

June 21, 1949.

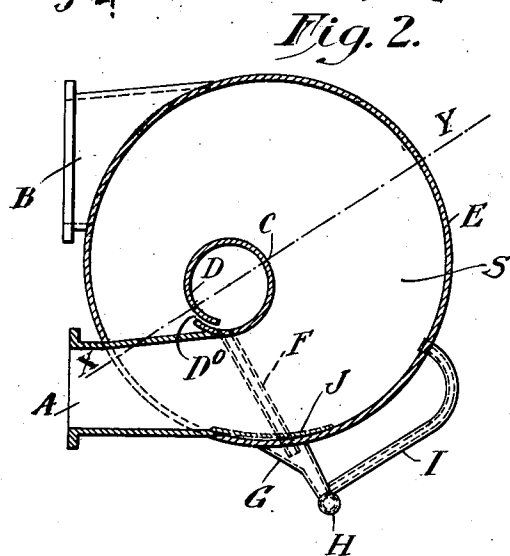
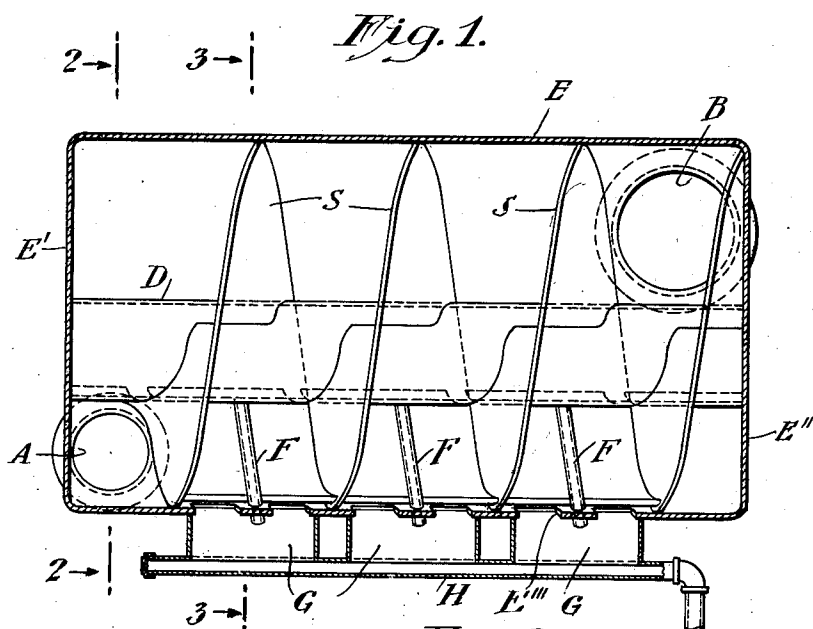
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2,473,602

FLUID SEPARATOR

Filed April 25, 1945

3 Sheets-Sheet 1



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Fig. 3.

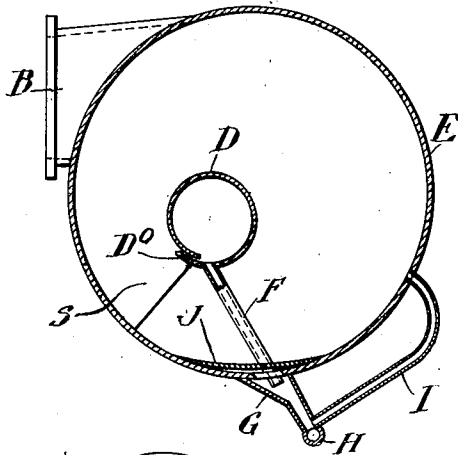
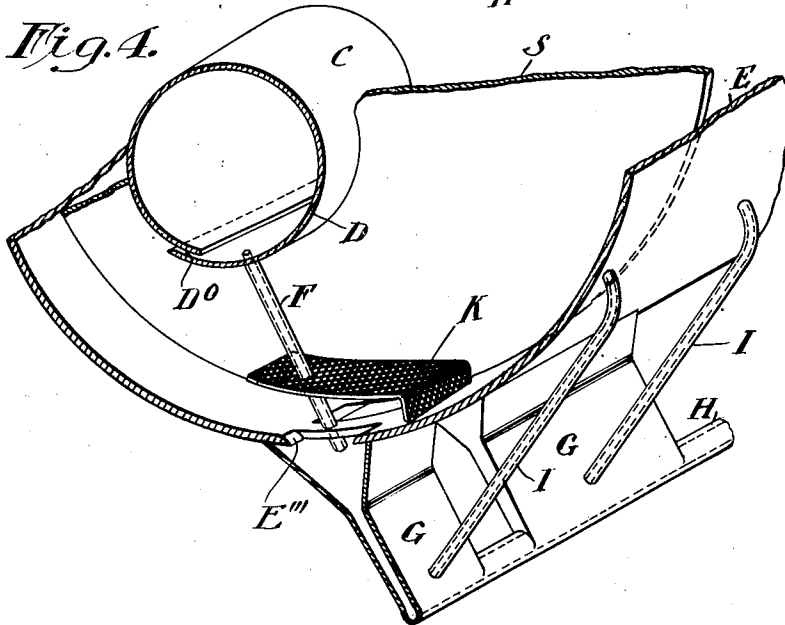


Fig. 4.



