April 5, 1927. 1,623,369

H. TILL

METHOD AND MEANS FOR CREATING A HYDRAULIC HEAD

Filed Dec. 9, 1925 4 Sheets-Sheet 1

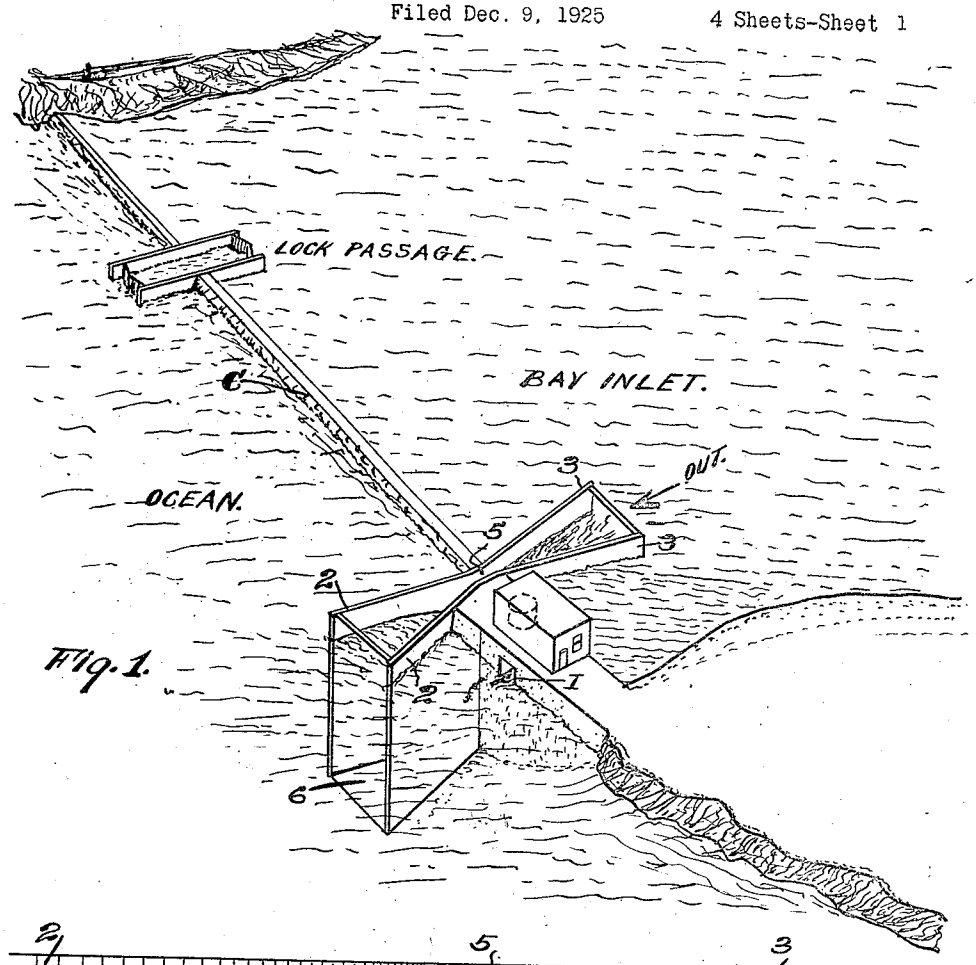



Fig. 1.

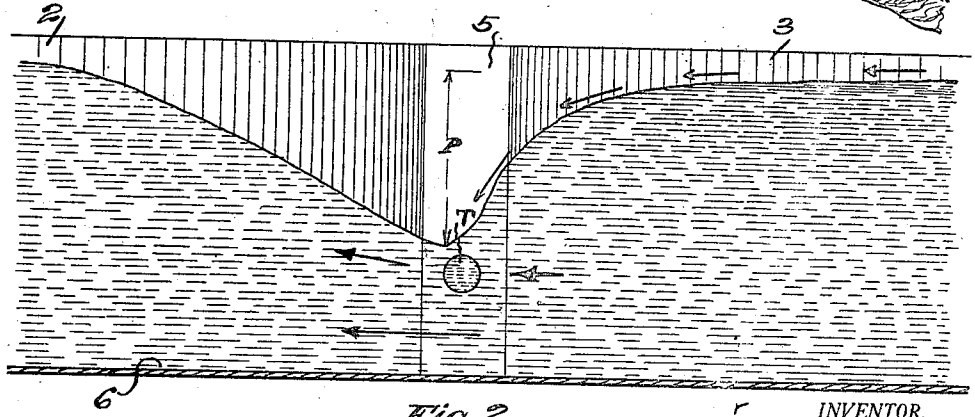



Fig. 2.

