June 15, 1954 A. SCHNÜRLE ET AL 2,681,050

CYLINDER FOR INTERNAL-COMBUSTION ENGINES

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Fig. 1

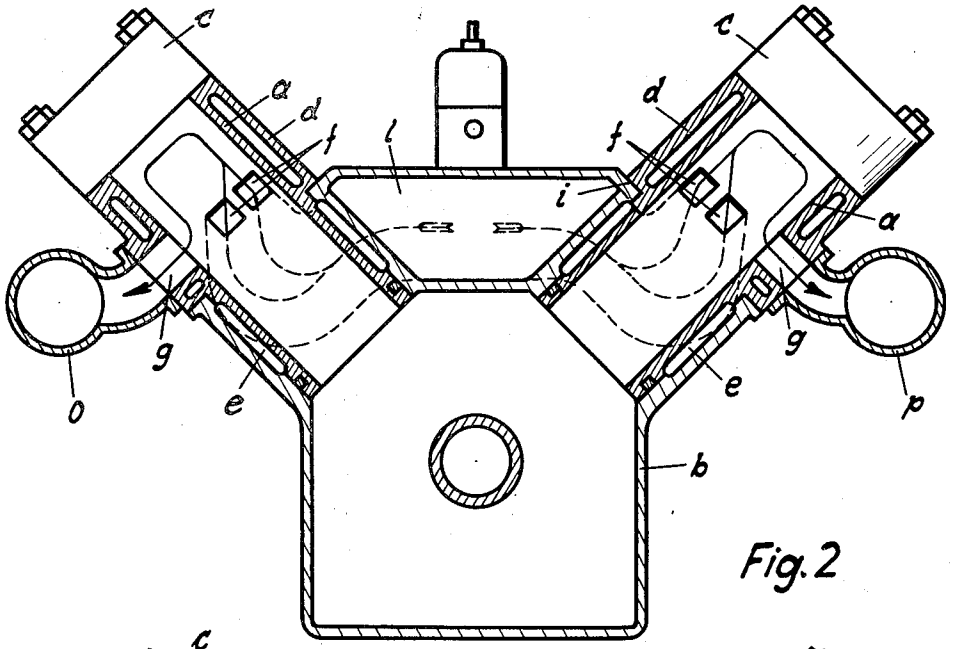
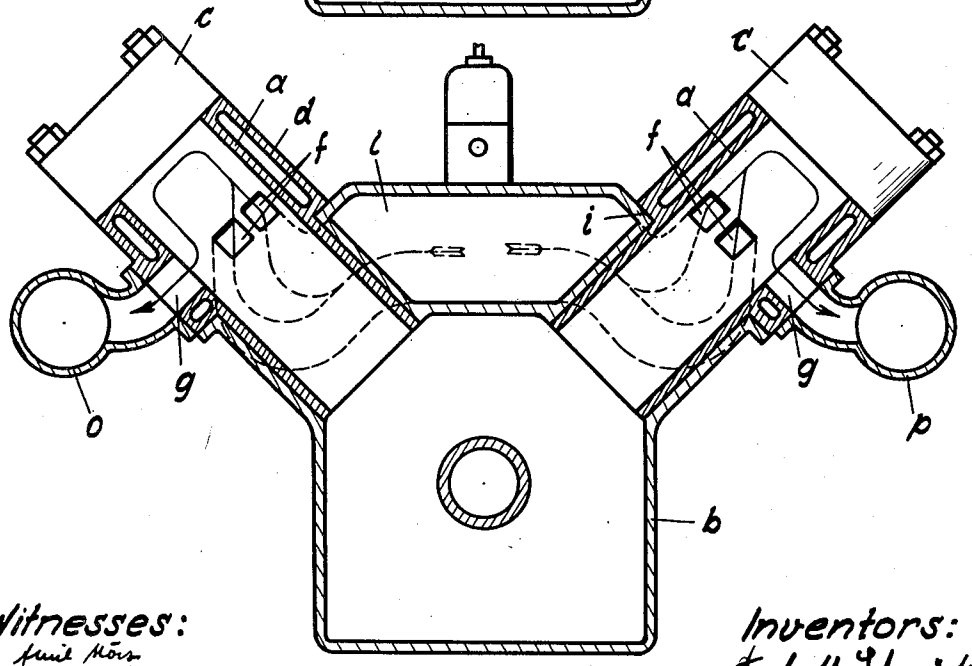


