Nov. 26, 1968 F. W. SHARP, JR 3,412,563

JET CLOSING DEVICE

Filed Jan. 3, 1967

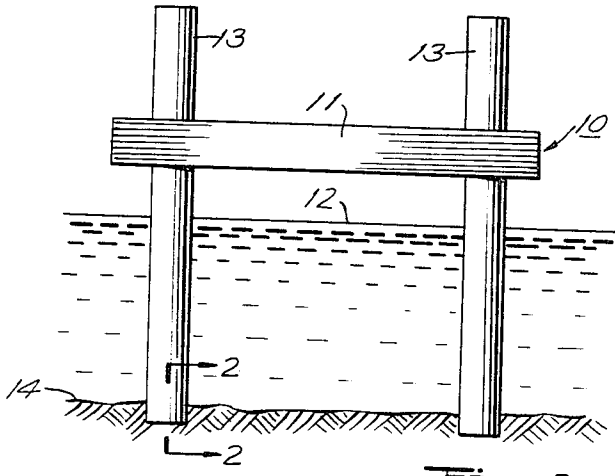

Fig. 1.

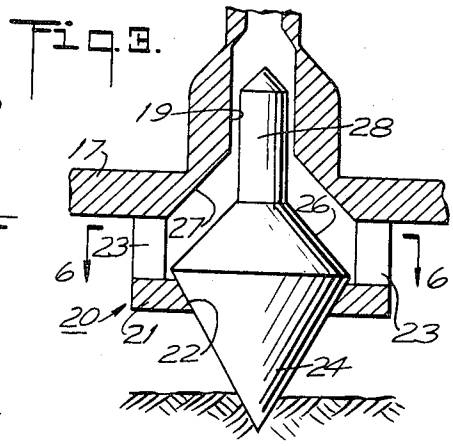

Fig. 3.

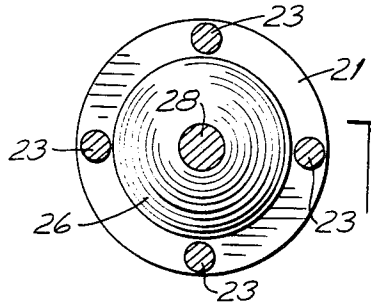

Fig. 6.

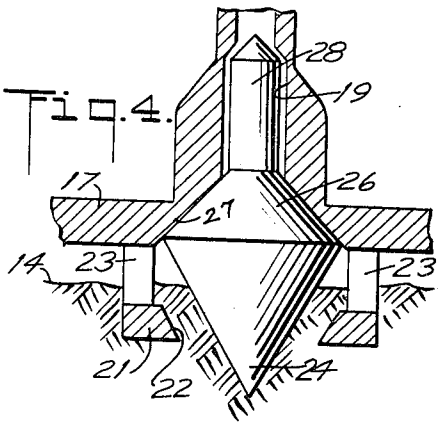

Fig. 4.

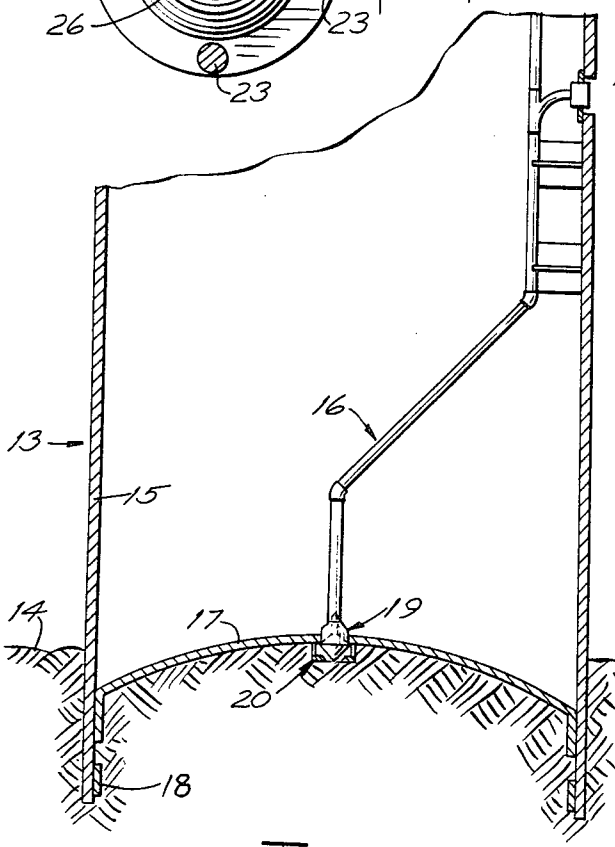

Fig. 2.

