.  

[0004] 2. Description of the Related Art

[0005] V-twin engines generally include a crankcase having a pair of cylinders, each cylinder including a cylinder bore in which a piston is reciprocatingly disposed, each of the pistons connected by a connecting rod to a common crank pin of a crankshaft rotatably carried within the crankcase. The cylinders are usually disposed at a 90° angle with respect to one another to define a V-space between the cylinders, although the angular spacing of the cylinders may vary. The crankshaft is usually disposed in a horizontal orientation when such engines are used in snow throwers, generators, or in sport vehicles, and the crankshaft is usually disposed in a vertical orientation when such engines are used in lawnmowers or in lawn and garden tractors. However, the foregoing configurations and applications may vary.

[0006] The cylinders each include an exhaust port for venting exhaust from the engine cylinders during running of the engine. Exhaust pipes communicate the exhaust from the exhaust ports to a common muffler, which is typically a separate component from the engine. The muffler is usually attached to the frame of the implement or machine with which the engine is used using suitable brackets and fasteners. The muffler may include pipes, baffles, or other structures therein for reducing the noise associated with the exhaust, and also includes an outlet for venting the exhaust to the atmosphere.

[0007] A problem with the foregoing arrangement is that motion between the engine and the implement, such as vibrations from the running engine or movement of the implement, may cause fatigue or failure within the exhaust system at the various connection points between the components of the system, such as between the exhaust pipes and the exhaust ports of the engine, or between the exhaust pipes and the muffler. Additionally, the numerous components of the exhaust system, such as the exhaust pipes, the muffler, and attachment hardware, must be separately attached to one another and/or to the implement with which the engine is used during final manufacturing of the implement.

[0008] Further, when the exhaust exits directly from the muffler, the exit point of the exhaust is necessarily directly dependent upon the location of the muffler itself. While the particular location of the exhaust outlet may not be important in many implementations with which the engine is used, it may be advantageous or necessary in some implementations to place the exhaust outlet at a specific location.

[0009] What is needed is an exhaust system for V-twin engines which is an improvement over the foregoing.

SUMMARY OF THE INVENTION

[0010] The present invention provides an exhaust system for V-twin engines of the type having a pair of engine cylinders connected to a crankcase, with a V-space defined between the engine cylinders. Each of the cylinders includes an exhaust port which faces outwardly of the V-space, and a pair of mufflers are attached directly to the exhaust ports of the respective engine cylinders. In this manner, the exhaust ports and mufflers are disposed outside of the V-space to promote the ready dissipation of the heat associated with the exhaust gases to the atmosphere. A common exhaust conduit is connected to both of the mufflers, and carries exhaust gases from the mufflers to a common exhaust outlet.

[0011] Advantageously, the exhaust conduit may be configured such that the exhaust outlet is disposed centrally with respect to the engine, to one side of the engine, or at any location with respect to the engine. In this manner, exhaust gases are carried by the exhaust conduit to a common exhaust outlet, the exhaust outlet selectively positionable with respect to the engine and/or with respect to the implement with which the engine is used.

[0012] For example, when the engine is used in a snow thrower application, the exhaust outlet may be disposed to one side of the engine and away from the discharge chute of the snow thrower, such that the hot exhaust gases are vented to the side of the snow thrower and away from the discharge chute. In this manner, melting and subsequent re-freezing of snow within the discharge chute is prevented, which could otherwise clog or impede the flow of snow through the discharge chute.

[0013] In another example, the engine is used in a generator application, in which the exhaust outlet is disposed to one side of the engine, and away from the fuel tank of the engine and the generator head of the generator.

[0014] In one form thereof, the present invention provides an internal combustion engine, including a crankcase; a pair of cylinders connected to the crankcase and defining a V-space therebetween, each cylinder including an exhaust port facing outwardly of the V-space; a pair of separate mufflers respectively attached to the exhaust ports; and an exhaust conduit connected to both of the mufflers, the exhaust conduit including at least one exhaust outlet.