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Filed Dec. 9, 1925 4 Sheets-Sheet 2

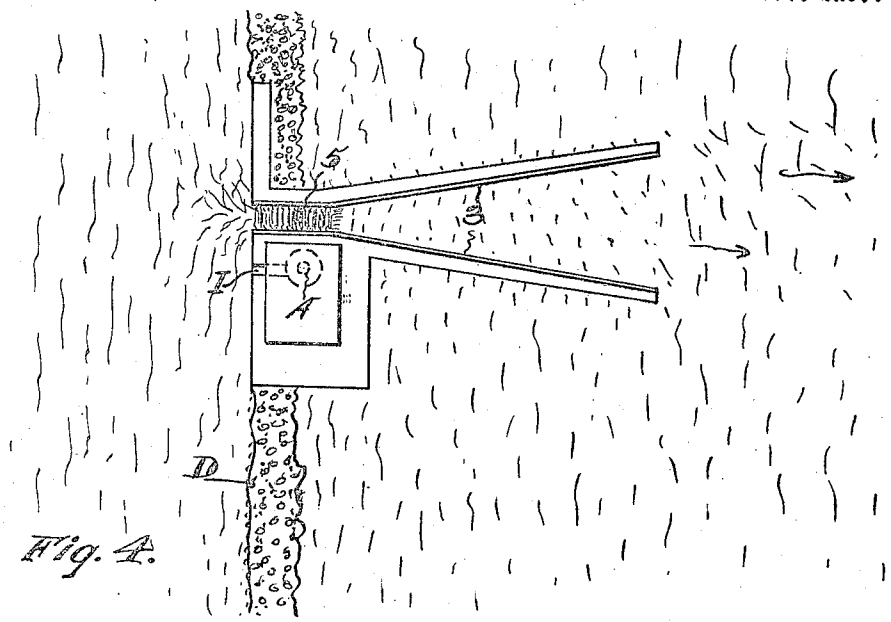
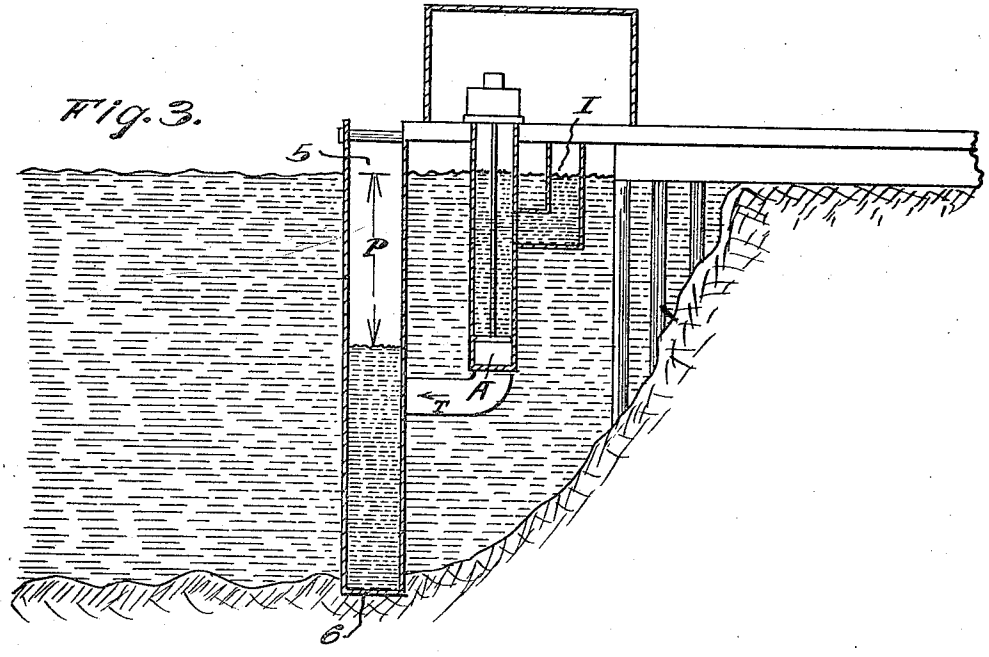



Fig. 4.

Fig. 3.