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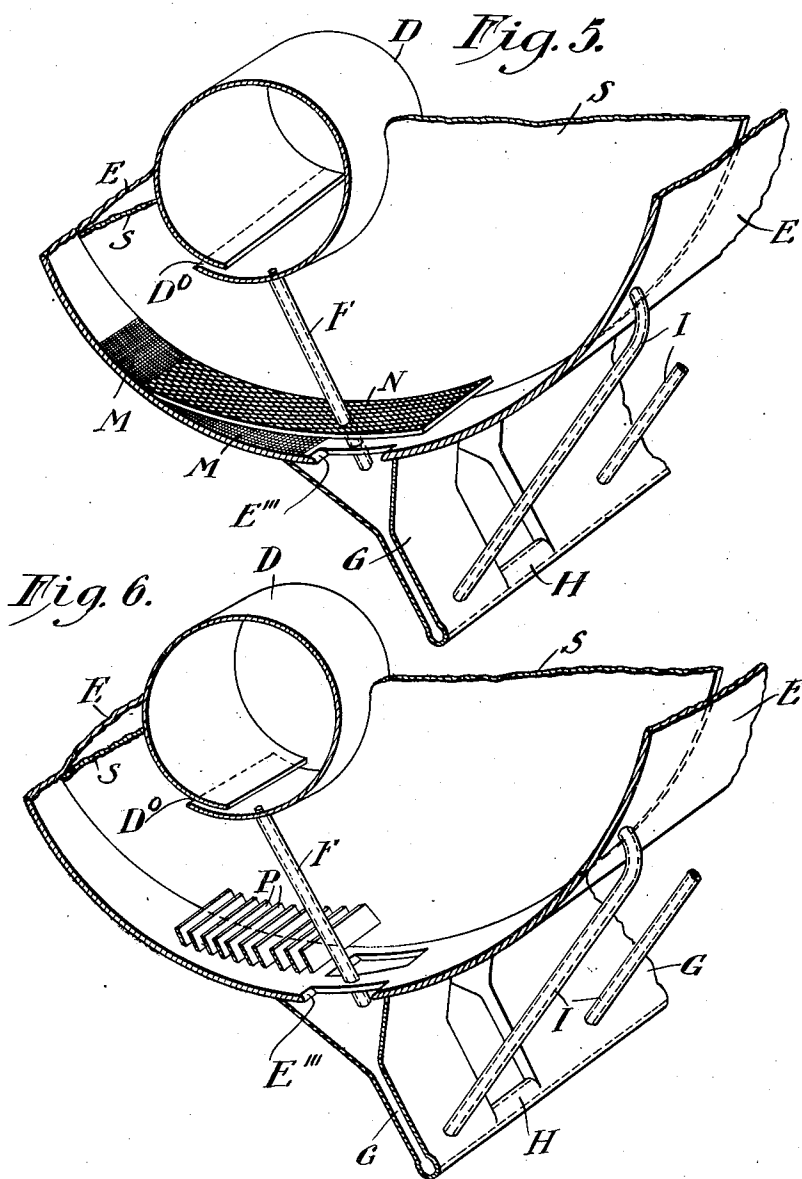
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,473,602

FLUID SEPARATOR

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Application April 25, 1945, Serial No. 590,170

4 Claims. (Cl. 183—79)

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The present invention relates to the fluid separators and more particularly to a centrifugal type such as disclosed in my United States Patent No. 2,015,076, patented September 24, 1935, wherein, for the separation of dense fluids from less dense fluids, such as oil particles from steam, the mixed fluid is directed through a pipe of non-circular cross-section and formed into a spiral coil. The pipe is pear-shaped in cross-section and its narrow portion extends outwardly and downwardly so as to collect the dense fluid particles. The dense fluid or oil particles are separated from the steam by centrifugal action and are dashed against the exterior wall surface and are finally deposited in the narrow portion of the pipe. Discharge openings from the channel are located at intervals along the length of the pipe through which the oil is extracted.

Several difficulties have been encountered in use of these separators. One such difficulty has been that drops of the dense fluid or oil particles rebounded from the wall surface of the pipe, against which they were dashed, into the interior region of the pipe, and being broken were easily swept along with the steam, and thus were not finally separated from the less dense fluid. Also difficulties arose in the construction of the separator, as for example, in the bending of the pipe into the spiral.