Fig. 2



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Fig. 3

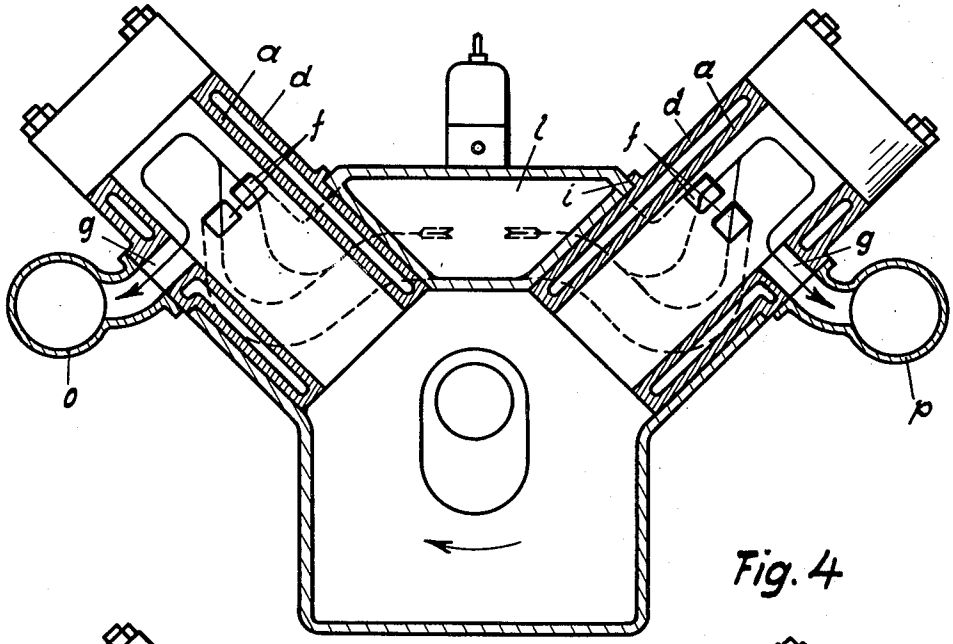
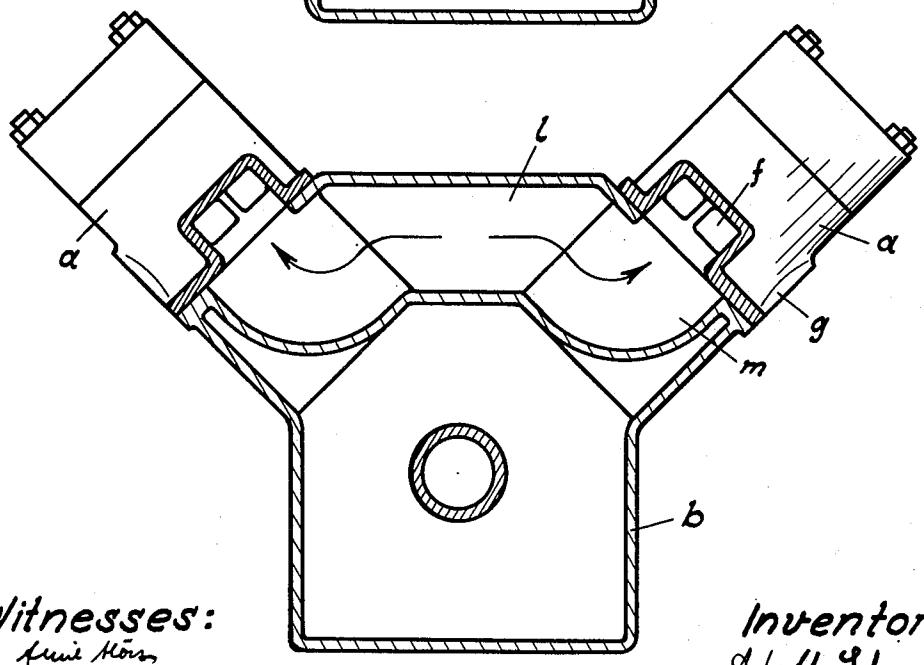


