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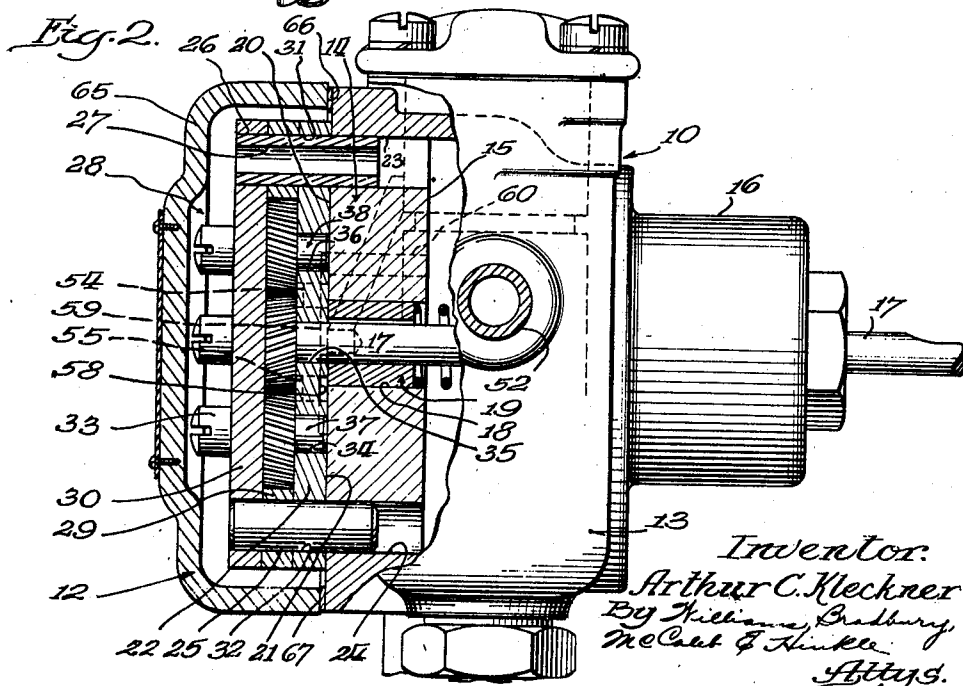
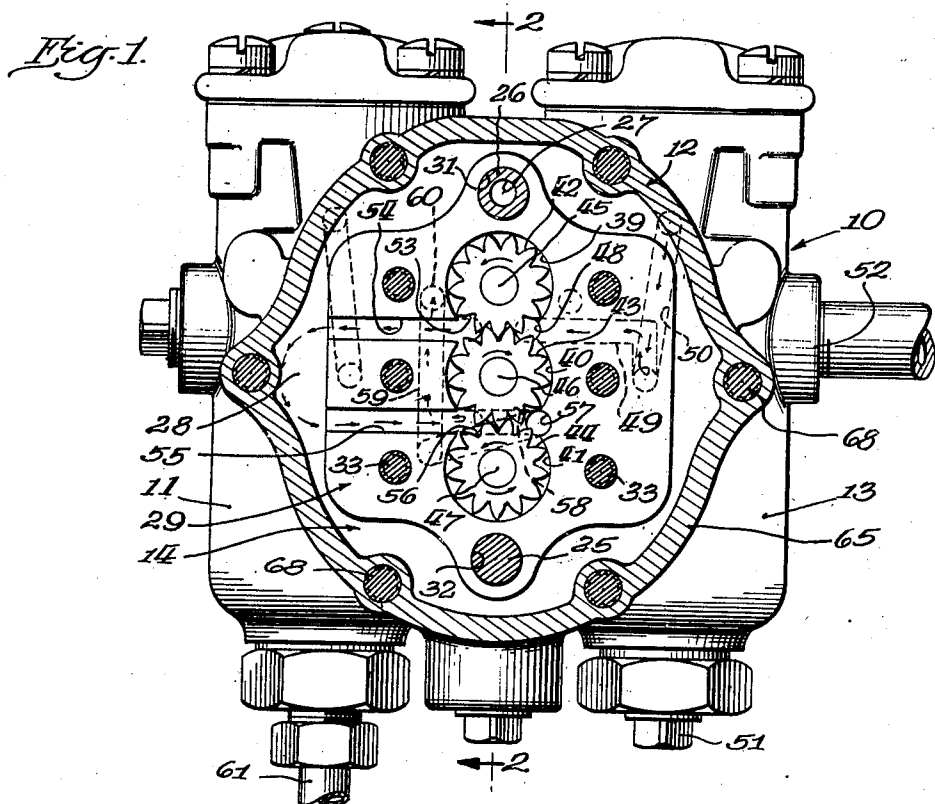
A. C. KLECKNER