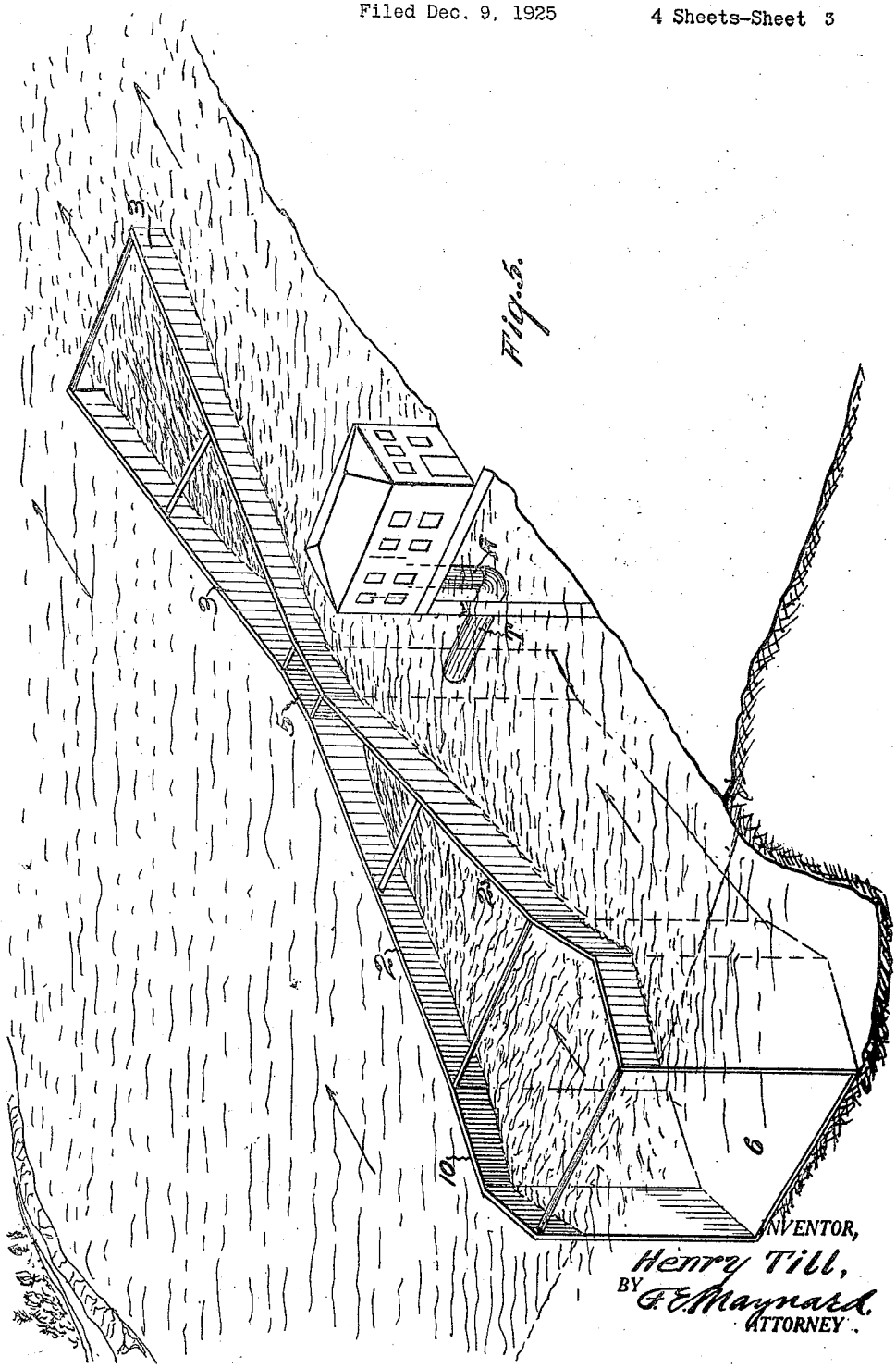

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Filed Dec. 9, 1925 4 Sheets-Sheet 3