Fig. 4



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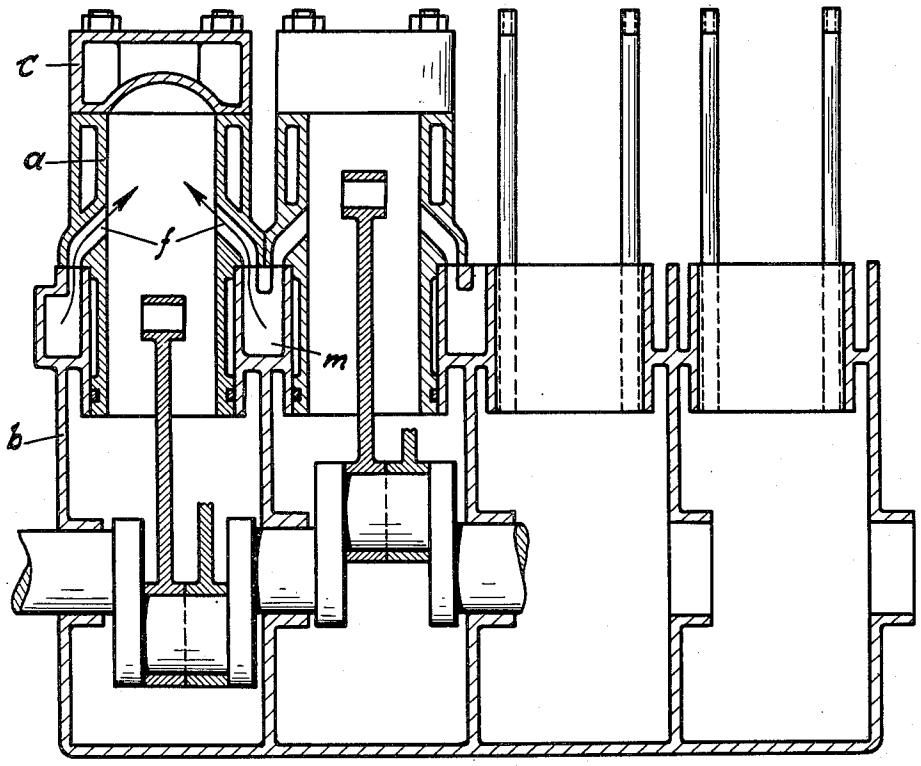
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Fig. 5



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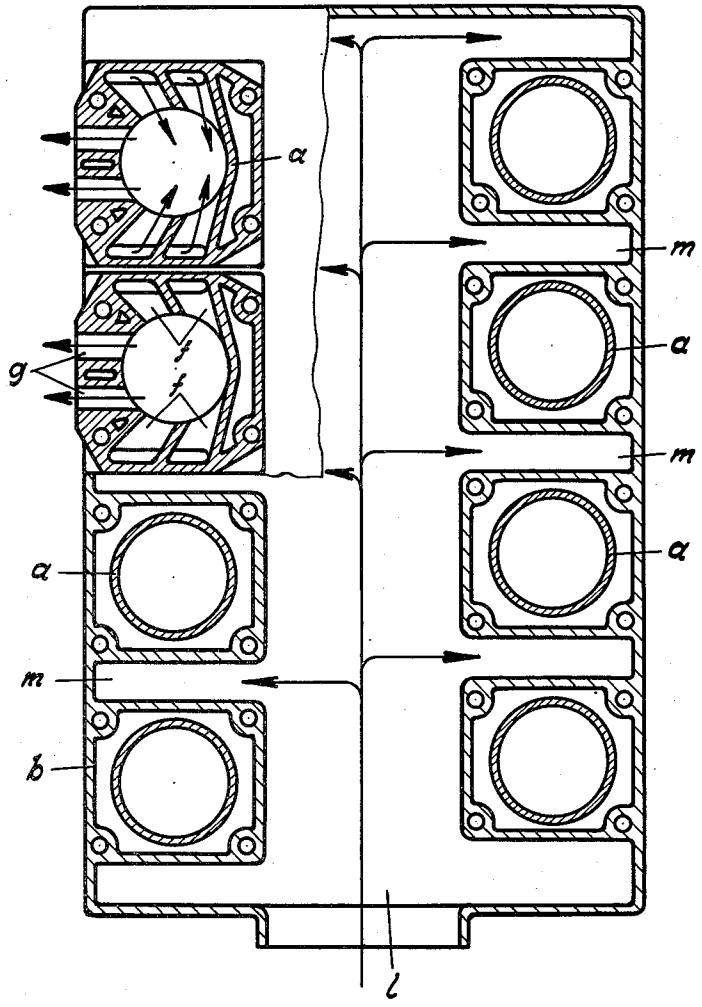
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CYLINDER FOR INTERNAL-COMBUSTION ENGINES

