No. 890,606. PATENTED JUNE 16, 1908.

C. CHURCHILL.

CLASSIFIER OR SEPARATOR.

APPLICATION FILED MAR. 28, 1907. RENEWED NOV. 9, 1907.

2 SHEETS—SHEET 1.

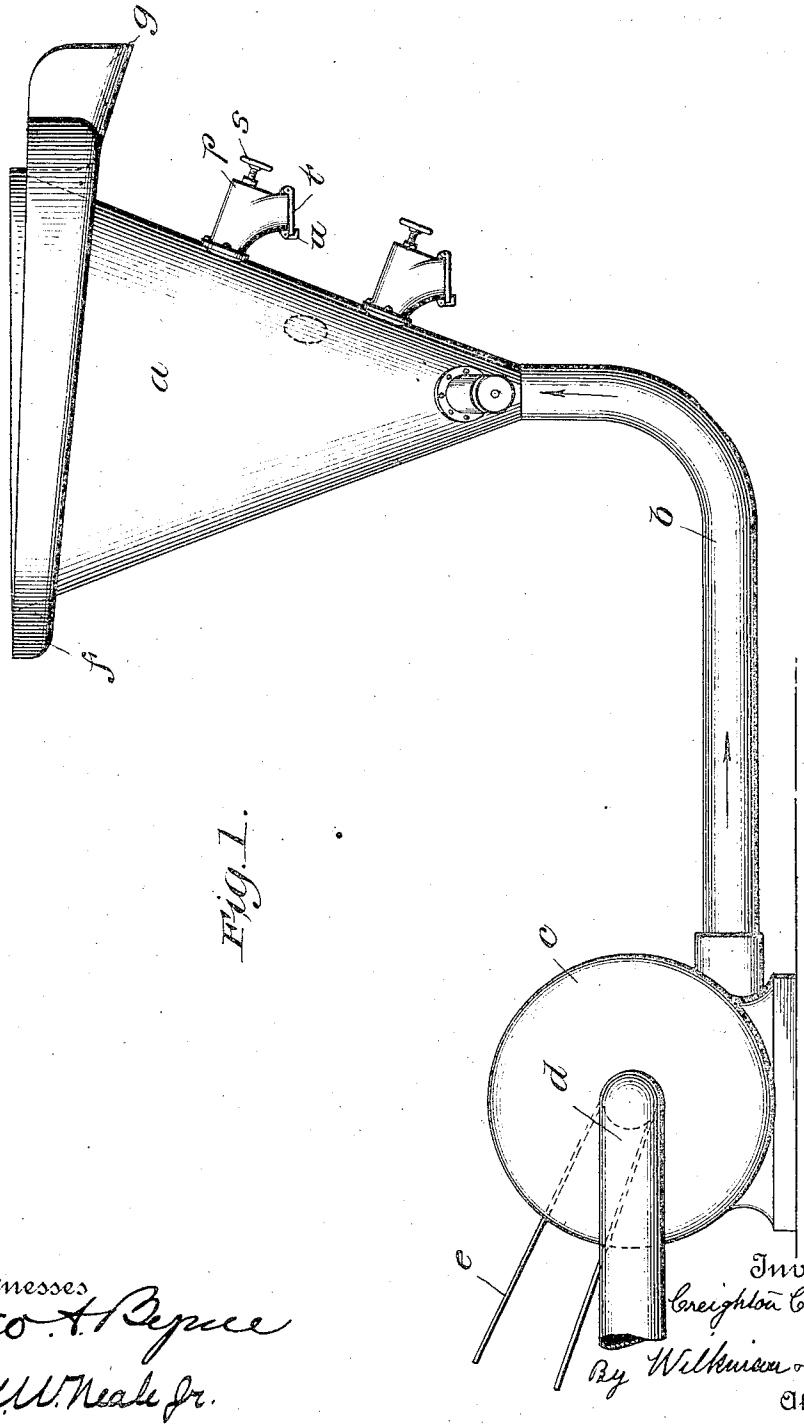

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

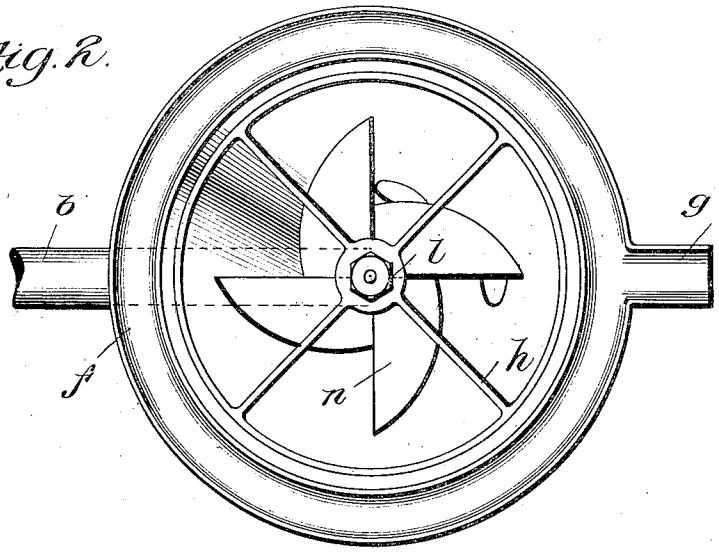
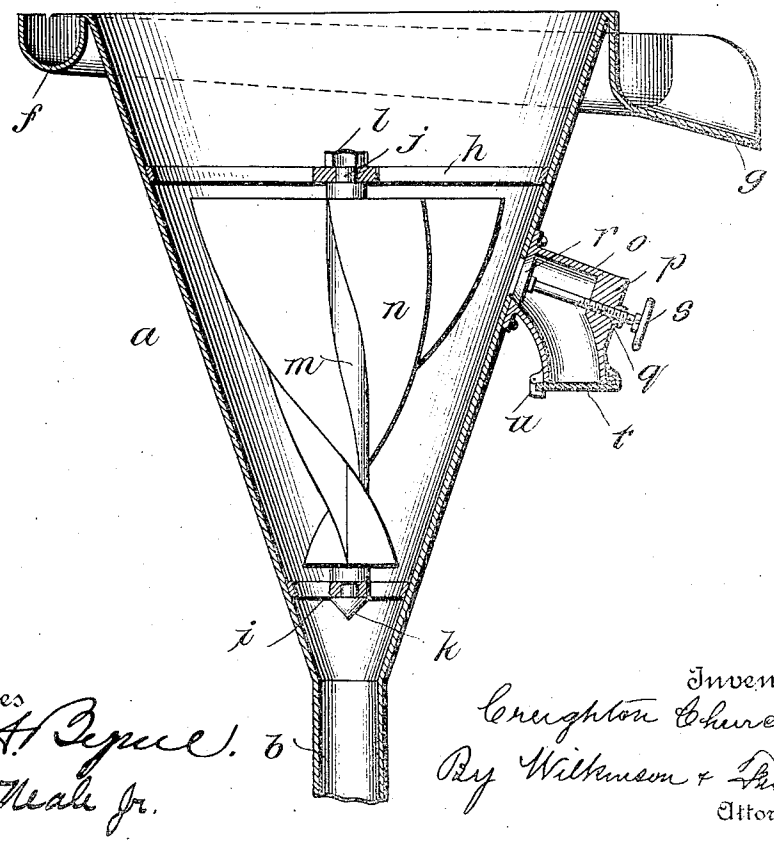


Fig. 3.



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UNITED STATES PATENT OFFICE.

CREIGHTON CHURCHILL, OF THE UNITED STATES NAVY, ASSIGNOR TO THE CHURCHILL COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

CLASSIFIER OR SEPARATOR.

No. 890,606. Specification of Letters Patent. Patented June 16, 1908.

Application filed March 28, 1907, Serial No. 365,124. Renewed November 9, 1907. Serial No. 401,495.

To all whom it may concern:

Be it known that I, CREIGHTON CHURCHILL, a citizen of the United States, and ensign in the United States Navy, serving on board the United States Steamship *Enterprise*, have invented certain new and useful Improvements in Classifiers or Separators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in classifiers or separators for materials of different specific gravities, and it depends for its action upon a combination of forces exerted by a current of water, by gravity and by centrifugal force.

It is primarily intended to separate mineral from sand or gravel, both in a fine condition, although it is not restricted to this use.

