Aug. 17, 1948. H. J. GOODYER 2,447,119

DEVICE FOR SEPARATING LIQUID OR FOREIGN MATTER IN SUSPENSION FROM FLUID UNDER PRESSURE

Filed June 30, 1944 2 Sheets-Sheet 1

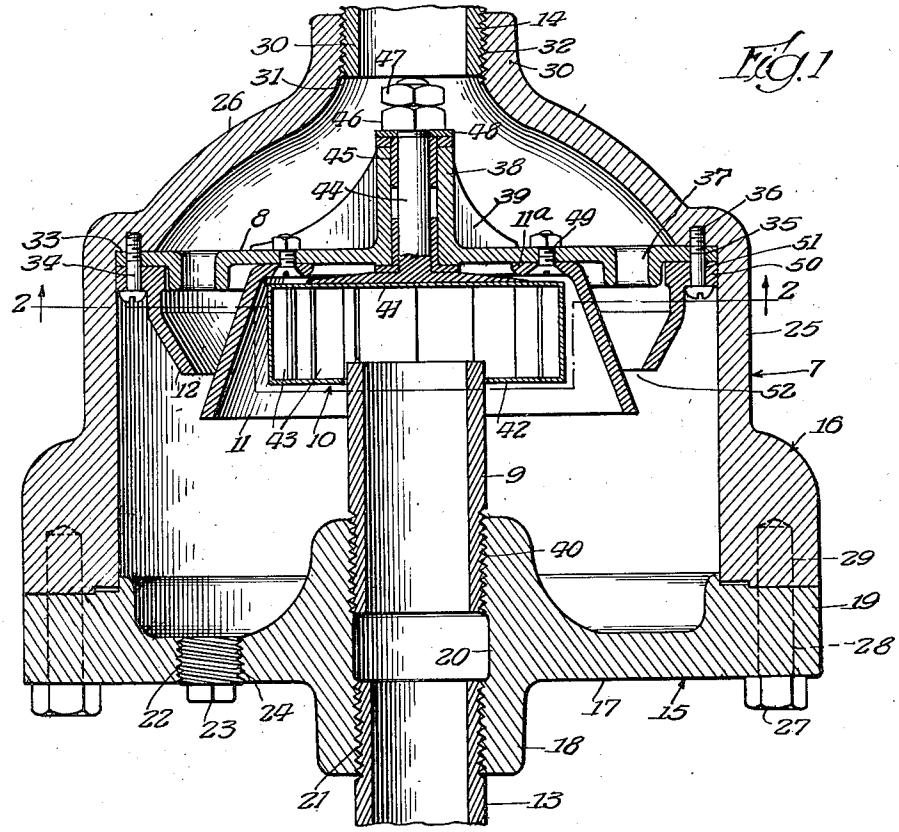


Fig. 1

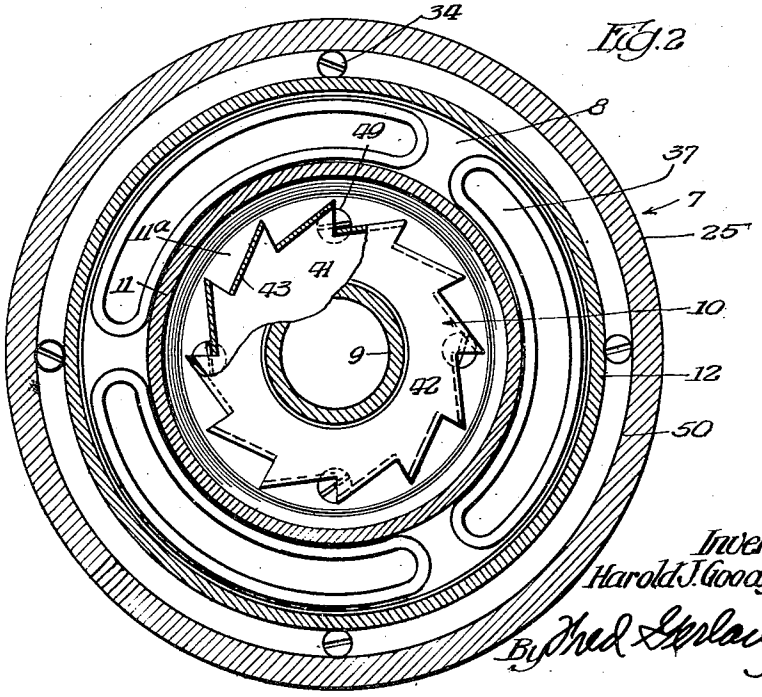


Fig. 2

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Fig. 3

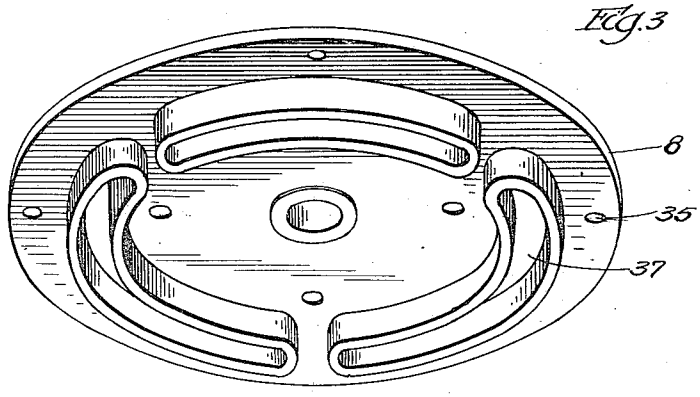


Fig. 4

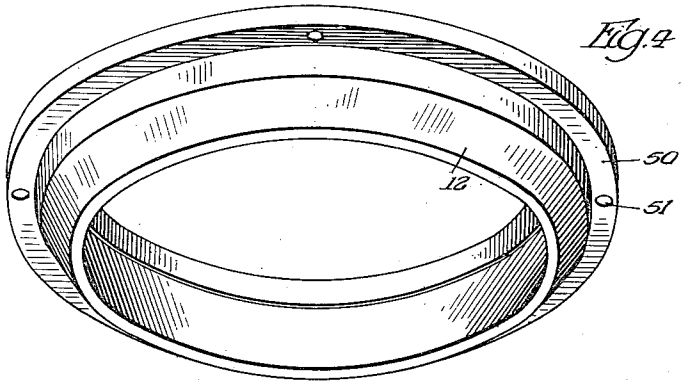


Fig. 5

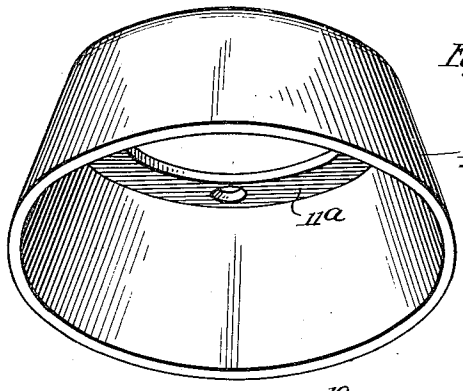
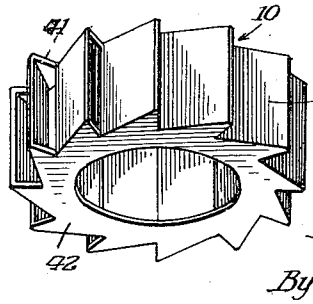


Fig. 6



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DEVICE FOR SEPARATING LIQUID OR FOREIGN MATTER IN SUSPENSION FROM FLUID UNDER PRESSURE

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4 Claims. (Cl. 183—77)

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The present invention relates generally to devices for separating or removing liquid or foreign matter in suspension from fluid under pressure. More particularly the invention relates to that type of separating device which is adapted to be interposed in, and form a part of, a pipe system for fluid under pressure and as its primary components or parts comprises: (1) a hollow casing which embodies a fluid inlet at the bottom thereof and a fluid outlet at its top and is adapted to have the fluid under pressure flow upwards therethrough; (2) an upstanding open ended tubular element which is disposed in the lower portion of the casing interior and has its lower end in communication with the casing inlet; and (3) a blade equipped deflector which is mounted directly over the upper end of the tubular element and so that it is rotatable about a vertical axis, and is adapted to be driven by the fluid under pressure emanating from the element and in connection with drive thereof to fling or direct the liquid or foreign matter outwards in a swirling manner so as to cause it to be separated or disunited from the fluid and accumulate in the lower portion of the casing interior.