It is thus among the objects of the present invention to provide a fluid separator which may be more simply constructed, more efficient in operation, and wherein the rebounding of the dense particles is inhibited.

According to the invention the inner wall surface of the casing is covered with a shock absorbing or force dissipating material so that the dense fluid particles will not so readily rebound upon being dashed against the separator casing inner wall. For this shock absorbing material, a felt of wool or artificial fleece, or a wire cloth of thin wire is used. The dense fluid particles as they are dashed against the soft material are broken and lose their velocity. The rebound of the particles is accordingly inhibited.

The wire cloth may be made of wires having a triangular cross-section and arranged so that their vertices point toward the fluid particles aimed at the wall surface. By such construction, easy entrance of the particles to the wall surface is afforded but on the rear of the wires there is a large area thereby to prevent the rebound of the broken fluid particles. Parallel plates arranged in a window blind-like manner on the casing wall surface may be used.

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Several forms of construction are shown but generally each form includes a cylindrically shaped separator casing having an inner wall surface, an inner cylinder of smaller dimension located within the casing and spaced from the wall surface thereof, and a spiral sheet extending between the two cylinders and from one end of the casing to the other end thereof. The inner cylinder and the spiral sheet are so fashioned and arranged as to provide a spiral path through the separator which is of varying cross-section. The mixed fluid enters an inlet at one end of the casing and upon passing through the separator is given alternate increase and decrease in the velocity by virtue of the varying cross-section. As the fluid leaves the point of minimum cross-section in the spiral passage, the fluid is given an increased velocity and just beyond this point the dense fluid particles are thrown outwardly by centrifugal action and dashed against the inner wall surface of the separator casing. At the point in the casing where the dense particles collide with the wall there is provided an opening through which the collected oil particles are extracted. Also located in this area on the inner wall surface is one of the above-mentioned soft materials or a perforated plate so as to inhibit the rebounding of the oil particles. An outlet is located at the opposite end of the separator casing for the exit of the less dense fluid or carrier.

For better understanding of the invention, reference may be had to the following detailed description taken in connection with the accompanying drawing, in which

Fig. 1 is an elevational view of a horizontal separator with portions of the outer casing removed to show in full the inner structure thereof;

Fig. 2 is a view in transverse cross-section taken at station 2—2 of Fig. 1;

Fig. 3 is another view in transverse section of the separator shown in Fig. 1 taken at station 3—3 thereof;

Fig. 4 is an enlarged fragmentary view, in perspective, of the separator shown in Fig. 1 to show more clearly its detail of construction and including one form of perforated means for preventing rebounding of the dense fluid particles; and

Figs. 5 and 6 are respectively views similar to Fig. 4 but showing respectively other means for preventing rebounding of the fluid particles.

Referring to Figs. 1, 2 and 3, E is the outer cylinder of casing, the inner wall of which serves as the outer or exterior surface of the separator. The ends of the cylinder E are closed as indi-

cated at E' and E''. Within the casing E, is eccentrically disposed an inner cylinder D which provides the inner surface of the separator. In the annular space between the two cylinders is a spiral coil S extending from one end of the separator to the other end thereof. On the outer casing E, adjacent the end E' is an inlet A through which the mixed fluids enter the annular space and at the opposite end of the casing E, adjacent the end E'', is an outlet pipe B through which the less dense fluid carrier or steam leaves the casing.

The cylinder D is eccentrically arranged within the casing E in order to provide for alternate expansion and contraction of the fluids as they pass in spiral fashion through the annular space. At its entrance A the fluid will expand and its velocity diminish up to the section CY, Fig. 2. From this point, the fluid starts to contract and its velocity will be increased until the section CX is reached. At the section CX the velocity of the fluid is the greatest. This cycle of expansion and contraction continues throughout the length of the annular space. By virtue of this expansion and contraction, the dense fluid or oil particles are better separated from the less dense fluid or steam. After having reached the maximum velocity, in the reduced section CX, the less dense fluid containing the oil or dense particles begins again to expand and to diminish its velocity whereas the oil particles will have a tendency to maintain their velocity. The oil particles are accordingly flung against the outer cylinder E, and are extracted at a point about 60 degrees beyond the section CX. Such extraction is made through spaced openings E'', Fig. 4, in the bottom of the casing E. Extraction apparatus is located beneath these openings E''. This extraction apparatus comprises a funnel G which receives the dense fluids or oil particles separated by the action of centrifugal force from the less dense fluids and conveys them to a horizontally extending pipe H from which they are finally extracted. Those particles which are not separated at the first section CX will be separated at the second or third stations CX after having made another turn or so in the annular space.

