Feb. 23, 1954 E. C. KIEKHAEFER 2,669,979

REED VALVE UNIT FOR CRANKCASE INDUCTION ENGINES

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Fig. 1

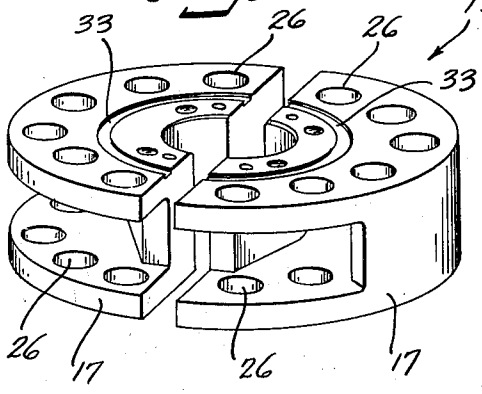


Fig. 2

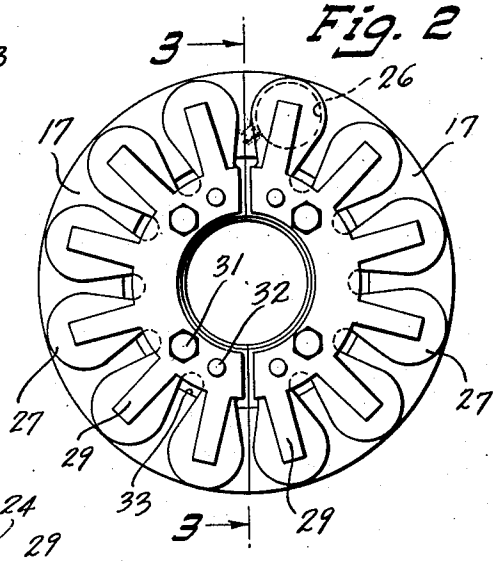


Fig. 3

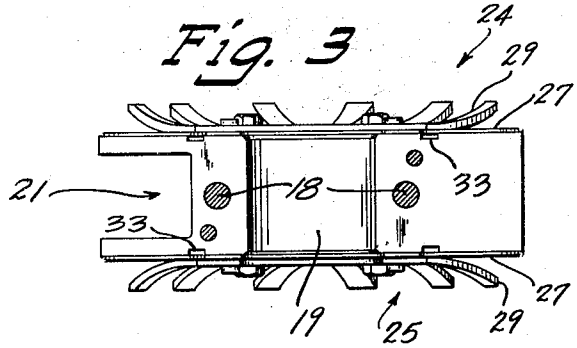


Fig. 4

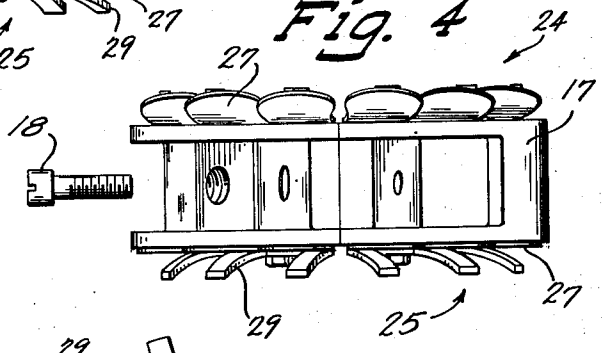
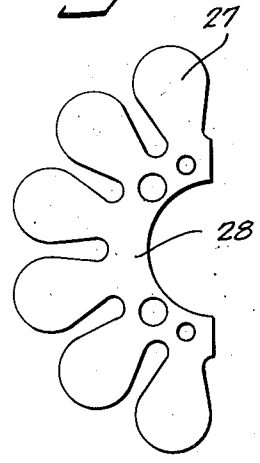