[0015] In another form thereof, the present invention provides an internal combustion engine, including a crankcase; a pair of cylinders connected to the crankcase and disposed in an angular relationship to one another, each cylinder including an exhaust port; a pair of separate mufflers respectively attached directly to the exhaust ports; and a common exhaust conduit connected between the mufflers, the exhaust conduit including an exhaust outlet.

[0016] In another form thereof, the present invention provides, in combination, an internal combustion engine, including a crankcase; and two cylinders connected to the crankcase and disposed in an angular relationship to one
another, each cylinder including an exhaust port; and an
exhaust system, including two separate mufflers respectively
attached to the exhaust ports; and a common exhaust conduit
having two end portions respectively connected to the
mufflers, the exhaust conduit including an exhaust outlet.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The above-mentioned and other features and
advantages of this invention, and the manner of attaining
them, will become more apparent and the invention itself
will be better understood by reference to the following
description of embodiments of the invention taken in con-
junction with the accompanying drawings, wherein:

[0018] FIG. 1 is a front perspective view of a V-twin
engine including an exhaust system in accordance with the
present invention;

[0019] FIG. 2 is a rear perspective view of the engine of
FIG. 1, showing an exhaust conduit in accordance with a
first embodiment;

[0020] FIG. 3 is a first exploded assembly view showing
an exemplary manner in which the exhaust system of the
engine of FIG. 1 may be assembled;

[0021] FIG. 4 is a rear perspective view of the engine of
FIG. 1, showing an exhaust conduit in accordance with a
second embodiment;

[0022] FIG. 5 is a view of a first exemplary implement
with which the engine of FIG. 1 may be used, the exhaust
system including the exhaust conduit of FIG. 4;

[0023] FIG. 6 is a second exploded assembly view show-
ing an exemplary manner in which the exhaust system of the
engine of FIG. 1 may be assembled;

[0024] FIG. 7 is a sectional view taken along line 7-7 of
FIG. 6, showing the slip-fit connection between the exhaust
conduit and a muffler; and

[0025] FIG. 8 is a view of a second exemplary implement
with which the engine of FIG. 1 may be used, the exhaust
system including the exhaust conduit of FIG. 4.

[0026] Corresponding reference characters indicate corre-
sponding parts throughout the several views. The exempli-
cfications set out herein illustrate preferred embodiments
of the invention, and such exemplifications are not to be
construed as limiting the scope of the invention any manner.

DETAILED DESCRIPTION

[0027] Referring first to FIG. 1, a small internal combus-
tion engine 20 is shown as a horizontal crankshaft V-twin
engine, such as that described in detail in U.S. patent
application Ser. No. 10/409,262, entitled INTERNAL COM-
BUSTION ENGINE, filed on Apr. 8, 2003 (Attorney File Ref.:
TEL0653-02), assigned to the assignee of the present
invention, the disclosure of which is expressly incorporated
herein by reference. Although engine 20 is shown as a
horizontal crankshaft V-twin engine, the present invention
may be embodied in vertical crankshaft V-twin engines as
well. As described in further detail below, engine 20 also
includes exhaust system 21.

[0028] Engine 20 generally includes crankcase 22 having
a pair of cylinders 24 which may be mounted to crankcase
22 in the manner described in the above-incorporated U.S.
patent application Ser. No. 10/409,262. A horizontally dis-
posed crankshaft 26 is rotatably carried within crankcase 22,
and is coupled to a pair of conventional piston/connecting
rod assemblies (not shown), one corresponding to each
cylinder 24. Cylinders 24 are mounted to crankcase 22 in a
manner in which cylinders 24 are disposed at an approxi-
mate 90° angle with respect to one another, with a V-space
25 between cylinders 24.

[0029] Further details regarding the various user inter-
faces of engine 20, including the engine controls, are set forth in
detail in U.S. patent application Ser. No. 10/409,202,
titled ENGINE CONTROL SYSTEM, filed on Apr. 8, 2003 (Attorney File Ref.: TEL0683). Also, further details
regarding the air intake and air cleaner system of engine 20
are set forth in detail in U.S. patent application Ser. No. 10/408,882, entitled AIR CLEANER ASSEMBLY FOR
INTERNAL COMBUSTION ENGINES, filed on Apr. 8, 2003 (Attorney File Ref.: TEL0681). Each of the foregoing
applications are assigned to the assignee of the present
invention, the disclosures of which are expressly incorpo-
rated herein by reference.