April 5, 1927. 1,623,369

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METHOD AND MEANS FOR CREATING A HYDRAULIC HEAD

Filed Dec. 9, 1925 4 Sheets-Sheet 4

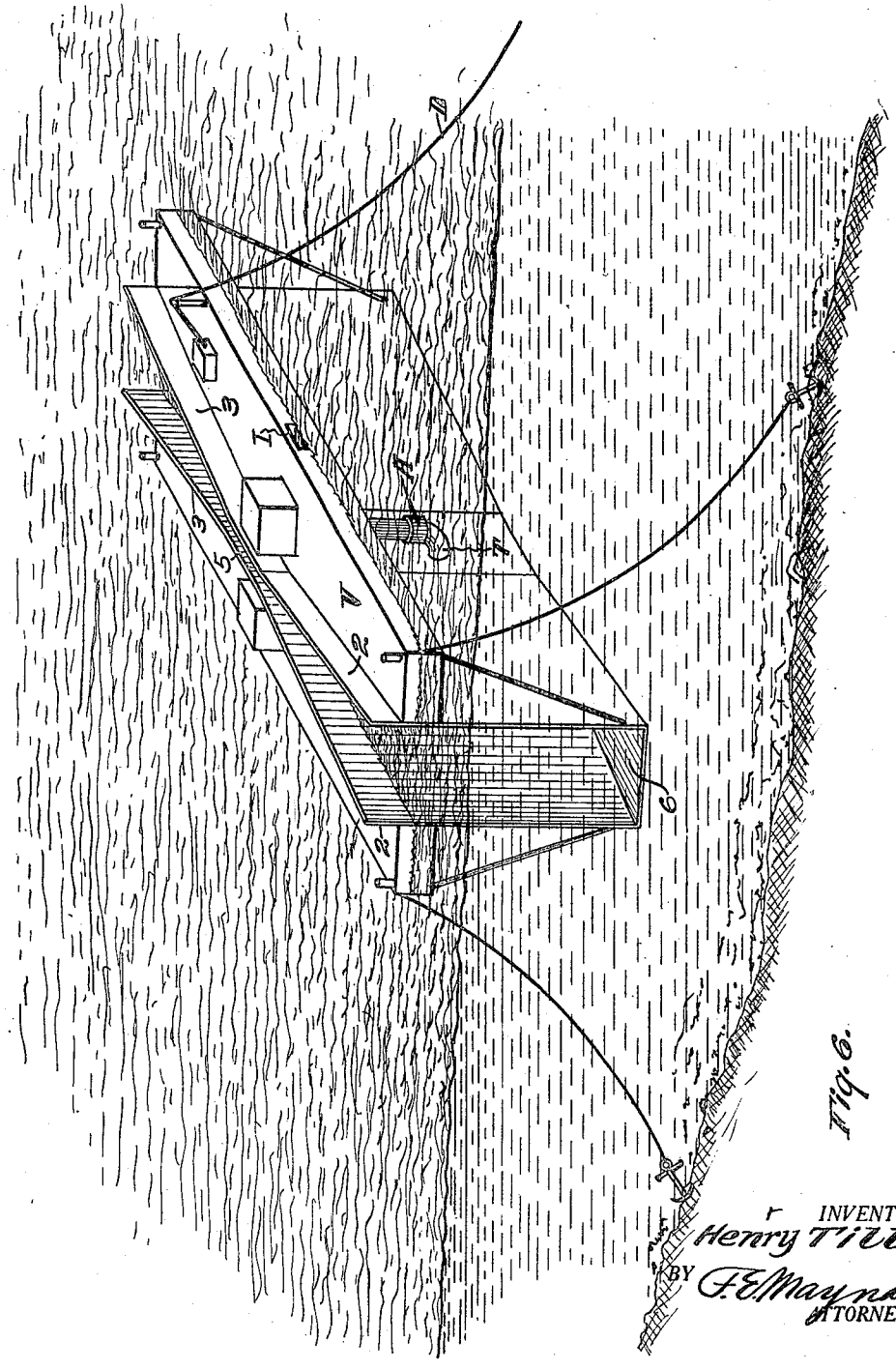


Fig. 6.

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# UNITED STATES PATENT OFFICE.

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## METHOD AND MEANS FOR CREATING A HYDRAULIC HEAD.

Application filed December 9, 1925. Serial No. 74,374.

This invention relates to hydraulics and more especially to hydraulic power apparatus and has for an object to provide a method and means for creating a very substantial positive hydraulic head which may be used for the generation of power through a water turbine or in other manner, and for other purposes.

The method comprising accelerating velocity of a running, open stream of water ad then decelerating flow in a spreading channel and thereby establishing a level lower than the normal level of the stream. In other words, by my invention I materially restrict or choke a running volume of water, confine its flow to a narrow open conduit and then cause the constricted water to pass into a spreading open top passage with the result that there is a very substantial depression produced in the throat where the water enters into the spreading discharge passage.

An object is to create a useful head in an open flowing body of water without causing a material rise in the normal upstream level, as is the result of an impounding dam. Advantages I gain are that there is no overflow of back country by impounded water, and a large river or a large, swift tidal current which could not possibly be dammed up, can be made the source of useful power.

Another object is to make available the inherent power of a very large cross-section area of a running stream at a predetermined point. The power of flowing water is, generally speaking, but little. However, as the power increases as the cube of the velocity of the stream a large cross-sectional area of a swift current holds great power development possibilities by this method.