2,256,743

FUEL PUMP

Filed Dec. 8, 1938

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

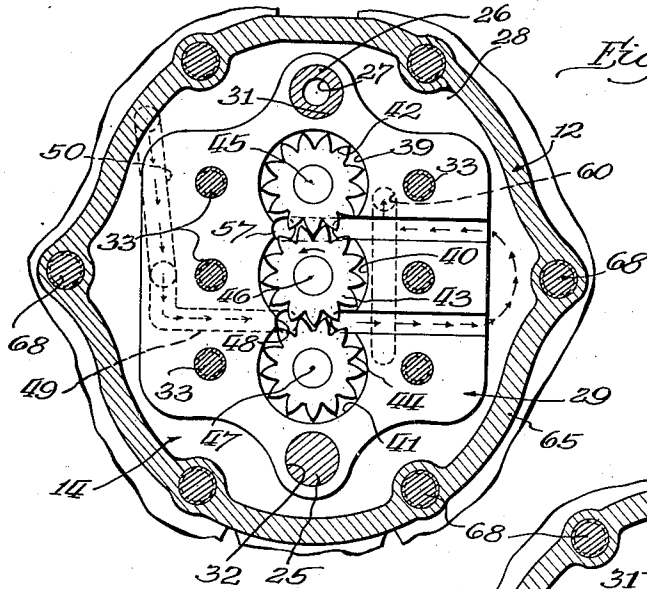


Fig. 3.

Fig. 4.

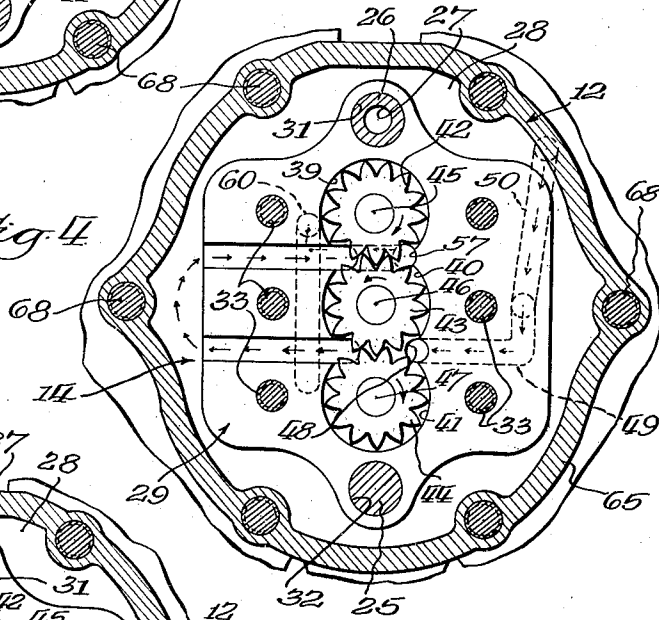
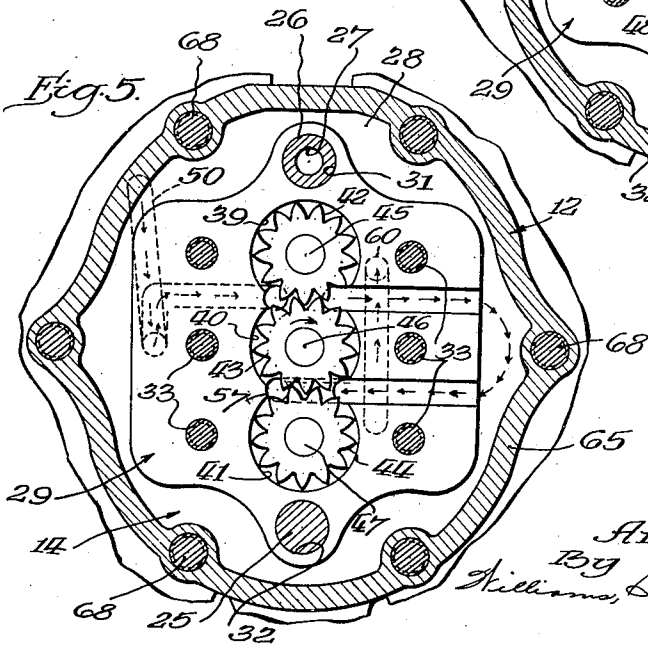