[0030] Engine cover or shroud 28 is connected to crank-
case 22 and covers at least a portion of each of crankcase 22
and cylinders 24. Shroud 28 may be formed of a relatively
thin sheet metal, or from an injection-molded or vacuum-
formed plastic material, for example. Cylinder wraps 30,
typically made of a relatively thin sheet metal, are also
connected to crankcase 22 and cylinders 24, and closely
surround cylinders 24 for directing cooling air around cylin-
ders 24. Fuel tank 32 is mounted via brackets 34 to the
upper ends of cylinder wraps 30. Air inlet screen 36 is
mounted to shroud 28, and covers an opening in shroud 28
through which intake air is drawn by rotation of the engine
flywheel (not shown), which is attached to an end of crankshaft 26 which extends externally from crankcase 22.

[0031] Specifically, rotation of the flywheel draws intake
air through loupers 38 of air inlet screen 36 and into an area
defined between crankcase 22 and shroud 28. The intake air
then passes through an air cleaner assembly, discussed in
detail in the above-incorporated U.S. patent application Ser.
No. 10/408,882 (Attorney File Ref.: TEL0681), before enter-
ing a carburetor for mixing with fuel from fuel tank 32
to form an air/fuel combustion mixture. The air/fuel com-
bustion mixture is conducted by a pair of intake pipes (not
shown) to the intake ports (not shown) of cylinders 24. The
carburetor, intake pipes, and intake ports of cylinders 24 are
each disposed internally within V-space 25.

[0032] Referring to FIGS. 3 and 6, each cylinder 24
includes an exhaust port 40, which is disposed on a side of
each cylinder 24 opposite the intake port of each cylinder 24.
In this manner, exhaust ports 40 of cylinders 24 each face
outwardly of V-space 25 toward the sides of engine 20.
Exhaust ports 40 terminate in mounting flanges 42, which
extend outwardly of cylinder wraps 30 for attachment thereto of mufflers 44.

[0033] Exhaust system 21 generally includes a pair of
mufflers 44 and exhaust conduit 60. One muffler 44 is
directly attached to each exhaust port 40 by suitable fasten-
ers 46, which pass through apertures 48 in muffler 44 and
engage apertures 50 of mounting flanges 42 of exhaust ports
40. As shown in FIGS. 1-4 and 6, mufflers 44 are respec-
tively mounted to the outside portions of cylinders 24, and are disposed on a side of cylinders 24 which is opposite V-space 25, such that heat from exhaust ports 40 and mufflers 44 is readily dissipated into the atmosphere around engine 20, and does not collect within V-space 25.

[0034] Mufflers 44 each generally include a pair of shell halves 52 and 54 formed of a suitable metal, such as a relatively thin sheet metal or stainless steel, for example. The shell halves 52 and 54 include abutting attachment faces, and may be attached to one another by crimping the peripheral edge of one shell half over the peripheral edge of the other shell half, for example. Mufflers 44 may include various internal exhaust passages, perforated baffles, spark arrestors, sound absorbent materials, or catalytic converter elements therein in order to dissipate the noise associated with exhaust gases which pass through mufflers 44, and/or to remove potential contaminant materials from the exhaust gases.

[0035] Exhaust conduit 60 is formed of a relatively heavy gauge metal or stainless steel, for example, and includes opposite end portions 62 received within respective outlets 58 of mufflers 44 by a slip-fit, interference fit, or another suitable manner. As shown in FIGS. 3, 4, and 7, end portions 62 of exhaust conduit 60 are each attached to outlets 58 of mufflers 44 via a slip-fit, such that exhaust conduit 60 is captured between mufflers 44, with exhaust conduit shown positioned adjacent the rear portion of engine 20. Alternatively, exhaust conduit may be positioned adjacent the front portion of engine 20.