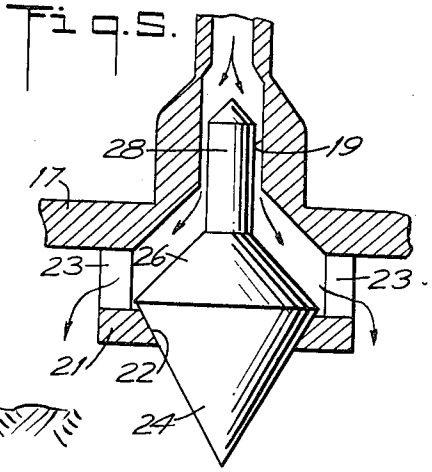

Fig. 5.

INVENTOR.
FRANK W. SHARP, JR.
BY
Kenyon & Kenyon
ATTORNEY

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JET CLOSING DEVICE

Frank W. Sharp, Jr., Houston, Tex., assignor to The Offshore Company, Houston, Tex., a corporation of Delaware

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ABSTRACT OF THE DISCLOSURE

A closing device for a jet line system of a marine platform caisson. A valve housing an upper seating portion to close off the orifice of the jet line when the caisson is in a marine bottom, and a lower seating portion to seat on a keeper ring to allow flow of jet streams of fluid from the jet line when the caisson is to be raised from the marine bottom, and the valve being sized to be moved between the keeper ring and the orifice so as to permit seating of only one seating portion at a time.

This invention relates to a jet closing device and more particularly, to a jet closing device for a caisson or the like. Still more particularly, this invention relates to a jet closing device for a marine platform caisson or the like.

Generally, marine platforms, such as dock or offshore oil well drilling barges, are constructed to be buoyant and to be towed or otherwise propelled to a marine site. In order to maintain the position of the platforms at a marine site, the platforms are frequently provided with caissons or similar members which are mounted for vertical movement with respect to the deck of the platforms so as to support the platforms on a marine bottom as well as to raise and lower the platforms relative to the water surface.

Heretofore, caissons for marine platforms have been formed of a tubular shape with closed lower ends which have been pushed into the upper layer of a marine bottom by suitable jacking assemblies on the platforms so as to achieve secure footings for the caissons. The upper layer of the marine bottom has usually been formed of loose soil in a muckish or muddy state and when such caissons have been raised by the jacking assemblies from the marine bottom, for example when the marine platform is to be moved to a new site, considerable suction force has often been imposed on the bottom of the caissons by the marine bottom in opposition to the raising forces of the jacking assemblies.

In order to overcome such suction forces, the caissons have been provided with jet lines through which streams of water have been jetted into the upper layers of the marine bottom to disturb the state of the soil and thereby break the suction on the bottom of the caisson. In some cases, the orifices of the jet lines have been formed in the face of the closed ends of the caissons so that the jets of water have been directed vertically into the marine bottom. In other cases, the jet lines have ended in nozzle bodies which project vertically from the closed end of a caisson into a marine bottom, and which have orifices for directing jet streams horizontally as well as vertically into the surrounding layer or soil. In these cases, however, the jet lines have been easily subjected to clogging during penetration of the caissons into a marine bottom as the orifices have been unprotected against entry of foreign matter. Further, these jet lines have not been efficient in breaking the suction of the marine bottom in a rapid low-cost manner since the jet streams have been directed in narrow horizontal or vertical paths which have not covered the entire face of the closed ends of the caissons.

Generally, this invention provides a jet closing device which is mounted on the face of a head of a caisson for cooperation with the orifice of a jet line system in the caisson. The head is generally of dished shape to facilitate its washing by jet streams of fluid from the jet line system. The jet closing device includes a keeper ring which is supported spaced from and in alignment with the orifice in the dished head by supports which are spaced around the ring and orifice so as to provide a plurality of openings between the supports. The device also includes a valve body which has a lower end which is shaped to seat within the keeper ring and an upper end which is shaped to seat within the orifice in the dished head.

When a caisson employing the jet closing device of this invention is lowered into a marine bottom, the valve body which has been resting on the keeper ring is forced from the keeper ring by the marine bottom, and is pushed into seating engagement with the orifice in the dished head, thereby preventing passage of any soil or foreign matter into the orifice. When the caissson is to be raised from the marine bottom, water is forced through the jet line system to push the valve body from the orifice and against the keeper ring. At the same time, jet streams of water pass through the openings formed between the keeper ring supports in a plurality of substantially transverse directions adjacent the face of the dished head. The jet streams of water continue to follow the contour of the face of the dished head so as to effect a substantially complete washing of the dished head. This causes a rapid and efficient breakup of the suction force of the soil on the lower end of the caisson. The caisson can then be quickly raised in a conventional manner with relative ease.