Fig. 5.



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UNITED STATES PATENT OFFICE

2,256,743

FUEL PUMP

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3 Claims. (Cl. 103—126)

The present invention relates to fuel pumps, and is particularly concerned with fuel pumps of the two stage gear type. By a two stage pump I mean a pump having its parts so arranged that two parts of the pump are adapted to perform different functions, such as, for example, the suction of a large supply of liquid fuel to the pump and the discharge of liquid fuel from the pump at a suitable pressure and in suitable volume for an oil burner.

The present fuel pump is an improvement over that disclosed in my prior Patent No. 2,009,137, issued July 23, 1935, on Multi-stage pump and pumping systems, in which one set of small gears is used for the high pressure stage of the pump and another set of larger gears, that is, longer gears are used for the suction stage.

One of the objects of the present invention is the provision of an improved multi-stage pump in which the number of operating parts and stationary parts is reduced so that the pump may be constructed more economically and may be placed within the means of a larger number of purchasers.

Another object of the invention is the provision of a simpler type of multi-stage pump in which a lesser number of gears is employed and therefore a lesser number of gear housing plates is also utilized.

Another object of the invention is the provision of an improved multi-stage pump in which the various gears are so arranged that parts of the gears are employed for one purpose and other parts for another purpose, so as to bring about the accomplishment of the two separate functions of multi-stage pumps of this type by a lesser number of gears.

Another object of the invention is the provision of an improved multi-stage pump which is sturdy, economical, efficient, self-priming, and adapted to perform its functions of providing a supply of liquid fuel under substantially constant pressure and at substantially constant volume at the nozzle of an oil burner under all kinds of adverse conditions.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the two sheets of drawings accompanying this specification,

Fig. 1 is a side elevational view, with the reservoir housing in partial section, showing the interior of the fuel pump and the exterior of the

attached units, such as the strainer housing and regulator valve housing;

Fig. 2 is a sectional view, taken on the plane of the line 2—2 of Fig. 1, looking in the direction of the arrows;

Figs. 3, 4, and 5 are fragmentary sectional views similar to Fig. 1 and relate to a pump of similar structure, with similar gear arrangements, but having a different arrangement of inlet and discharge conduits, whereby it is shown that the pump may be so arranged that it may be operated for left hand or right hand rotation, with the intake on the left or the intake on the right. For example, in Fig. 1 the central or driving gear is arranged for clockwise rotation and the liquid intake is on the right hand. In Fig. 3 the main or central shaft is arranged for rotation in a counterclockwise direction, but the liquid intake or strainer would be on the left. In Fig. 4 the main shaft is arranged for counterclockwise rotation and the liquid fuel intake or strainer is on the right. In Fig. 5 the shaft is arranged for clockwise rotation, with the liquid intake or strainer on the left.

The foregoing conditions are conditions which might have to be met by the manufacturer of the pump, to supply the needs of various manufacturers of oil burners, as some manufacturers have the fuel unit so located and arranged that it must rotate in one direction and others in the opposite direction, and some prefer the strainer on the left, and others on the right.

Referring to Fig. 1, 10 indicates the fuel unit, which preferably comprises a metal casting, having a fuel regulator valve 11, a pump reservoir 12, and a strainer housing 13.

The present pump structure may, however, be embodied in separate pumps, from which the regulator valve 11, strainer 13, and pump reservoir may have been completely eliminated, and the structure described is merely one of the preferred embodiments of the invention.

