This invention relates to improvements in power plant and engine arrangement, and more particularly to an improved disposition of operating engine accessories of engines of internal combustion type, in relation to direct-connected power-consuming units, for example, a generator closely and directly coupled to the engine by which it is driven.

In present day marine and railway installations, and in the case of many stationary installations, it is highly advantageous so to arrange an engine in relation to a power-consuming unit driven thereby, and to arrange the operating engine accessories, such as pumps, blowers and other power-requiring adjunctives of the engine proper, such as to require a minimum of space about the engine, and so as to most economically to utilize the usually limited head room above the engine, as well as to minimize the overall length of the power plant. It is, in many cases, of equal importance to economize on requirement of overall width of the power plant, and particularly that of the engine proper, so as to provide head room and easy access for an operator for routine attention to each side of the engine, and for access to controls and to all operating portions of the plant. The present invention has as its major objective, the attainment of the foregoing advantages in a measure considerably improved over that hereetofore attained in direct-connected installations of comparable type. The present invention is particularly applicable to vertical multi-cylinder internal combustion engines, and in the particular example selected for present disclosure, is shown as applied to a two-cycle engine of this type, employing a blower as a source of scavenging air. The reference in the specification and claims to a vertical engine, is not intended to exclude V type designs, but is utilized to embrace all of the several types wherein the height of the engine proper is one of its predominant dimensions.

Another important object of the invention may be stated as attained in an improved location and mounting of a blower on an engine of vertical type, and such that the blower is easily removable, and upon removal, permits full access to, and easy removal and replacement of the direct-connected power-consuming unit, such as a generator.

Another object akin to those heretofore stated, is attained in an improved flange mounting at the load end of an engine frame structure, such that, when the blower is removed, full vertical clearance is provided to enable lifting or lowering the generator or other power-consuming unit, so as to permit it to swing clear of the end of the engine frame and yet, when the parts are operatively assembled, to utilize to fullest advantage, the space at the end of the power take-off end of the engine.

Yet another object may be stated as an improved disposition and arrangement of operating engine accessory, such as to keep both sides of the engine free and clear for purposes of service and access.

The foregoing and numerous other objects and advantages of the invention will appear as the description proceeds, when considered in conjunction with the accompanying drawing, hereinafter referred to.

The invention in its broader aspects is applicable to an engine designed and arranged for direct-connection to any of the usual or suitable power-consuming units such as an electric generator, a mechanical or hydraulic reduction gear, hydraulic coupling, or any other rotary mechanism of a type which may be connected directly to a crankshaft extension or other power take-off shaft of the engine, and which will usually be coupled closely thereto. Accordingly, the unit described as a power-consuming unit, although illustrated and exemplified as an electric generator, should be taken to include any rotary mechanism which may be employed as the driven apparatus in a direct-connected power plant. Similarly, although the operating engine accessory of the presently selected embodiment of the invention, consists of a scavenging air blower, it may likewise consist of any of the operative adjuncts necessary to the operation of the engine and forming a part thereof.

In the drawing, Fig. 1 is a top or plan elevation of an engine constructed in accordance with the present improvements, together with a direct-connected electric generator; Fig. 2 is a side elevation of the power plant shown by Fig. 1, and Fig. 3 is a fragmentary vertical sectional elevation, somewhat enlarged, of the assembly shown by Figs. 1 and 2 and as viewed along line 3—3 of Fig. 1.