[0036] Specifically, referring to FIGS. 6 and 7, end portions 62 of exhaust conduit are received within openings 58 in shell halves 52 of mufflers which are defined by inwardly-formed lips 53 in shell halves 52. In this manner, exhaust conduit 60 may be attached to mufflers 44 concurrently with the attachment of mufflers 44 to exhaust ports 40, such that separate brackets and fasteners are not needed to attach exhaust conduit 60 to mufflers 44. For example, as shown in FIGS. 3 and 6, one muffler 44 may be first attached to its respective exhaust port 40, followed by attachment of the second muffler 44 to its exhaust port 40 with concurrent insertion of end portions 62 of exhaust conduit 60 within outlet openings 58 of mufflers to capture exhaust conduit 60 between mufflers 44. Thus, the total number of components needed to assemble exhaust system 21 is reduced, and easy assembly of exhaust system 21 is facilitated.

[0037] Exhaust conduit 60 may be covered by a protective cage to prevent incidental contact with exhaust conduit 60, which becomes heated by passage of exhaust gases therethrough during running of engine 20. Additionally, exhaust conduit 60 may optionally include perforations 66, as shown in FIG. 2, for venting exhaust gases at any location along exhaust conduit 60.

[0038] As shown in FIG. 2, exhaust conduit 60 includes outlet 64 through which exhaust gases may exit exhaust conduit 60. Outlet 64 vents exhaust gases from both of mufflers 44, and is therefore a common outlet for mufflers 44. As shown in FIG. 2, outlet 64 is positioned centrally behind engine 20 and substantially above the power take-off ("PTO") end of crankshaft 26. Outlet 64 may include a cover, such as a perforated screen, a mesh material, or a suitable spark arrestor.

[0039] Alternatively, referring to FIG. 4, outlet 60 of exhaust conduit 60 may be configured such that it faces to one side of engine 20 to thereby vent exhaust gases to the atmosphere along one side of engine 20. Thus, outlet 64 of exhaust conduit 60 may be selectively positioned or configured in order to vent exhaust gases from exhaust gas conduit 60 at any desired location around engine 20, depending upon the particular application or implement with which engine 20 is used.

[0040] For example, referring to FIG. 5, snow thrower 70 is shown, which generally includes transaxle 72 having wheels 74, and engine 20 mounted above transaxle 72. Handle 76 is mounted to transaxle 72 or another portion of snow thrower 70 to allow same to be maneuvered and wheeled about by a user. Auger assembly 78 is mounted to a front end of transaxle 72, and includes auger 80 driven by engine 20 through transaxle 72. Auger assembly 78 also includes discharge chute 82, through which snow is discharged after collection by auger assembly 78.

[0041] As shown in FIG. 5, outlet 64 of exhaust conduit 60 is configured to vent exhaust gases outwardly toward the side of engine 20 and snow thrower 70, and away from discharge chute 82. Therefore, the heat associated with the exhaust gases is directed away from discharge chute 82 such that snow within discharge chute 82 is prevented from melting and re-freezing therewithin, which could clog or obstruct the flow of snow through discharge chute 82.

[0042] In FIG. 8, generator set 90 is shown, including engine 20 and generator head 92. Engine 20 is mounted to, and supported by, skid frame 94. Skid frame 94 may include wheels and a handle (not shown) to allow same to be moved about by an operator. Generator set 90 may further include additional components (not shown), such as a control panel, battery, etc., mounted to generator head 92 and/or skid frame 94.

[0043] Generator head 92 is also attached to and supported by skid frame 94 and further, is operably attached to engine 20 in a manner in which generator head 92 is driven by crankshaft 26 of engine 20. As shown in FIG. 8, outlet 64 of exhaust conduit 60 is configured to vent exhaust gases outwardly toward the side of engine 20 and skid frame 94. Therefore, the heat associated with the exhaust gases is directed away from components of generator set 90, such as fuel tank 32 of engine 20, generator head 92, the control panel of generator set 92, etc., and to the side of skid frame 94.

[0044] Thus, it can be seen that exhaust assembly 21 of the present invention allows the directing of exhaust gases from cylinders 24 to a common outlet 64 which may be positioned at any location with respect to engine 20 in order to accommodate the particular construction of the implement or machine with which engine 20 is used.