The pump unit casting is provided with a main body 14, which is formed with a by-pass chamber 15 located between the regulator valve chamber 11 and strainer chamber 13, and adapted to be utilized for receiving the excess of fuel over that utilized by the nozzle of the oil burner.

The unit preferably has a tubular projection 16 at the right adapted to house a shaft seal, preferably of the type utilizing a bellows diaphragm, whereby the main shaft 17 may be rotatably mounted, and maintains a fluid-tight condition, with a minimum amount of friction and leakage.

The main body of the unit 14 is provided with

a transverse cylindrical bore 18 for receiving a bearing bushing 19, serving as the main bearing of the shaft 17. The shaft projects from the unit at the right, as shown in Fig. 2.

The body 14 is provided with a substantially plane surface 20, which is adapted to engage a similar surface 21 on a pump bearing plate 22. The body 14 may be provided with a pair of transverse cylindrical bores 23, 24, the axes of which are parallel, and which are adapted to receive the alignment pins 25, 26 for holding the pump plates in alignment with each other. If desired, one or the other of the pins 25, 26 may be provided with a centrally located conduit 27 for placing the reservoir chamber 28 in communication with the by-pass chamber 15.

The reservoir chamber 28 is provided by means of a cover plate 65, which embraces all of the pump plates and has its edge 66 engaging a gasket 67, which engages the plane surface 20 of the pump body 14. The cover is secured in place by a plurality of screw bolts 68, which pass through apertures in the cover and are threaded into the body 14.

The pump preferably comprises a plurality of the plates, such as the bearing plate 22, the gear housing plate 29, and the cover plate 30. Each of the plates is provided with a bore 31 for receiving the tubular member 26 and a bore 32 for receiving the alignment pin 25. Thus the plates may be more accurately aligned by means of the members 25, 26 than could be accomplished by the threaded screws 33, which pass through apertures in the three plates 22, 29, and 30, and are threaded into the body 14. The screw bolts 33 clamp the plates of the pump together, and, as the plates are all ground to substantially plane engaging surfaces, a substantially liquid-tight construction is secured.

The bearing plate 22 is formed with a plurality of cylindrical bearing bores 34, 35, and 36 for receiving the shafts 37, 17, and 38, respectively. If desired, shafts 37 and 38 may be wholly eliminated, and the bearing plate 22 also wholly eliminated, since the gears may be rotatably mounted in suitable sockets in the gear housing plate 29, so as to eliminate the necessity for separate shafts for each gear except the main driving shaft 17.

The gear housing plate, like the bearing plate 22 and the cover plate 30, may comprise a ground steel plate, and the gear housing plate is formed with a plurality of intercommunicating gear sockets or cylindrical bores 39, 40, 41. Each of the bores 39, 40, 41 houses one of the gears 42, 43, 44, which are preferably gears provided with helical teeth, in order that the gears may not only carry the liquid in the tooth grooves, but may tend to force the liquid toward discharge at a predetermined edge of the gear.

The gears 42-44 are all driven by the shaft 17, due to the inter-engagement between the teeth of the gear 42 with the gear 43, and those of the teeth 44 with the gear 43.

The partially cylindrical bores or sockets 39, 40, 41 are so arranged that they engage the periphery of the gear teeth of gears 42-44 when the gears are inter-meshed with each other. As a matter of practice, the gear centers 45, 46, 47 are preferably arranged in an alignment, but are not necessarily so arranged in the present case.

In the embodiment of Fig. 1 the arrow at the gear 43 indicates that the shaft 17 may rotate in a clockwise direction. In this case the body 75

14 and bearing plate 22 are provided with an intake port 48 located to communicate with the two gear sockets 39 and 40 at the point of their juncture on the right hand of Fig. 1; that is, the intake port is located where the teeth of the gears 42 and 43 begin to separate, and port 48 may be connected by conduit 49 with any fuel tank or any complete unit having the strainer. It leads through conduit 50 to the upper part of the strainer chamber 13.

Liquid fuel is in every case taken in the lower port or side of the strainer chamber at 51 or 52 and passes through the strainers and out of the upper part of the strainer chamber to the pump inlet at 48. In most cases the lateral port 52 is utilized for a partial gauge.