Referring by characters of reference to the drawing, a generator 8 is shown only in outline, as the parts and internal construction thereof are not material to the present improvements or design. A generator shaft 9 is shown as operatively connected through a balance and coupling device 7 to an extended end portion 5 of the lower crankshaft 9 of the engine. The en-
engine includes a sub-base and case portion 10, a
frame structure thereafter, indicated generally at
11, an exhaust belt or deck including a man-
fold 12 provided with a connection 13 for the
exhaust piping. The engine controls are exem-
plified in the present disclosure by a lever 15.
The frame 11 is provided by preference, with a
frame extension 16 at its load end, this extension
being provided with flanges such as 17
equipped with a plurality of holding screws 18 for the
detachable securing of the casing 16 of a
scavenging air blower indicated generally at 20.
The blower is of a modification of shafts 21 and 22, with corresponding
blower rotor elements 23 and 24 secured respecti-
vely to the shafts 21 and 22. An inlet air is
provided to the blower 25 through an inlet port
or opening 26, and the air is discharged through a
connection (not shown) into the frame of the
gine, to a space about the cylinders 31 of the
engine, one of which is shown by Fig. 3, whence
the air is available for scavenging purposes as
through the ports 23, as from an air belt, cham-
ber or manifold 33. The details of the air pas-
sages into and internally of the frame of the
equipment form of themselves no part of the present
invention but are described and claimed in a
co-pending application of Hans Davids, et al., filed
August 28, 1939, and bearing Serial No. 202,233;
also a co-pending application of James W. Owens,
filed August 28, 1939, and bearing Serial No.
202,250.
The engine disclosed is of two-cycle opposed
piston type, embodying a plurality of the cylin-
ders 31. The cylinder proper is provided by a re-
movable liner assembly, constituting the subject
matter of a co-pending application of Antonse et al.,
filed December 30, 1938, and bearing Serial No.
249,434. Each cylinder is
provided with a pair of pistons 34 and 35 con-
ected respectively, through rods 36 and 37 to
the lower and upper crankshafts of the engine, the
latter thereof being indicated at 38 and the upper
 crankshaft at 40. These crankshafts are
operatively connected in timed relation through
the provision of a sprocket 41 on shaft 38, a cor-
responding sprocket 42 on shaft 39 and a silent
chain 43 engaging the sprockets.
A power drive for the operating engine acces-
sory such as the blower 25, is shown as including
a gear 48 secured to an extension 49 of crank-
shaft 40. With gear 45 meshes a smaller gear
47 carried by the lower blower shaft 21; shaft 21
also carries a gear 46 which meshes with a
companson gear 49 on shaft 22. It will thus ap-
ppear that through rotation of the shaft 40 the
blower drive is effected through gears 45,47, and
the two rotor shafts of the blower are revolved in
the usual definite relation through gearing 49
and 48, the blower being driven at somewhat high-
er speed than the crankshafts due to the en-
up relation provided by the larger gear 45 and smaller
47.
It will clearly appear from the drawing that
the zone of the detachable flange securing of the
blower casing to the engine frame, as through
flanges 17, is substantially in the same trans-
verse plane as the inner end of the body of the
generator 5. Thus when the blower is removed,
as may be easily done, the generator may be read-
ily disconnected from the balancing and coup-
ing device 7 and vertically hoisted or lowered into
place for ease of assembly and removal.
It will have appeared that the location of one
of the larger operating engine accessories such
as the blower, at the load end of and in over-
hanging relation to the generator, serves to clear
both sides of the engine so as to enable ready
access to practically all operating parts thereof
at all times, and to provide an increased width of
runway for the engine attendant at each side of the
power plant.
The current design is preferably embodied in
an arrangement of the overhanging blower such
that the casing 16 does not extend appreciably
above the removable hood elements 50 which
overlap the upper crankshaft, and hence does not,
in spite of its size, add anything to the head room requirement of the engine.
Otherwise expressed, this operating engine adjunct
exemplified by the blower, utilizes only a space
above the generator or similar unit, which
would otherwise be waste space, and since it does not
add to the overall width of the engine proper, be-
ing within the confines thereof, offers an espe-
cially advantageous location in installations such
as those in submarines, as well as in railway us-
age, and in fact in any arrangement where space
about the power plant is at a premium.
Although the design is shown as ar-
anged with its rotor axes, being those of shafts
21 and 22, in the same vertical plane as the
shaft of generator 5, in case the generator frame is
relatively higher, the blower may be mounted
otherwise than as shown.
From the foregoing it will have appeared that
the arrangement illustrated and described, fully
attains each of the several objectives herein-
above expressed, as well as the other advantages
appearing from the more detailed description of
the arrangement selected for disclosure.
Although the invention has been described
by making rather specific reference to a selected
embodiment thereof, it is to be understood that
many changes may be made in the structure and
arrangement of parts, without departing from the
spirit and intended scope of the invention as de-
efined by the claims heretofore appended.
I claim as my invention:
1. A direct-connected power plant including a
vertical multi-cylinder, two-cycle, opposed-pis-
ton engine having an upper crankshaft, a lower
 crankshaft, and a positive operative connection
between the two crankshafts, a generator closely
 coupled to the lower crankshaft, the engine in-
cluding a frame structure provided with an ex-
tension on the upper portion of its generator-
load end, said upper crankshaft projecting into
said frame extension and having a gear element
secured thereto, a Roots type blower detachably
carried by said frame extension and projecting in
overhanging relation to the generator, the blower
 including a pair of gear-connected rotor shafts,
couer projecting inwardly of said frame
extension and having a pinion secured thereto,
operatively meshing with said engine crankshaft
gear element, the other of said blower rotor shafts
being substantially in axial alignment with the
upper crankshaft of the engine, the zone of con-
nection of the blower to the overhanging portion
of the engine frame being axially inward of the
generator, whereby to provide for vertical clear-
ance for lifting the generator or parts thereof
vertically with respect to its mounting, upon re-
moval of the blower.
2. A direct-connected power plant including a
vertical multi-cylinder, two-cycle, opposed-piston
engine having an upper crankshaft, a lower
 crankshaft, and a positive operative connection
between said crankshafts, a generator closely
coupled to the lower crankshaft, the engine including a frame structure provided with an extension on the upper portion of its generator-load end, said upper crankshaft projecting into said frame extension and having a gear element operatively secured thereto, a Roots type blower detachably carried by said frame extension and projecting in overhanging relation to the generator, the blower including gear-connected upper and lower rotor shafts, the upper shaft thereof being substantially in axial alignment with the upper crankshaft of the engine, and the lower shaft of the blower projecting inwardly of said engine frame extension and having a pinion secured thereto, operatively meshing with said crankshaft gear element, for driving the blower, said gear and pinion being relatively adapted for effecting a blower speed substantially greater than the engine speed, the zone of connection of the blower to the overhanging portion of the engine frame being axially inward of the generator, whereby to provide for vertical clearance for lifting the generator or parts thereof vertically with respect to its mounting, upon removal of the blower.

ANKER K. ANTONSEN.