One object of the invention is to provide a separating device of this type which is an improvement upon and has certain advantages over previously devised devices for the same purpose and is characterized by the fact that it effectively and efficiently fulfills its intended purpose and embodies such a small number of parts that it may be manufactured or produced at a comparatively low cost.

Another object of the invention is to provide a separating device of the type under consideration in which the rotary deflector is so designed or constructed and has the blades thereof arranged in such manner that rotation thereof is assured regardless of pronounced fluctuation or variation in the pressure of the fluid emanating from the upper end of the tubular element in the lower portion of the casing interior.

Another object of the invention is to provide a separating device of the last mentioned character in which the deflector embodies an imperforate plate directly above the upper open end of the tubular element and the blades of the deflector are disposed in a circular or annular series, depend from the margin of the plate, and are arranged so that they surround the upper end of the element and extend tangentially with respect to the circle in which they are disposed.

A further object of the invention is to provide a separating device of the type and character

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under consideration which comprises an annular downwardly flared baffle around the deflector and in addition an annular downwardly tapered baffle which surrounds or extends around the first mentioned baffle and has the lower end thereof positioned above, and spaced slightly outwards from the lower end of, the downwardly flared baffle so as to form therebetween an annular or ring shaped passage through which the fluid passes upwards to the casing outlet after the liquid or foreign matter is removed or disunited therefrom as the result of the action of the rotary deflector.

A still further object of the invention is to provide a separating device which is generally of new and improved construction in which the component parts thereof are so designed and arranged that they may be readily dismantled in connection with cleaning, repair, replacement or inspection thereof.

Other objects of the invention and the various advantages and characteristics of the present separating device will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawings which accompany and form a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a vertical section of a separator embodying the invention;

Figure 2 is a horizontal section on the line 2—2 of Figure 1;

Figure 3 is a bottom perspective view of the disc-like plate which is located in the upper portion of the casing interior and serves to support the rotary blade equipped deflector and the two annular baffles;

Figure 4 is a bottom perspective view of the outer annular baffle, i. e., the baffle that is downwardly tapered and surrounds the downwardly flared baffle;

Figure 5 is a bottom perspective view of the inner annular baffle; and

Figure 6 is a bottom perspective of the rotary blade equipped deflector.

The device which is shown in the drawings constitutes the preferred form or embodiment of the invention. It is primarily designed and adapted to separate or remove liquid or foreign matter in suspension from fluid under pressure, and as its primary or principal parts comprises a casing 7, a plate 8, a tubular element 9, a deflector 10,

an inner baffle 11, and an outer baffle 12. It is contemplated that the device will be interposed in, and form a part of, a pipe system which is adapted to have the fluid under pressure circulate therethrough, and includes an inlet pipe 13 and an outlet pipe 14.

The casing 7 is preferably formed of cast metal and surrounds and houses the plate 8, the element 9, the deflector 10, and the baffles 11 and 12. It is composite or sectional in character and consists of a lower section 15 and an upper section 16. The lower section is in the form of a circular bottom wall 17 and this, as shown in Figure 1, embodies at the central portion thereof an integral vertically extending tubular part 18 and has at its outer marginal portion an upstanding annular flange 19. The tubular part 18 defines at the bottom of the casing an inlet 20 for the fluid under pressure. The inlet pipe 13 of the pipe system extends vertically and has the upper end thereof extending into the lower end of the tubular part 18 and removably connected thereto by a screw thread connection 21. The wall 17 embodies between the part 18 and the flange 19 a vertically extending hole 22 which permits the liquid or foreign matter that is removed from the fluid under pressure as it flows through the casing to be removed from the casing interior. Such hole 22 is normally closed by a plug 23 which is removably secured in place by a screw thread connection 24. The upper section 16 of the casing 7 overlies the lower section 15 and consists of a substantially cylindrical side wall 25 and an upwardly bulged or dome shaped top wall 26. The lower end of the side wall corresponds in diameter to, and rests upon, the upstanding flange 19 at the outer marginal portion of the bottom wall 17. An annular series of upstanding bolts 27 serves releasably to secure together the lower and upper sections of the casing. The shanks of these bolts extend through holes 28 in the flange 19 and into internally threaded sockets 29 in the lower end of the side wall 25 of the upper casing section 16. The top wall 26 of the upper casing section embodies at the central portion thereof an integral upstanding nipple 30 and this is in axial alignment with the tubular part 18 and defines a fluid outlet 31 at the top of the casing. The pipe 14 of the pipe system with which the separating device is used extends vertically and has its lower end projecting into the nipple 30 and removably secured thereto by way of a screw thread connection 32. When the device is in operation fluid under pressure enters the casing via the inlet 20 and then after flowing upwards through the casing interior flows out of the casing via the outlet 31 and the outlet pipe 14. The lower portion of the casing interior constitutes a sump or collecting chamber for the liquid or foreign matter which is removed or disunited from the fluid as the latter travels upwards through the casing interior.