The body 14 or the bearing plate 22 may be provided with a liquid discharge port 53 at the opposite side of the gears 42, 43, the port 53 being connected by a conduit 54, chamber 28, and conduit 55, with a liquid intake port 56 disposed at the left hand side of the engaging teeth of gears 43 and 44.

The pressure discharge port 57 may be formed in body 14 or bearing plate 22 at the right hand of the inter-engaging teeth of gears 43 and 44, and it may be connected by a transverse conduit 58 located either in the body 14 or bearing plate 22, with an upwardly extending conduit 59 which leads to a discharge port 60 leading into the regulator valve chamber 11.

In the event of the incorporation of the pump in a unit having such a regulator valve, the regulator valve is adapted to discharge fuel at substantially constant pressure and in substantially constant volume at the nozzle port 61, and the balance of the fuel from the regulator valve is by-passed into the by-pass chamber 15 in the same manner as disclosed in my prior Patent No. 2,051,301 on Fuel supply units for oil burners, or the like, issued August 18, 1936.

The operation of the gear pump in two stages is as follows: Liquid fuel is sucked up through the intake conduits 49, 50 and intake port 48 and carried between the teeth spaces of the upper gear 42 around to the discharge port 53, where it is discharged through the conduit 54 into reservoir 28. A similar amount is taken up into the gear tooth space of gear 43 at the right from intake port 48 and carried down to the pressure discharge conduit 57. The outlet port of the pump, such as the by-pass port 27 from the reservoir, is arranged above the gears 42-44 so that the tooth spaces are always filled with liquid fuel after the pump has once been run, and this facilitates an immediate supply of liquid fuel under pressure when the pump starts.

Even in the absence of liquid fuel between the gear spaces, the tooth spaces of gear 42 carry liquid fuel which is discharged against nothing but atmospheric pressure and, as that portion of the pump does not work against any pressure except the resistance of the conduits, it is adapted to draw up liquid fuel and provide an immediate supply of liquid fuel for filling a reservoir 28 or for supplying the other parts of the pump.

The gear teeth of gear 43 at the left side of that gear are rotating in a clockwise direction, and therefore are adapted to take liquid at the intake port 56 and carry it up and discharge at the port 53.

That portion of the gear 43 merely produces a circulation of liquid in the conduits 54, reser-

voir 28, and conduit 55. The gear teeth of gear 44, however, take liquid fuel from the conduit 55 and reservoir 28 at the intake port 56 and carry it around in a counter-clockwise direction, as indicated by the arrows, and discharge it at the pressure discharge port 57.

The gears 42, 43, 44 are all of the same length and same size gear teeth and tooth spaces, but due to the fact that the gear teeth of gear 42 are not working against any pressure, except the resistance of the conduits, they pump a larger amount and an excess of liquid fuel over that pumped by the teeth of gear 44 and the teeth of gear 43 at the right hand side, which are working against a very high pressure. The result is that there is a greater slippage or leakage in the lower part of the pump, comprising the teeth of gear 44, than there is at the upper part of the pump at the teeth of gear 42, and the net result is that there is a larger amount of liquid fuel drawn up to the pump for use by the high pressure gear than is discharged at the discharge port 57 of the high pressure stage.

Thus a two stage arrangement is provided by using only three gears instead of four, and the gears are all of the same size, thus reducing the number of different parts. A number of pump plates have been eliminated, such as the plates which would be required for a partition between the larger and smaller gears in my prior patent and the plate which would be required for housing the extra pair of gears utilized in such devices of the prior art. Thus the present invention may be constructed at a much lower cost than the devices of the prior art.

Referring to Fig. 3, this is a pump of similar construction, but the conduits have been reversed with respect to those of Fig. 1 because of having the main shaft operate in the opposite direction. The intake in this case is at the left hand side of the pump, as indicated by the conduit 50.

In this case the low pressure stage is at the lower gear 44 and the high pressure stage is at the upper gear 42, liquid fuel at high pressure being discharged at the port 57.