Fig. 5



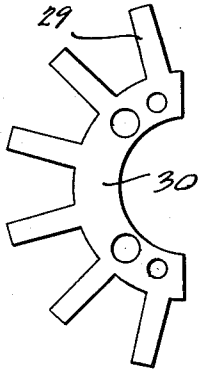


Fig. 6

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REED VALVE UNIT FOR CRANKCASE INDUCTION ENGINES

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Fig. 7

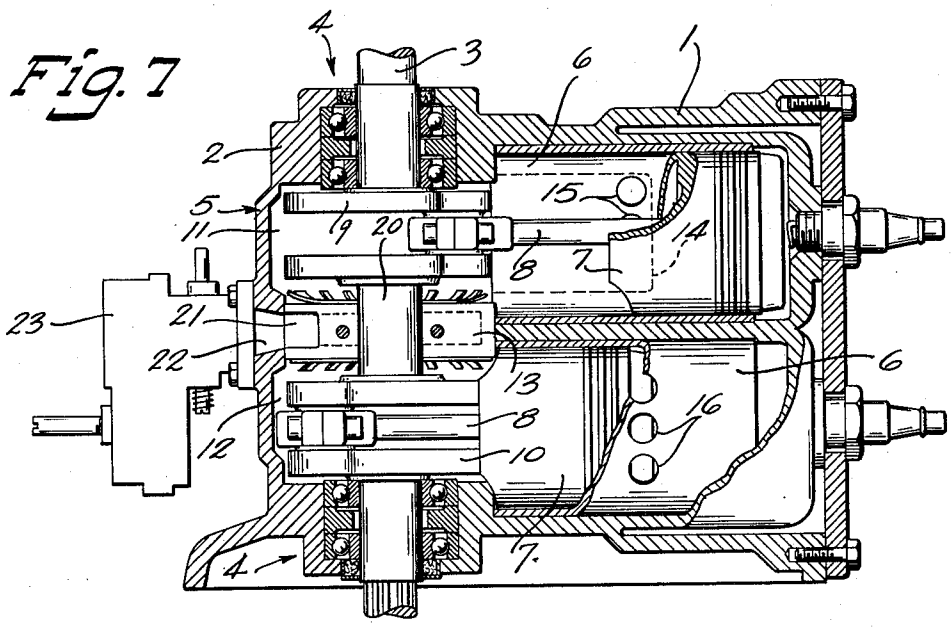
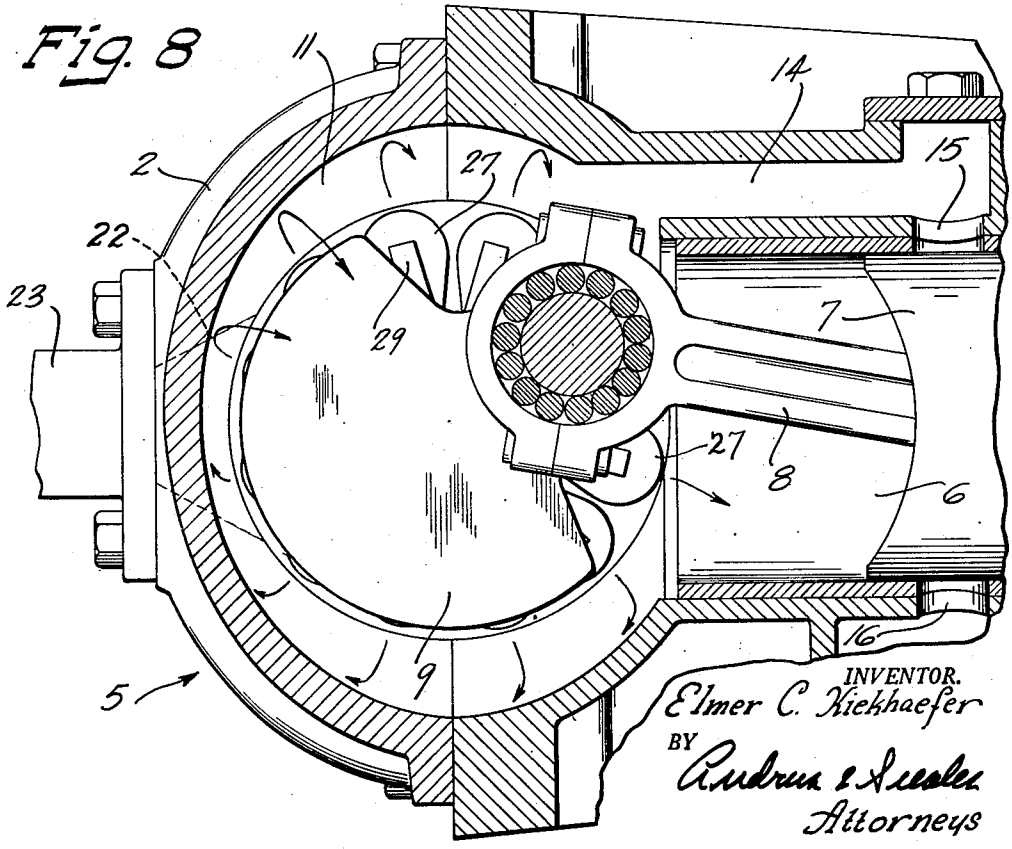