The plate 8 is disposed in, and extends transversely across, the upper portion of the casing interior and, like the casing, is preferably formed of cast metal. It is circular so far as contour or conformation is concerned and has the outer margin thereof in abutment with a downwardly facing annular seat 33 which is formed at the juncture of the side and top walls of the upper section 16 of the casing 7. The diameter of the plate 8 is slightly less than the internal diameter of the side wall 25. An annular series of upstanding screws 34 serves releasably to hold the plate 8 in place against the seat 33. The shanks of the screws extend through holes 35 in the outer marginal portion of the plate 8 and into internally threaded sockets 36 in the seat defining portion of the upper casing section 16. Directly inwards of its outer marginal portion the plate 8 is provided with an annular series of equidistantly spaced arcuate slots 37. These slots are preferably three in number and permit the fluid under pressure to flow upwards past the plate 8 en route to the outlet 31. The central portion of the plate 8 embodies an integral upstanding tubular part 38 and this, as shown in Figures 1 and 3, is reenforced by way of a plurality of radially extending triangular webs 39 which are formed integrally with the plate 8.

The tubular element 9 is disposed in the lower portion of the casing interior and extends vertically. The lower end of the element 9 projects into the upper end of the tubular part 18 and is removably secured thereto by way of a screw thread connection 40. The upper end of the element 9 terminates a short distance beneath the central portion of the circular plate 8. In connection with operation of the separator the fluid under pressure which enters the inlet 20 flows upwards through the tubular element 9 and then after passing into the portion of the casing interior beneath the plate 8 flows upwardly through the slots 37 and then is discharged from the casing interior via the outlet 31. The tubular element 9 is circular in cross section and is preferably in the form of a metallic pipe.

The deflector 10 is disposed above and around the upper end of the tubular element 9 and directly underlies the central portion of the plate 8. It is mounted or supported, as hereinafter described, for rotation about a vertical axis and comprises an inperforate upper plate 41, a ring shaped lower plate 42 and an annular series of blades 43. A vertically extending shaft 44 serves rotatably to support the blade equipped deflector. This shaft is disposed in the upstanding tubular part 38 on the central portion of the plate 8 and is journalled in a pair of vertically spaced bearings 45. The latter are suitably secured within the end portions of the tubular part 38. The lower end of the shaft 44 is fixedly connected to the central portion of the imperforate upper plate 41 of the deflector. The upper end of the shaft projects above the upper end of the tubular part 38. It is externally threaded and has applied thereto a nut 46 and a lock nut 47. A washer 48 is interposed between the nut 46 and the upper end of the uppermost bearing 45 and forms a thrust bearing for preventing downward displacement of the shaft and deflector relatively to the plate 8. The ring shaped lower plate 42 of the deflector surrounds the upper end of the tubular element 9 and is located directly beneath the upper edge of the latter. The inner diameter of the lower plate is slightly greater than the external diameter of the element 9. The blades 43 extend between, and are joined to, the outer marginal portions of the upper and lower plates 41 and 42. They are flat and arranged so that they extend in parallel relation with the axis of rotation of the deflector also tangentially with respect to the circle in which they are disposed. As shown in Figure 2, the leading edge of each blade is spaced inwards from, but in radial relation with, the trailing edge of the preceding blade. The fluid under pressure emanating from the upper end of the tubular element 9 is caused to flow outwards between the upper and lower plates 41 and 42 and impinges against the inner faces of