Accordingly, it is an object of the invention to provide a self-actuating check valve for the lower end of a cassion jet line which prevents entry of soil into the jet line.

It is another object of the invention to provide a jet closing device for a jet line of a caisson which facilitates a substantially complete washing of the lower end of the caisson upon removal of the caisson from within a layer of soil.

It is another object of the invention to provide a jet closing device for a jet line in the lower end of a caisson which is substantially maintenance-free.

It is another object of the invention to provide a jet closing device which permits a substantially full scouring of a dished head in the lower end of a caisson submerged in a marine bottom.

It is another object of the invention to provide a jet closing device which permits a rapid breakup of the suction force of a marine bottom on a caisson of a marine platform seated therein.

These and other objects and advantages of the invention will become more apparent from the following detailed description and appended claims taken in conjunction with the accompanying drawings in which:

FIG. 1 illustrates a side view of a marine platform supported by caissons on a marine platform;

FIG. 2 illustrates an enlarged view taken on line 2—2 of FIG. 1;

FIG. 3 illustrates a view of the jet closing device of the invention during penetration of a caisson into the marine bottom;

FIG. 4 illustrates a view of the jet closing device similar to FIG. 3 with the valve body in seating engagement with the orifice in the caisson head;

FIG. 5 illustrates another view of the jet closing device similar to FIG. 3 with the valve body seated in the keeper ring; and

FIG. 6 illustrates a view taken on line 6—6 of FIG. 3.

Referring to FIG. 1, marine platform **10** has a deck **11** which is supported above the water line **12** by a plurality of spaced caissons **13** on a marine bottom **14**.

Referring to FIG. 2, each caisson **13** is formed of a shell **15** of cylindrical or other suitable shape which carries an interior jet line system **16**. The lower end of the caisson **13** is provided with a recessed head **17** which, for example, has a face of dished shape. Head **17** is mounted in shell **15** as by welding, and an annular band **18** is secured in shell **15** below and spaced apart from head **17** to reinforce the shell. In addition, the jet line system **16** terminates in an orifice **19** which is formed in head **17** in a central position so as to direct a jet stream of fluid from the jet line system **17** into the marine bottom **14**.

Referring to FIGS. 2, 3 and 6, a jet closing device **20** is mounted on the face of head **17** in alignment with the orifice **19** of the jet line system **16**. The jet closing device **20** includes a keeper ring **21** of generally annular shape with a central opening having a conical seat **22**. The keeper ring is in spaced alignment with orifice **19** and is supported by a plurality of supports **23** in columnar fashion from the face of head **17**. Supports **23** are equally spaced about keeper ring **21** in order to provide a plurality of openings for passage of jet streams of fluid transversely of the keeper ring from the orifice **19** of the jet line system. Jet closing device **20** in addition, includes a valve body **24** which is disposed concentrically within keeper ring **21**. The lower end **25** of valve body **24** has a conical shape corresponding to the conical seat **22** in the keeper ring **21**, and the upper end **26** of valve body **24** has a conical shape for seating in a complementary seat **27** in orifice **19**. Additionally, valve body **24** is formed with a stem **28** having an upper end which is sized to project into the orifice **19** to guide the valve body relative to the orifice.

Valve body **24** is sized to be loosely received between keeper ring **21** and the face of head **17** so that, as viewed in FIG. 3, when the valve body is seated in the keeper ring **21**, the upper end **26** of the valve body is spaced from the seat **27** of orifice **19**.

Referring to FIG. 4, in operation, when a caisson **13** is being lowered into the marine bottom **14**, valve body **24** which is of sufficient weight to be initially seated in seat **22** of keeper ring **21** under the force of gravity is brought into contact with the marine bottom **14** and, while penetrating slightly into the marine bottom, is raised from keeper ring **21** into mating engagement with the seat **27** in orifice **19**. This closes the jet line system **16** and prevents the introduction of any soil of the marine bottom **14** into the jet line systtem **16**.

Referring to FIG. 5, when a caisson **13** is being lifted from the marine bottom **14**, fluid such as water is fed under pressure through the jet line system **16** in a usual manner to force valve body **24** toward keeper ring **21**. When the valve body moves out of mating engagement with the seat **27** of orifice **19**, the fluid flows as indicated between stem **28** and the wall of the orifice **19** substantially uniformly over the upper end **26** of the valve body **24**, and the fluid is directed between supports **23** in multiple jet streams transversely of the keeper ring **21** and across the contour of the face of the caisson head **17**. In passing over the face of head **17**, the fluid jet streams substantially fully wash the face of the head **17** of the marine bottom soil, thereby breaking the suction force of the marine bottom **14** on the lower end of the caisson and facilitating the raising of the caisson from the marine bottom.