Fig. 8



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REED VALVE UNIT FOR CRANKCASE INDUCTION ENGINES

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Application September 11, 1950, Serial No. 184,242

9 Claims. (Cl. 123—73)

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This invention relates to crankcase induction valve means for two-cycle, internal combustion engines, and particularly two-cylinder, alternate firing engines.

The invention provides a crankcase induction reed valve unit which admits and directs the fuel mixture into the crankcase in streams directed radially from and arranged about the crankshaft passing through the crank chamber.

A principal object of the invention is to provide a reed valve unit which will admit greater fuel charges more efficiently into the crank chamber.

A further object is to provide a valve unit of maximum volumetric capacity without necessarily increasing the volumetric capacity of the crank chamber to accommodate the valve unit.

Another object is to provide a more efficient arrangement of the reeds with respect to the crank chamber of an engine.

A more particular object is to admit the fuel mixture into the main part of the crankcase chamber in the most direct manner whereby the engine will receive a greater amount of fuel charge with each stroke.

These and other objects and advantages will be more fully set forth in the following description of a preferred embodiment of the invention as illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a perspective view of the split bearing block adapted to support the center main bearing of an engine crank shaft and showing the passages as formed therein for the crankcase induction system of the engine;

Fig. 2 is a plan view of the joined block showing the reed sections and rocker arms therefor as arranged on one face of the block;

Fig. 3 is a view taken on line 3—3 of Fig. 2 showing the mating surface of one of the members of the bearing block;

Fig. 4 is a front elevation of the block showing the upper set of reeds in open position and the lower reeds closed;

Fig. 5 is a detail plan view of a section of the reeds;

Fig. 6 is a detail plan view of a section of the rocker arms;

Fig. 7 is a cross-sectional view of a two-cycle, alternate firing, two cylinder engine employing crankcase precompression with one piston cut away to show the intake ports and employing the reed valve-center bearing block shown in Figs. 1 to 4; and

Fig. 8 is a horizontal transverse section of the

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engine shown in Fig. 7 viewing the valve block in plan as shown in Fig. 2.

The engine shown in the drawings includes the cylinder block 1 and member 2 which join in a transverse plane passing through the axis of the engine crankshaft 3. Crankshaft 3 is supported at each end in the journal bearing assemblies 4 which close the opposite ends of the generally cylindrical crankcase 5 formed jointly by cylinder block 1 and member 2.

Each of the two cylinder bores 6 opening into crankcase 5 carries a piston 7 connected by a rod 8 to the corresponding upper and lower crank throws 9 and 10, respectively, of crankshaft 3. Crank throws 9 and 10 are spaced 180° with respect to the crankshaft axis so that the pistons reciprocate in opposite directions for alternate firing or with each 180° of crankshaft rotation.

Crankcase 5 is divided into the separate upper and lower crank chambers 11 and 12 by the bearing block 13.

In the two-cycle operation of the engine, the fuel mixture is admitted into the cylinders through the corresponding passages 14 in the side of cylinder block 1. Each passage 14 communicates with the respective crank chamber and opens through ports 15 into the respective cylinder bore 6. The exhaust gases are discharged through opposite ports 16 opening from each cylinder bore into suitable exhaust means, not shown. The intake and exhaust ports of each bore are controlled by the respective piston which opens the ports at the lower end of each piston stroke and otherwise closes the ports during the compression and power stroke.