With this object in view, my invention consists in the construction and combinations of parts hereinafter described and claimed.

In the accompanying drawings:— Figure 1 is a side elevation of my apparatus. Fig. 2 is a plan view of the separating cone, and Fig. 3 is a cross section of the same.

My invention consists principally of a hollow circular cone, in which is mounted a freely-movable rotator or propeller, having spiral blades of gradually increasing pitch, the material being forced into the bottom of this hollow cone by suitable means.

a represents the hollow cone, *b* the pipe conducting the material into the bottom thereof, which pipe connects with a centrifugal pump *c*, having an inlet pipe *d*, and driven by a belt *e*. Any other suitable means, however, may be used for forcing a current of water mixed with the material to be treated in a steady stream up through the hollow cone. Around the top of the cone is arranged a circular discharge trough *f*, terminating in a spout *g*, this trough and spout being inclined. Within the cone are two spider frames *h* and *i*, secured to the interior of said cone in any suitable way, and in the central bosses of these frames is mounted a pin *j*, having a pointed head *k*, and fastened by a nut *l* at the top, the head and nut serving to firmly secure the pin in the bosses of the spider frames.

Loosely mounted on the pin *j* is the hollow shaft *m*, carrying the propeller blades *n*, which, as shown in Figs. 2 and 3, are spiral in shape, and of increasing pitch from the bottom to the top.

At intervals, the walls of the cones are perforated, and the openings therein have secured around them discharge pipes, such as *o*, each having an enlargement *p*, which serves as a bearing for the rod *q*, of a valve *r*, said rod also being provided with a hand-wheel *s*. The pipes *o*, which extend outward and downward from the cone, each have a swinging door *t* at the bottom, closed by a latch *u*.

The operation is as follows:—The material, mixed with water, is forced upwardly through the cone in a steady stream. This stream strikes the propeller blades, causing the propeller to revolve, and producing a rotary movement of the liquid, which, combined with the force of the stream coming in at the base of the cone, causes the material to travel upwardly in a spiral path, the solid particles being thrown out by centrifugal force. The construction described entirely prevents the formation of eddies in the cone, such as would naturally result if a stream of water were pumped into the bottom of a hollow cone. The separation is accomplished by means of the coaction of the stream of running water, gravity and centrifugal force. Under the combination of these three forces any particular material will rise to a definite height and lodge along the side of said cone, or be carried around in an approximately circular path in said cone at a distance above the space of said cone, which is determined by the specific gravity of the particle and its mass. If the particle is light, it will be carried up over the top of the cone. If the particle is heavy, it will stop near one of the discharge valves. Thus the sand, gravel, etc. are carried up over the top of the cone, while heavier mineral particles do not rise so high, and can be discharged through one of the discharge pipes *o* by opening the corresponding valve *r* and flap *t*.

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

1. A separator or classifier, consisting of a hollow cone and provided with means for forcing a stream of the material to be treated, mixed with water, up through the base thereof, and a loosely mounted rotatable propeller provided with spiral blades in said

cone and adapted to be driven by said stream, substantially as described.

2. A separator or classifier, consisting of a hollow cone and provided with means for forcing a stream of the material to be separated, mixed with water, up through the base thereof, and a rotatably mounted propeller in said cone provided with spiral blades and adapted to be driven by said stream, said propeller increasing in size from the bottom up so as to correspond with the slope of the cone, substantially as described.

3. In a separator or classifier, the combination of a hollow inverted cone, a pipe connected with the bottom of said cone, and means for forcing the material under treatment through said pipe, said cone being provided with valved discharge pipes at different heights, and having rotatably mounted therein a propeller having spiral blades of a pitch increasing from the bottom upwardly, substantially as described.

4. In a separator or classifier, the combination of a hollow cone provided with a discharge spout and with valved discharge pipes at different heights thereon, a pipe for supplying material to the bottom of said cone, a centrifugal pump for delivering the material through said pipe, a pair of spider frames mounted in said cone, and a rotatable propeller mounted in said spider frames, said propeller being provided with spirally-arranged arms of a pitch increasing from the bottom upward, substantially as described.

In testimony whereof, I affix my signature, in presence of two witnesses.

CREIGHTON CHURCHILL.

Witnesses:

S. R. CUSHING,

N. J. WIENER.