[0045] While this invention has been described as having a preferred design, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.
What is claimed is:

1. An internal combustion engine, comprising:
   a crankcase;
   a pair of cylinders connected to said crankcase and
defining a V-space therebetween, each cylinder includ-
ing an exhaust port facing outwardly of said V-space;
   a pair of separate mufflers respectively attached to said
eaxhout ports; and
   an exhaust conduit connected to both of said mufflers, said
   exhaust conduit including at least one exhaust outlet.

2. The internal combustion engine of claim 1, wherein
   said exhaust ports are disposed on respective sides of said
   cylinders which are opposite said V-space.

3. The internal combustion engine of claim 1, wherein
   said exhaust conduit includes opposite end portions, said
   end portions respectively attached to said mufflers.

4. The internal combustion engine of claim 3, wherein
   said exhaust conduit is attached at said opposite end portions
   to said mufflers via a slip-fit connection, said exhaust
   conduit captured between said mufflers.

5. The internal combustion engine of claim 1, wherein
   said exhaust outlet is positioned centrally with respect to
   said cylinders, said exhaust outlet directing exhaust outwardly
   of said engine.

6. The internal combustion engine of claim 1, wherein
   said exhaust outlet is positioned centrally with respect to
   said cylinders, said exhaust outlet directing exhaust gases outwardly
   to one side of said engine.

7. The internal combustion engine of claim 1, wherein
   said cylinders are disposed in a perpendicular relationship
   with respect to one another.

8. The internal combustion engine of claim 1, wherein
   said mufflers are attached directly to said exhaust ports.

9. An internal combustion engine, comprising:
   a crankcase;
   a pair of cylinders connected to said crankcase and disposed
   in an angular relationship to one another, each said
   cylinder including an exhaust port;
   a pair of separate mufflers respectively attached directly to
   said exhaust ports; and
   a common exhaust conduit connected between said muff-
   lers, said exhaust conduit including an exhaust outlet.

10. The internal combustion engine of claim 9, wherein
    said cylinders define a V-space therebetween, said exhaust
    ports disposed on a side of said cylinders opposite said
    V-space, said mufflers disposed externally of said V-space.

11. The internal combustion engine of claim 9, wherein
    said exhaust outlet is positioned centrally with respect to
    said cylinders, said exhaust outlet directing exhaust outwardly
    of said engine.

12. The internal combustion engine of claim 9, wherein
    said exhaust outlet is positioned adjacent one of said cylin-
    ders, said exhaust outlet directing exhaust gases outwardly
to one side of said engine.

13. The internal combustion engine of claim 9, wherein
    said cylinders are disposed in a perpendicular relationship
    with respect to one another.

14. The internal combustion engine of claim 9, wherein
    said exhaust conduit includes a pair of end portions, said end
    portions respectively attached to said mufflers.

15. The internal combustion engine of claim 14, wherein
    said exhaust conduit is attached at said opposite end portions
    to said mufflers via a slip-fit connection, said exhaust
    conduit captured between said mufflers.

16. In combination:
   an internal combustion engine, comprising:
   a crankcase; and
   two cylinders connected to said crankcase and disposed
   in an angular relationship to one another, each cy-
   linder including an exhaust port; and
   an exhaust system, comprising:
   two separate mufflers respectively attached to said
   exhaust ports; and
   a common exhaust conduit having two end portions
   respectively connected to said mufflers, said exhaust
   conduit including an exhaust outlet.

17. The combination of claim 16, wherein said end
    portions of said exhaust conduit are respectively attached to
    said mufflers via a slip-fit connection, said exhaust conduit
    captured between said mufflers.

18. The combination of claim 16, wherein said cylinders
    define a V-space therebetween, said exhaust ports disposed
    on a side of said cylinders which faces outwardly of said
    V-space.

19. The internal combustion engine of claim 16, wherein
    said exhaust outlet is positioned centrally with respect to
    said cylinders, said exhaust outlet directing exhaust outwardly
    of said engine.

20. The internal combustion engine of claim 16, wherein
    said exhaust outlet is positioned adjacent one of said cylin-
    ders, said exhaust outlet directing exhaust gases outwardly
to one side of said engine.

* * * * *