The precompression of the fuel mixture for transfer of the mixture through passages 14 to the respective cylinder and to displace the exhaust gases remaining in the fired cylinder is effected with each crank chamber by the corresponding piston during the downward power stroke.

The two complementary, semi-circular bearing members 17 comprising block 13 are joined by bolts 18 passing therethrough on each side of a central axial bore 19 as shown in Fig. 3. Bore 19 is adapted to fit the center bearing 20 of crankshaft 3 between crank throws 9 and 10 for the journal support of the crankshaft. The outer dimension of members 17 fit the corresponding machined inner surfaces of crankcase 5 to divide the latter into chambers 11 and 12.

The induction manifold passages 21 in members 17 jointly register with the opening 22 in crankcase member 2. The carburetor 23 secured

to and carried by crankcase member 2 provides for delivery of the fuel mixture through opening 22 to passages 21 from which the fuel is selectively admitted to chambers 11 and 12 as controlled by the upper and lower reed valves 24 and 25, respectively. Opening 22 is generally circular adjacent to carburetor 23 to conform with the usual circular fuel-mixing passage, not shown, of the carburetor. The cross-section of opening 22 is generally uniform in area and extends circumferentially of members 17 to correspond with the rectangular cross-section of passages 21 where they register with opening 22. This reduces the distance from the carburetor to the valves 24 and 25 for greater induction of fuel into chambers 11 and 12 and provides a more turbulent-free flow of the air thereto.

The reed valves 24 and 25 include and control two series of valve ports 26 provided in each member 17 which open from passages 21 into the respective chambers 11 and 12. The arrangement of ports 26 and passages 21 with respect to chambers 11 and 12 is similar to that disclosed and claimed in the co-pending application of the present inventor, Serial No. 117,325, filed September 23, 1949, Patent No. 2,612,882, granted October 7, 1952, for Crankcase Induction Valve for Two-Cycle Engine.

Each port 26 may be circular as shown and is thereby readily formed by drilling. Each series of ports opens from passages 21 into the corresponding chamber and are arranged symmetrically about the bore 19 supporting the center main bearing 20 of crankshaft 3.

The flat, flexible reeds 27 are disposed normally to close ports 26 and in response to a greater pressure in passages 21 to open the ports and allow the admission of the fuel mixture to the respective chamber during the up-stroke of the corresponding piston, as described above. Reeds 27 for each series of ports in each member 17 are joined at their roots by a semi-circular base strip 28. The rockers 29 which limit the opening movement of the respective reeds are similarly formed and joined by a semi-circular base runner 30 of semi-circular form for each set of rockers 29.

Before assembly of members 17 on crankshaft 3 the reeds 27 and corresponding rockers 29 are first secured to the upper and lower faces of each member 17. The rockers are secured to member 17 by the bolts 31 with reeds 27 disposed therebetween and located thereon by the projecting pins 32 which pass through the reed base strip 28 and runner 30 of the rockers. The annular groove 33 formed in both upper and lower faces of block 13 is disposed to receive any dirt beneath the reeds. Such dirt tends to be worked into the minimum clearances between the reed and the block. By location of the groove where the curvature of the reed in an open position begins to lift from the block, the groove serves to prevent dirt or foreign matter from becoming lodged therebetween and accumulating to interfere with the full closing of the ports.

The upper and lower reed valves and block 13 are dimensioned to occupy the space around the crankshaft center main bearing 20 between crank throws 9 and 10.

Each reed 27 projects from base strip 28 radially or from a center and toward the circumferential wall of crankcase 5. In opening ports 26 the flexible reeds are lifted from block 13 by the greater pressure within passages 21 against rockers 29. The rockers limit the flexing of reeds 27 and distribute the stress by limiting the flexing generally to an arc of a circle.

When the ports 26 to either the upper or lower chambers, 11 and 12, respectively, are opened the reeds are angularly disposed with respect to the direction of flow of fuel mixture through the ports so that the fuel mixture is directed against the walls of the chamber.

The fuel mixture entering the chamber is given some rotational movement by the crankshaft 3 and otherwise enters the chamber in all directions and flows around the crank throw into the larger open center of the chamber, as shown in Fig. 8. In addition, several reeds are adjacent to the piston and cylinder bore which latter opens into the crank chamber. The reeds of the ports referred to serve to direct a flow of mixture into the bore beneath the piston.