Referring to Fig. 4, in this embodiment the low pressure stage is again at the lower gear 44, the intake being at the conduit 50, and the high pressure stage is at the uppermost gear 42, the outlet 57 being at the right hand side of the gears. In this case the main shaft operates counter-clockwise, and the strainer is on the right hand.

Referring to Fig. 5, in this case the main shaft operates in a clockwise direction, with the strainer arranged on the left hand and the intake of the pump being at the conduit 50, again on the left end. The high pressure outlet of the pump is at the left side at the port 57 adjacent the lowermost gear 44, and connected by suitable conduits to the high pressure outlet port 60.

It will thus be observed that I have invented an improved gear pump of the multi-stage type which requires a lesser number of gears than any of the devices of the prior art. The gears for the low pressure stage and the high pressure stage may be of the same size, but I utilize the characteristic of greater slippage in the high pressure gear in such manner that an excess of liquid fuel is pumped by the low pressure gear to assure a constant supply of liquid fuel to the high pressure gear.

Due to the elimination of the extra gear and elimination of gear housing plates, the present

pump may be constructed at a lower cost and may be placed within the means of a larger number of purchasers, and the ultimate cost of an oil burner to the consumer is thereby reduced.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a liquid pump of the gear type, the combination of a gear housing comprising a housing plate having intercommunicating cylindrical apertures for three gears, gears arranged in said apertures, means for engaging the ends of said gears to effect a closure of said housing, said gears being arranged to be driven from one of the gears, and said one of said gears being provided with a drive shaft, said housing being provided with a low pressure inlet and a low pressure outlet at the intersection of two of said gears, predetermined parts of which two gears constitute a low pressure stage, a reservoir, said low pressure outlet being in communication with said reservoir at substantially atmospheric pressure, and said housing having an inlet at another intersection of predetermined ones of said gears communicating with said reservoir, and having a high pressure outlet at the opposite side of the intersection of said latter gears, certain parts of said predetermined ones of said gears constituting the high pressure stage, the low pressure stage of said gears pumping an excess of volume of liquid over the high pressure stage of said gears, due to the difference in resistance to the discharge of fuel from the gears of said stages.

2. In a liquid pump of the gear type, the combination of a gear housing comprising a housing plate having intercommunicating cylindrical apertures for three gears, gears arranged in said apertures, means for engaging the ends of said gears to effect a closure of said housing, said gears being arranged to be driven from one of the gears, and said one of said gears being provided with a drive shaft, said housing being provided with a low pressure inlet and a low pressure outlet at the intersection of two of said gears, predetermined parts of which two gears constitute a low pressure stage, a reservoir, said low pressure outlet being in communication with said reservoir at substantially atmospheric pressure, and said housing having an inlet at another intersection of predetermined ones of said gears communicating with said reservoir, and having a high pressure outlet at the opposite side of the intersection of said latter gears, certain parts of said predetermined ones of said gears constituting the high pressure stage, the low pressure stage of said gears pumping an excess of volume of liquid over the high pressure stage of said gears, due to the difference in resistance to the discharge of fuel from the gears of said stages, said reservoir comprising an enclosure surrounding the body of said pump, and maintaining said housing plate immersed in liquid, said reservoir having a by-pass outlet located above the inlet to said high pressure stage whereby the liquid in said reservoir is adapted to prime said high pressure stage.

3. In a two stage liquid pump of the gear type, the combination of a gear housing having bearings for a drive shaft and having intercommunicating cylindrical apertures for receiving three gears arranged in a series, one of said gears being connected to said drive shaft, a reservoir, said housing having an inlet conduit communicating with two of said gears adjacent their points of engagement on the side toward which said latter two gears are rotating, said housing also having a discharge aperture leading from the opposite side of said latter two gears to said reservoir, whereby liquid fuel is discharged into the reser-

voir, and said reservoir having a return conduit in communication with the inlet conduit of said pump, said housing also having a high pressure intake communicating with said reservoir and leading to the point of intersection of the third gear and one of the gears of said first-mentioned two gears, and said housing having a high pressure outlet leading from the intersection of said latter two gears, whereby an excess of fuel is pumped up to said reservoir and a predetermined volume is discharged from said pump at high pressure.

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