the blades. Due to the tangential or angular arrangement of the blades the fluid in connection with impingement against the blades, causes the deflector to rotate. During rotation of the deflector the fluid flows outwards between the blades and is caused to swirl. As a result of the swirling action the liquid or other foreign matter in suspension in the fluid is caused, by centrifugal force, to be thrown outwards toward the side wall 25. Because the upper and lower plates of the deflector confine the fluid under pressure emanating from the upper end of the tubular element so that it must flow outwards past the blades positive rotation of the deflector is effected and an effective removal of the suspended liquid or foreign matter in the fluid is obtained.

The inner baffle 11 is annular and surrounds and projects beneath the rotary deflector 10. It is concentrically arranged relatively to said deflector and is downwardly flared as shown in Figure 1. The upper end of the baffle 11 is provided with an integral inwardly extending flange 11a which fits against the central portion of the bottom surface of the plate 8 and is secured in place by means of bolts 49. The inner baffle receives the liquid and foreign matter which is flung outwards by the blades of the deflector and serves to direct such liquid or foreign matter downwards into the lower portion of the casing interior which, as previously pointed out, constitutes a sump.

The outer baffle 12, like the inner baffle, is annular. It surrounds and is spaced from the inner baffle and embodies at its upper end an integral outwardly extending flange 50 which abuts against the outer marginal portion of the plate 8 and is held in place by the bolts 34. The shanks of such bolts extend through holes 51 in the flange and serve to maintain the outer baffle 12 and the plate 8 in clamped relation with the seat 33. The outer baffle is downwardly tapered and is so proportioned or dimensioned that the lower end thereof terminates above and slightly outwards of the lower end of the inner baffle and defines therewith an annular passage 52 through which the fluid flows upwards after the liquid or other foreign matter in suspension is removed therefrom by the action of the rotary deflector and the inner baffle.

When the separating device is in operation as the result of circulation of fluid under pressure through the pipe system including the pipes 13 and 14 the fluid with liquid or foreign matter in suspension therein enters the casing via the inlet 20. After passing into the inlet the fluid flows upwards through the tubular element 9 and then is laterally deflected by the upper plate 41 of the deflector 10. As the result of lateral deflection the fluid under pressure impinges against the inner faces of the plates 43 and then flows outwards through the spaces between the blades. As heretofore pointed out, impingement of the fluid against the plates results in the deflector rotating and flinging outwards the liquid or foreign matter in suspension in the fluid. Such liquid or foreign matter, after being flung outwards by the blades of the deflector, strikes against the inner surface of the inner baffle 11 and is directed by the latter downwardly into the lower portion of the casing interior. After the liquid or foreign matter is removed from the fluid under pressure due to the coaction of the deflector and inner baffle the pure or cleaned fluid flows upwards through the annular passage 52 and then enters the upper portion of the casing interior via the arcuate slots 37 in the plate 8. After entering such upper portion of the casing interior the fluid under pressure flows into the outlet pipe 14 via the outlet 31 in the upstanding nipple 30. To clean the separator it is only necessary to remove the plug 23. As soon as the plug is removed the liquid or other matter in the casing drains or flows from the sump via the hole 22.

The herein described separating device is extremely efficient in operation as the result of the design, construction and arrangement of the rotary blade equipped deflector 10 and the inner and outer annular baffles 11 and 12. It consists of but a comparatively small number of parts and hence may be manufactured or produced at a low cost. In view of the fact that the casing is of composite character access may be readily had to the operating parts of the device. The device has many capabilities of use. For example, it may be used as an air or gas cleaner or to remove water from steam.