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Fig. 6



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2,681,050

CYLINDER FOR INTERNAL-COMBUSTION ENGINES

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Application April 19, 1950, Serial No. 156,744

Claims priority, application France June 22, 1948

5 Claims. (Cl. 123—41.74)

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This application is a continuation-in-part of our application for patent of the United States, Serial No. 37,866, filed July 9, 1948, now abandoned.

The present invention relates to two stroke cycle V-type engines in which the scavenging and exhaust ports of the engine cylinders are opened and closed by the engine pistons. The scavenging air is distributed to the engine cylinders from a scavenging air reservoir located in the engine crankcase.

In such two-stroke cycle engines exacting requirements must be met as regards the scavenging of the cylinders. The design of the passageways (conduits) leading from said reservoir to the cylinder barrels should be as simple as possible and should also afford favorable flow conditions of the scavenging air passing through them. In conjunction with a satisfactory scavenging performance, a favorable arrangement of the exhaust passageways and manifolds is desired so that the scavenging and exhaust system of the engine does not unduly enlarge the overall space requirements of the engine while avoiding excessive heating effects upon the control and fuel-supply components of the engine. To conjointly satisfy these various desiderata in V-type engines has been a difficult problem.

It is therefore an object of our invention to provide a two-cycle V-type engine of compact design with a scavenging and exhaust system which combines the advantages of good scavenging performance with a design superior to those heretofore known as regards minimized thermal and space-limiting effects upon other engine components.

According to the invention, the cylinders of a V-type engine have their respective lower portions seated in the crankcase. The upper portions of the cylinders are provided with exhaust and scavenging ports designed for a reverse loop system of scavenging, the scavenging ports being arranged on both sides of the exhaust ports. The cylinders are provided with conduits leading to the scavenging ports. Scavenging air is supplied to these conduits through lateral branches of a scavenging air reservoir which is located in the upper portion of the crankcase in the V-space between the two banks of cylinders. The lateral branches extend within the bank contour between each two adjacent cylinders and at the ends of each bank. The exhaust ports of the cylinders in each bank face the outside of the bank. The scavenging conduits for each cylinder curve from the branches of the air reservoir upwardly to the respective scavenging ports between the cylinders and at the end of each bank and have at each scavenging port a direction pointing toward the cylinder wall portion opposite the exhaust ports.

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The cylinders may be provided with a water jacket extending the entire length of the cylinders or with a water jacket surrounding only the upper portion of the cylinder, the water jacket of the lower cylinder portion then being formed by the cylinder and by the crankcase or being dispensed with entirely.

Cylinders of the above design provide for good conditions of flow for the scavenging air and for a favorable location of the exhaust manifolds. The exhaust manifolds, being located on the outer sides of the cylinder banks, can easily be removed and reinstalled making the exhaust ports readily accessible for cleaning. Due to this location of the exhaust manifolds, the accessories, such as the fuel pump or fuel injection pump, located between the cylinder banks are not subjected to the heat radiating from the exhaust manifolds. This location of the exhaust manifolds also reduces the over-all height of the engine.

The accompanying drawings show several examples of engines according to the present invention.