All of the reeds controlling the ports opening into a chamber open and close substantially in unison. The arrangement of the reeds and manifold system utilizes the space between the crank throws which in engines of the class described is considerable by reason of the high bore-stroke ratio and spacing of the cylinders.

The fuel mixture may be considered to be admitted to the crank chamber about the periphery of one side or cheek of the crank throw. The radial arrangement of the reeds provides direction of the flow in divergent directions with a minimum of interference by the crank throw and allowing maximum velocity so that the maximum amount of gas mixture is admitted with each up-stroke of the piston.

Various embodiments of the invention may be employed within the scope of the following claims.

I claim:

1. In a two-cycle, internal combustion engine, a crankshaft, a crankcase having circular end walls journally supporting said crankshaft and side walls forming therewith a crank chamber adapted to receive a fuel mixture for precompression prior to transfer to the engine cylinder, a passage within one end wall of said crankcase opening thereinto through a series of ports symmetrically arranged about said crankshaft, and a reed valve normally closing each respective port and disposed with respect thereto to open into the crank chamber and direct the fuel mixture entering the chamber radially of the crankshaft and against the adjacent side wall of said crankcase.

2. In an internal combustion engine having a crankcase forming a crank chamber for induction and precompression of the fuel mixture, a crankshaft having a crank throw and a journal bearing supporting said throw, said crankcase having an end wall adjacent the crank throw and spaced therefrom and including a complementary bearing supporting said crankshaft bearing and having a side wall extending from said end wall about said crank throw, a fuel induction passage formed in said crankcase having a series of ports opening in said end wall, said ports being arranged about said bearing and opening towards said crank throw, and valve reeds fixed at one end to said end wall and having a free opposite end, the fixed ends of said valve reeds being adjacent said bearing and the free end extending toward the side wall of the crankcase, said reeds being normally seated over said ports on said end wall and subject to flexing to open said ports and allow the entry of fuel mixture therethrough into said chamber,

the opposite end of each reed being angularly disposed to deflect the fuel mixture passing through said ports radially of said crankshaft and against the adjacent wall of said chamber.

3. In a two-cycle, internal combustion engine having a crankshaft and a crank chamber receiving a fuel mixture for precompression, said chamber being substantially cylindrical and having a circular end wall spaced from the crank and normal to the axis of crank rotation, a series of ports opening into said chamber from said end wall for the delivery of fuel mixture thereto, and a series of flexible reeds having a common circumferentially extending base strip secured upon said end wall, each reed extending radially from said strip over a respective port normally closing the latter and being disposed to be lifted from said end wall to open said port and to deflect the fuel mixture entering said chamber against the side walls of said chamber adjacent the end wall thereof and around the crank into the center of the chamber.

4. In an internal combustion engine having a crankcase forming a crank chamber for induction and precompression of the fuel mixture, a crankshaft having a crank throw and a journal bearing supporting said throw, said crankcase having an end wall adjacent the crank throw and spaced therefrom and including a complementary bearing supporting said crankshaft bearing and having a side wall extending from said end wall about said crank throw, a fuel induction passage formed in said crankcase having a series of ports opening in said end wall, said ports being arranged about said bearing and opening towards said crank throw, valve reeds fixed at one end to said end wall and having a free opposite end, the fixed ends of said valve reeds being adjacent said bearing and the free end extending toward the side wall of the crankcase, said reeds being normally seated over said ports on said end wall and subject to flexing to open said ports and allow the entry of fuel mixture therethrough into said chamber, the opposite end of each reed being angularly disposed to deflect the fuel mixture passing through said ports against the adjacent wall of said chamber, and radially arranged arms secured to said end wall and projecting over each of said reeds to limit the flexing of said reeds.