The invention is not to be understood as restricted to the details set forth since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. A device adapted to remove foreign matter in suspension from fluid under pressure and comprising a casing having a fluid inlet at the bottom thereof and a fluid outlet at its top, an upstanding open ended tubular element disposed in the lower portion of the casing and having the lower end thereof in communication with the inlet, a deflector in the casing mounted to rotate about a vertical axis and embodying a horizontal substantially imperforate plate disposed above and in centered relation with the upper end of the element and an annular series of spaced apart angularly disposed blades depending from the marginal portion of the plate and arranged so that they surround the upper end of the element, and an annular horizontally disposed downwardly flared inner baffle mounted fixedly in the casing and positioned so that it directly surrounds the deflector, and an annular horizontally disposed downwardly tapered outer baffle mounted fixedly in the casing and arranged so that it surrounds the inner baffle and its lower end is disposed above, and in spaced relation with, the lower end of the inner baffle and forms therewith an annular passage for permitting upflow of fluid in the casing to the outlet.

2. A device adapted to remove foreign matter in suspension from fluid under pressure and comprising a casing having a fluid inlet in the central portion of its bottom and a fluid outlet at its top, an upstanding open ended tubular element disposed in the central lower portion of the casing and having its lower end in communication with the inlet, a horizontal plate disposed in, and extending across, the upper portion of the casing interior and having openings directly inwards of its outer margin, a blade equipped deflector disposed in the casing directly above the upper end of the element and supported from the central portion of the plate so that it is rotatable about a vertical axis, an annular horizontally disposed downwardly flared inner baffle positioned so that it directly surrounds the deflector and having the upper end thereof connected to the plate inwards of the openings in the latter, and an annular horizontally disposed downwardly ta-

pered outer baffle arranged so that it surrounds the inner baffle and having the lower end disposed in spaced relation with the lower end of the inner baffle and its upper end connected to the plate outwards of said openings.

3. A device adapted to remove foreign matter in suspension from fluid under pressure and comprising a sectional casing having a fluid inlet in the central portion of its bottom and a fluid outlet at its top, an upstanding open ended tubular element disposed in the central lower portion of the casing and having the lower end thereof in communication with the inlet, a horizontal plate disposed in, and extending across, the upper portion of the casing interior and having openings directly inwards of its outer margin, a deflector positioned between the central portion of the plate and the upper end of the element, supported by the plate so that it is rotatable about a vertical axis, and embodying a horizontal substantially imperforate plate above and in centered relation with the upper end of the element, and an annular series of spaced apart angularly disposed blades depending from the marginal portion of the last mentioned plate and arranged so that they surround said upper end of the element, an annular horizontally disposed downwardly flared inner baffle positioned so that it directly surrounds the deflector and having the upper end thereof connected to the first mentioned plate inwards of the openings in the latter, and an annular horizontally disposed downwardly tapered outer baffle arranged so that it surrounds the inner baffle and having the lower end disposed in spaced relation with the lower end of the inner baffle and its upper end connected to said first mentioned plate outwards of said openings.

4. A device adapted to remove foreign matter in suspension from fluid under pressure and comprising a sectional casing having a fluid inlet in the central portion of its bottom and a fluid outlet at its top, an upstanding cylindrical open ended tubular element disposed in the central lower portion of the casing and having the lower end thereof in communication with the inlet, a horizontal plate disposed in, and extending across, the upper portion of the casing interior and

having openings directly inwards of its outer margin, a deflector positioned between the central portion of the plate and the upper end of the element, supported by the plate so that it is rotatable about a vertical axis, and embodying a horizontal imperforate upper plate disposed above, and in centered relation with, the upper end of the element, a circular series of flat spaced apart blades depending from, and extending at right angles to, the marginal portion of said upper plate and arranged so they surround the upper end of the element and extend substantially tangentially with respect to the circle in which they are disposed, and a horizontal ring shaped lower plate connected to, and extending inwards from the lower ends of the blades and extending around and spaced slightly from said upper end of the element, an annular horizontally disposed downwardly flared inner baffle positioned so that it directly surrounds the deflector and having the upper end thereof connected to the first mentioned plate inwards of the openings of the latter, and an annular horizontally disposed downwardly tapered outer baffle arranged so that it surrounds the inner baffle and having the lower end disposed in spaced relation with the lower end of the inner baffle and its upper end connected to said first mentioned plate outwards of said openings.

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