The invention thus provides a jet closing device which not only prevents the introduction of foreign matter into the jet line system of a caisson, but also serves to substantially completely wash the bottom of the caisson to break any suction force on the caisson bottom when the caisson is to be lifted from the marine bottom. Not only does the jet closing device efficiently and rapidly break the suction force on the caisson, but the jet closing device is also of a simple construction which allows substantially maintenance-free operation.

Having thus described the invention, it is apparent that changes may be made therein without departing from the spirit and scope of the invention. Accordingly, it is intended that the subject matter described herein and shown in the drawings be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In combination with a caisson having a head closing the lower end thereof and a jet line system having an orifice in said head; a jet closing device comprising a keeper ring, a plurality of supports supporting said keeper ring in spaced alignment with said jet line system orifice on the face of said head, and a valve body disposed within said supports between said head and keeper ring for alternative seating in said orifice at one end thereof and said keeper ring at the other end thereof, said valve body having a shaped lower end for projecting through and seating in said keeper ring and a shaped upper end for seating in said orifice.

2. The combination as set forth in claim **1** wherein said supports are spaced around said keeper ring and head to provide a plurality of openings therebetween for passage of jet streams of fluid transversely of said keeper ring.

3. The combination as set forth in claim **1** wherein said keeper ring is annular.

4. The combination as set forth in claim **1** wherein said valve body ends are each of cone shape.

5. The combination as set forth in claim **1** wherein said head is dished and said jet closing device is disposed centrally of said head whereby a substantially full scouring of the face of said head is achieved upon passage of a plurality of jet streams of fluid between said supports from said jet line system when said valve body is seated in said keeper ring.

6. The combination as set worth in claim **1** wherein said head is recessed in said caisson.

7. In combination with a marine platform support caisson for penetrating a marine bottom having a dished head closing the lower end thereof and a jet line system having an orifice in said head for directing a jet stream of fluid into the marine bottom; a jet closing device comprising an annular keeper ring having a conical seat therein, a plurality of supports supporting said keeper ring in depending relation from said head in spaced alignment with said orifice therein, and a valve body disposed within said supports between said head and said keeper ring for alternative seating in said orifice at one end thereof and in said keeper ring conical seat at the other end thereof, whereby upon penetration of said caisson into the marine bottom said valve body seats in said orifice and upon passage of a fluid through said jet line system for removal of said caisson from the marine bottom said valve body seats in said keeper ring seat to allow passage of a plurality of jet streams of fluid between said supports adjacent the face of said head to substantially fully scour said face.

8. The combination as set forth in claim **7** wherein said head is recessed in said caisson.

9. The combination as set forth in claim **7** wherein said supports are equally spaced around said keeper ring.

10. In combination with a jet line system having an orifice for discharging fluid; a jet closing device including an annular keeper ring, a plurality of supports spaced around said keeper ring supporting said keeper ring in spaced depending alignment with said orifice, and a valve body disposed within said supports, said valve body being cone shaped at the lower end to project through and to seat in said keeper ring and at the upper end to seat in said orifice for sealing of said orifice.

11. The combination as set forth in claim **10** wherein said supports are circumferentially spaced about said keeper ring to form a plurality of openings therebetween

whereby a plurality of jet streams of water can be passed between said supports transversely of said keeper ring upon seating of said valve body in said keeper ring, said valve body being spaced from the orifice of the jet line system.

12. In combination, a head, a jet line system having an orifice terminating in said head for the flow of water therefrom, and a closing device including a plurality of supports depending from said head in spaced circumferential disposition about said orifice to form a plurality of circumferentially spaced openings therebetween, an annular keeper ring mounted on said supports below said head in spaced relation to said head and in alignment with said orifice, and a valve body disposed within said supports, said valve body being cone shaped at the lower end for seating in and projecting through said keeper ring and at the upper end for seating in said orifice and having a stem projecting from said cone shaped upper

end into said orifice to guide said valve body relative to said orifice, said valve body being sized to alternately seat in said orifice and said keeper ring whereby, upon seating in said keeper ring, said valve body directs a flow of water from said orifice of said jet line system into a plurality of jet streams passing from said openings between said columns across the bottom of said head.

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JACOB SHAPIRO, *Primary Examiner.*