Fig. 1 is a transverse sectional view of a V-type engine showing the engine cylinders, crankcase and scavenging-air reservoir. The water jacket of the lower cylinder portion is here formed by the cylinder and the crankcase.

Fig. 2 shows a transverse sectional view of a V-type engine similar to that of Fig. 1 but having the lower portions of the cylinders not surrounded by coolant.

Fig. 3 shows a transverse sectional view of a V-type engine also similar to that of Fig. 1, the lower cylinder portions of this engine being surrounded by a water jacket which forms an integral part of the cylinder.

Fig. 4 shows a different transverse sectional view of a V-type engine of the design shown in the previous figures; the section being taken through the lateral branches of the air reservoir.

Fig. 5 shows a longitudinal sectional view of two cylinders of a 4-cylinder bank of a V-type engine.

Fig. 6 shows a longitudinal sectional view of an 8 cylinder V-type engine, the sectional plane passing generally through the crankcase and, for two of the cylinders, through the exhaust and scavenging ports.

In the different engine designs shown the cylinders *a* are individually cast units. The lower portions of the cylinders are inserted in the crankcase *b*. The cylinders have separate heads *c*. The upper portions of all cylinders shown are watercooled . In both Figs. 1 and 2, the upper cylinder portion has an integrally cast water jacket *d*. The lower portions, however, differ from each other, the lower portion in Fig. 1 being designed as a wet liner and the lower portion in Fig. 2 as a dry liner. In Fig. 1 the lower water jacket *e* is formed by the cylinder wall and the crankcase.

In the engine shown in Fig. 3, the water jacket *d* extends the entire length of the cylinder. In such an engine, the cylinders and pistons are cooled more efficiently than the cylinders shown in Figs. 1 and 2. The scavenging air conduits are likewise better cooled than in the cylinder designs shown in Fig. 1 and especially in Fig. 2.

In all illustrated embodiments, the scavenging conduits *f* and the exhaust conduits *g* are cast integrally with the cylinders and are located in the upper cylinder portions. The cylinders are scavenged according to the reverse loop scavenging principle, the cylinders having scavenging ports on both sides of the exhaust ports (see Fig. 6). The scavenging air entering the cylinders through the scavenging ports is directed towards the portion of the cylinder wall opposite the exhaust ports where it is deflected towards the cylinder head. In the cylinder head the scavenging air reverses its flow and is deflected towards the exhaust ports. The flow of the scavenging air is indicated by arrows.

The cylinders are fastened at the flange surface or shoulder *i* to the crankcase *b*. All engines shown in the drawings are provided with a scavenging-air reservoir *l* which is located between the two banks of cylinders and extends the full length of the crankcase. The reservoir is cast integrally with the crankcase. The reservoir *l* is provided with lateral branches *m* (Figs. 4, 5 and 6) through which scavenging air flows to the openings of the conduits *f* of the cylinders *a*. The branches *m* of the reservoir extend laterally between each two adjacent cylinders of each bank. There are also branches at the ends of each cylinder bank. Scavenging air is thus supplied to each cylinder through two of the lateral branches. The communicating openings of the lateral branches *m* and of the conduits *f* are located in the flange surfaces *i*.

The lateral branches of the reservoir are curved in such a way that the flow conditions of the scavenging air are favorable especially where the scavenging air enters the scavenging conduits *f* of the cylinders. The conduits *f* have a bell-shaped curvature (see Fig. 5) and have at each scavenging port a direction pointing upwardly towards the portion of the cylinder wall opposite the exhaust ports.

The cylinders *a* are mounted on the crankcase *b* in such a way that the exhaust conduits *g* of both cylinder banks face towards the outside of the engine. Accordingly, the exhaust manifolds *o* and *p* are located on the outside of the engine. The V-space between the cylinder banks on top of the crankcase or air receiver is therefore available for installation of accessories or other sub assemblies, which will not be subjected to the heat radiating from the exhaust manifolds.