The dense fluid or oil particles not only are separated by centrifugal action, but also partially by virtue of the tendency of the particles to adhere to the casing wall upon the fluid containing the oil particles coming in contact therewith. Oil particles that adhere to the inner cylinder D pass into the same through a slot D⁰ formed by the spaced overlapped ends of the cylinder. The oil entering this slot collects in the bottom of the cylinder D and is passed to funnel G by means of drain pipe F.

In order to prevent rebounding of the oil particles or drops of oil, perforated means or wire cloth J is provided over the extraction openings E''. The wall surface of the cylinder E may also be covered with a felt of mineral and vegetable fibre in order to prevent rebounding of the oil particles dashed against the cylinder wall at another locations thereover. The individual wires are preferably of triangular cross-section arranged so that one of their vertices point toward the fluid particles aimed at the wall surface to afford easy entrance to the particles but poor return.

Referring now to Fig. 4 there is shown an arrangement of perforated expanded metal or wire cloth K wherein a horizontal portion of the same is spaced from the cylinder wall to constitute a

trap that directs the oil particles to the extraction openings and which would otherwise have crossed the opening without having fallen into it. At the same time the wire cloth K operates to avoid rebounding of the particles that fall directly onto the same.

In Fig. 5, there is shown a combined arrangement adjacent the openings E''' comprising felt material M secured to the inner wall of the casing E and over which is disposed, in spaced relation therefrom, a wire cloth N. The felt material M may extend on the wall to some distance beyond the wire cloth N.

In Fig. 6, the rebounding of the oil particles is prevented by a series of parallel plates P extending in the direction such that the oil particles will be aimed at the spaces between them. These plates are arranged so that they resemble a window blind.

I have described what I believe to be the best embodiments of my invention. I do not wish, however, to be confined to the embodiments shown, but what I desire to cover by Letters Patent is set forth in the appended claims.

I claim:

1. In a fluid separator, a cylindrically shaped separator casing closed at its ends and having an inner cylindrical wall surface, an inner structure within the separator casing and cooperating with the inner wall surface thereof to provide a spiral fluid path of varying cross-section, an inlet for the mixed fluid at one end of the casing and an outlet at the other end of the casing for discharging the less dense fluids, and an outlet for extracting from the casing the dense fluid particles separated from the less dense fluid, said outlet being provided through the separator external casing at a point in the fluid path about 60° beyond the point of minimum cross-section therein.

2. In a fluid separator, a separator casing having an inner wall surface, an inner structure within the outer cylinder, said inner structure including an inner member extending from one end of the casing to the other end thereof and a spiral sheet extending between the inner member and the wall surface of the casing, an inlet at one end of the casing for the mixed fluids and an outlet at the other end for discharging the less dense or carrier fluid, said inner member and the spiral member being so shaped and so arranged as to provide a spiral path throughout the length of the casing of varying cross-section, and an outlet for extracting from the casing the dense fluid particles separated from the less dense fluid, said outlet being provided through the separator external casing at a point in the fluid path about 60° beyond the point of minimum cross-section therein.

3. In a horizontal fluid separator, an outer cylindrically-shaped casing having an inner wall surface, an inner cylinder eccentrically positioned within the outer casing, a spiral sheet extending throughout the length of the casing and between the inner wall surface thereof and the inner cylinder, to provide a spiral path for the mixed fluid of varying cross-section, an inlet and an outlet respectively located at opposite ends of the casing, said inner cylinder having spaced overlapped longitudinal edges near the point of minimum cross-section in the spiral path thereby providing a slot to collect dense particles within the inner cylinder, and means for extracting from the separator the collected dense fluid particles of the inner cylinder and of the separator casing.

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4. In a horizontal fluid separator for separating entrained liquid particles from a gas or vapor current, a cylindrically-shaped casing having an inner wall surface, an inner cylinder eccentrically positioned within the outer casing, a spiral sheet extending throughout the length of the casing and between the inner wall surface thereof and the inner cylinder thereby to provide a spiral path of varying cross-section, an inlet and an outlet at the respective ends of the casing, said casing having longitudinally spaced discharge openings in the bottom thereof with partitions there-between and located across lines tangential to the path of travel at the minimum cross-section where the dense particles are dashed against the casing inner wall surface by centrifugal action, perforated shock absorbing means extending over the area of the inner wall surface adjacent the discharge openings therein to prevent rebounding of the dense particles in that area, funnel means connected to the casing bottom beneath the discharge opening to collect the dense particles from the casing, said inner cylinder having spaced overlapped longitudinal

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edges near the same point of minimum cross-section thereby providing a slot to collect dense particles within the inner cylinder, a drain pipe extending from within the inner cylinder through the perforate means, and a partition between discharge openings and into the funnel means.

JEAN LOUMIET ET LAVIGNE.

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