5. In a two-cycle, internal combustion engine having a crankshaft and a crank chamber receiving a fuel mixture for precompression, said chamber being substantially cylindrical and having a circular end wall spaced from the crank and normal to the axis of crank rotation, a series of ports opening into said chamber from said end wall for the delivery of fuel mixture thereto, a series of flexible reeds having a common circumferentially extending base strip secured upon said end wall, each reed extending radially from said strip over a respective port normally closing the latter and being disposed to be removed from said end wall to open said port and to deflect the fuel mixture entering said chamber against the side walls of said chamber adjacent the end wall thereof and around the crank into the center of the chamber, and a circumferentially extending member secured to said end wall over said base strip and having a radially projecting arm extending over each of said reeds to limit the movement of said reeds.

6. In an alternate firing, two cylinder internal combustion engine having a crankcase for induction and precompression of the fuel mixture, a crankshaft having spaced crank throws and an intermediate journal, a split bearing member assembled on said journal and dividing said crankcase into corresponding crank chambers having side walls extending from said bearing member about said crank throws, a fuel induction passage formed in said bearing member having a series of ports opening therefrom into said chambers, said ports being arranged about said journal and opening towards the crank throws, and valve reeds having ends fixed to said bearing member, the fixed ends of said valve reeds being adjacent said journal and the free end extending toward the side walls of the crankcase, said reeds being normally seated over said ports on said member and subject to flexing to open said ports and allow the entry of fuel mixture therethrough from said passage into the respective chamber, the free end of each reed when flexed being angularly disposed to deflect the fuel mixture passing through said ports radially of said crankshaft journal and against the adjacent wall of the respective chamber.

7. In a two cylinder internal combustion engine having a crankcase, a crankshaft having spaced crank throws and an intermediate bearing supporting said throws, complementary bearing support members for said crankshaft assembled thereon and disposed to divide said crankcase into corresponding crank chambers for induction and precompression of the fuel mixture, a fuel induction passage formed in said members and a series of ports opening into each of said chambers, said ports being arranged about said bearing and opening towards the corresponding crank throw, valve reeds fixed to said members, the fixed ends of said valve reeds being adjacent said bearing and the free end extending toward the side wall of the crankcase, said reeds being normally seated over said ports on said member and subject to flexing to open said ports and allow the entry of fuel mixture therethrough into said chamber, the opposite end of each reed when flexed being angularly disposed to deflect the fuel mixture passing through said ports against the adjacent wall of said chamber, and radially extending fixed arms secured to said member and projecting over each of said reeds to limit the flexing of said reeds.

8. In a two cylinder, two-cycle, internal combustion engine having a crankshaft and a crankcase therefor receiving a fuel mixture for precompression, complementary journal bearing members assembled on said crankshaft to support the same and disposed to divide said crankcase into separate crank chambers for the respective cylinders, each member having a fuel supply passage and opposite faces forming an end wall of each chamber, a series of ports in each member opening into each of said chambers from said passages for the delivery of fuel mixture thereto, a series of flexible reeds having a common circumferentially extending base strip secured to each face of each member, each reed extending radially from said strip over a respective port normally closing the latter and movably disposed to open said port and to deflect the fuel mixture entering the respective chamber against the walls of said crankcase into the center of the chamber, and a circumferentially extending member secured to each of said members over each of said base strips and having a radially projecting arm extending over each of said reeds to limit the movement of said rods.

9. In an alternate firing, two cylinder internal combustion engine having a crankcase for induction and precompression of the fuel mixture, a crankshaft having spaced crank throws and an intermediate journal, a split bearing member assembled on said journal and dividing said crankcase into corresponding crank chambers having side walls extending from said bearing member about said crank throws, a carburetor secured to and exteriorly of said crankcase adjacent said member, fuel induction passages formed in said bearing member having a series of ports opening therefrom into said chambers, said ports being arranged about said journal and opening towards the crank throws, said crankcase having an opening from said carburetor and extending circumferentially of said member an extended distance in opposite directions to communicate with the passage thereof and provide a flow of the fuel mixture directly to a number of adjacent ports, and valve reeds having ends fixed to said bearing member, the fixed ends of said valve reeds being adjacent said journal and the free end extending toward the side walls of the crankcase, said reeds being normally seated

over said ports on said member and subject to flexing to open said ports and allow the entry of fuel mixture therethrough from said passage into the respective chamber, the free end of each reed when flexed being angularly disposed to deflect the fuel mixture passing through said ports radially of said crankshaft journal and against the adjacent wall of the respective chamber.

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