We claim:

1. A water-cooled two-cycle engine, comprising a crankcase, a crankshaft traversing said crankcase, a single scavenging-air reservoir located on top of said crankcase and forming an integral housing structure together with said crankcase, two V-arranged banks of cylinders mounted on said structure, said reservoir extending axially between said banks along the bottom of the V-space, each of said cylinders having a liner integral with a cooling jacket and having a peripheral shoulder portion around said jacket and forming an annular seating face in a radial cylinder plane, each cylinder having said face seated on said structure, each cylinder having exhaust duct means located above said seating face and symmetrical to a radial crankshaft plane, and each cylinder having scavenging ports located in said shoulder portion on both peripheral sides respectively of said exhaust duct means for reversed-flow scavenging, said shoulder portion having respective openings in said seating face, said openings communicating with said scavenging ports, said housing structure having lateral passages extending from said reservoir to beside and between said cylinders and communicating with said openings in said seating faces.

2. A two-cycle engine, comprising a crankcase, a crankshaft traversing said crankcase, a scavenging-air reservoir located on top of said crankcase and forming an integral housing structure together with said crankcase, said reservoir having a top wall and said structure having cylinder-seating openings slanted downwardly away from said top wall on both axial sides respectively of said structure, two V-arranged banks of cylinders seated in said openings, each of said cylinders having exhaust duct means located in a radial crankshaft plane and having two groups of exhaust ports for reversed-flow scavenging located on diametrically opposite cylinder sides in a direction parallel to the crankshaft, branch ducts extending laterally from said reservoir to beside and between the cylinders of each bank and communicating with all said scavenging ports of all cylinders, each of said cylinders having said exhaust duct means and said scavenging ports disposed on a radial cylinder plane located above and in spaced relation to said slanted seating opening for said cylinder, said plane extending in outwardly spaced relation to said top wall.

3. A two-cycle engine, comprising a crankcase, a crankshaft in said crankcase, two banks of cylinders V-arranged on said crankcase, a single scavenging-air reservoir extending along the bottom of the V-space and forming an integral structure with said crankcase, said structure having on each longitudinal outer side a wall portion inclined downwardly and outwardly away from the top of said reservoir and each of said wall portions having cylinder-seating openings, each of said cylinders being disposed in one of said openings and having a peripheral shoulder portion seated on said inclined wall portion, each of said cylinders having exhaust port means symmetrical to a radial plane of the crankshaft and having scavenging ports on both peripheral sides respectively of said exhaust port means for reversed-flow scavenging, said exhaust port means and said scavenging duct being located in said shoulder portion within a common plane upwardly spaced from said inclined wall portion, and branch ducts extending from said reservoir outwardly and upwardly to beside and between said cylinders completely within the contour of said structure and

being in communication with said scavenging ports.

4. In an engine according to claim 3, each of said cylinders having a liner and having a cooling jacket space extending from the lower end of the cylinder upwardly along said reservoir, said jacket space having a lower space portion below said shoulder portion and an upper space portion above said shoulder portion and having an inner wall formed by said liner, said upper jacket-space portion having an outer wall integral with said liner, and said housing structure having walls surrounding said lower jacket-space portion and forming the outer wall thereof.

5. A two-cycle engine, comprising a crankcase, a crankshaft in said crankcase, two banks of cylinders V-arranged on said crankcase, a single scavenging-air reservoir extending along the bottom of the V-space and forming an integral structure with said crankcase, said structure having on each longitudinal outer side a wall portion inclined downwardly and outwardly away from the top of said reservoir and each of said wall portions having cylinder-seating openings, each of said cylinders being disposed in one of said openings and having a peripheral shoulder portion, said shoulder portion forming an annular seating surface seated upon said inclined wall portion, each of said cylinders having exhaust duct means located near said shoulder portion in upwardly spaced relation to said seating surface, each of said cylinders having scavenging ducts on both

peripheral sides respectively of said exhaust port means for reversed-flow scavenging, said ducts being gradually curved and being upwardly and inwardly inclined from said seating face toward the interior of the cylinder and having respective inner ports communicating with the interior of the cylinder in the same radial cylinder plane as said exhaust port means, and said ducts having outer openings located in said seating face, and branch ducts extending from said reservoir outwardly and upwardly to beside and between said cylinders completely within the contour of said structure and being in communication with said outer openings of said scavenging ducts.

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