My invention, appropriately called a "fall creator" is based upon the fact that if a passage or channel (open at its top) with upright, longitudinally converging entrance side walls and longitudinally divergent discharge side walls is placed in a stream, the surface of the water in the passage, instead of being humped up by the narrowing of the passage, as one might expect, is greatly depressed at the narrowest part, or throat, and its velocity greatly increased at that point and the water again rises to approximately the same level it had before on reaching the down stream end of the passage.

The lowest portion of the created depression I utilize as the lower level of a head of water taken from the normal level of the stream, the difference-head being used on a suitable turbine whose tail water is discharged or inducted into the constricted throat at or below the greatest point or zone of depression.

Other objects and advantages will be made manifest in the following specification of method and apparatus incorporating the invention; it being understood that modifications, variations and adaptations may be resorted to within the spirit, scope and principle of my invention.

Figure 1 is a perspective of an embodiment of apparatus as installed in a tidal currrent as in inlet from the ocean to a bay, or in a tidal river.

Figure 2 is a vertical section and graph indicating the formation taken by water in action in apparatus of the form of Fig. 1.

Figure 3 is a vertical cross-section showing a typical motor and turbine wheel installation, with its discharge tube leading to the throat.

Figure 4 is a plan of an embodiment for use in a unidirection stream.

Figure 5 is a perspective of a "fall creator" for installation in a unidirection river.

Figure 6 is a perspective of a moored, floating power plant for a tidal river, ocean straits current, or other deep running water body.

The apparatus of Fig. 1 for creating a head in a tidal stream consists of two sets of walls 2—2 and 3—3, each set having its walls preferably vertical and converging gradually toward a central and narrow throat 5. The entire length of the passage formed between the walls is open at the top and has a smooth and perfectly unobstructed bottom 6 to avoid scouring of the bottom and breaking of continuity of water flow and eliminating surface rising from bottom distortion. In other words, whatever its cross-section, the bottom lines are longitudinally uniplanar.

The sides 2 and the sides 3 form duplicate passage mouths for production of equal and similar effects whether the tide is running into the bay inlet or is running out, thus producing in the throat 5 a depression P, as clearly outlined in Fig. 2. Incoming water is greatly increased in speed of flow at the throat while the water in the discharging side of the passage loses its speed as it leaves the throat.

Obviously the water body beyond the outpouring side has a normal level and this tends to enter the far end of the outlet side but does not pass in toward the throat 5 against racing water from the throat in sufficient volume or speed to prevent the creation of a very material depression or pocket P in the throat. Therefore, a positive head is created equal to the difference between the highest water level at the inflow side and the bottom of the pocket P.

If, now, high level water be turned into the penstock or intake I of a turbine A, Fig. 3 and if the tail tube T be led into the throat 5 at a point below the pocket P then the differential head will be utilized in the turbine.

In Fig. 1 a causeway C throws all the incoming or outgoing water through the fall creator. The penstock opens to both sides of the causeway so as to take water from the higher side at tide reversal.

Figure 4 shows, in plan, an arrangement adapted to a stream running only in one direction with a low natural fall. In this case a dam D gives a small head from which water flow is accelerated as it passes into throat 5. In this arrangement only a spreading outlet 3 is required. The penstock I is open only upstream to obtain highest head water for turbine A.

Another form of apparatus is shown in Fig. 5 which is adapted for a large unidirection stream where a dam is not allowed or is undesirable. In this type the intake walls 2 have a water pen 10 at the mouth and the apparatus is stationary. The tail tube T of the turbine plant leads to the throat 5.

In instances where ample stream is available as in an ocean straits or large deep river but where it is impracticable or not allowable to place a stationary power plant or fall creator of the kind here disclosed a floating equipment may be opportune. Hence I show, in Fig. 6, a fall creator as combined with a floating vessel V which may be suitably anchored, or in other manner held, out in the stream, which may be unidirectional, or tidal. One or more power units may be provided on the vessel and generated power (electricity) conducted away by a cable D.

The character of the device and many suitable locations permit installations of very large dimensions, the larger the installation, the less the proportional loss by friction.

A number of the fall creators may be installed in spaced relation, side by side in a very large stream, or tidal current, or they may be arranged in alignment along the stream.

It is understood that only such volume of water will be passed through the turbine as can be carried away from the throat by the inherent power of that portion of the stream entering the device and as will not destroy the created depression or pocket and lose the head gained.

What is claimed is:

1. The method of utilizing the power of a large area of cross-section of stream without materially backing up the upstream level by converging the flowing stream section into a narrow open topped throat and then passing the water from the throat in a spreading open body whereby to cause a pocket to be created at the throat and between the level of the upstream side and the level of the downstream side, such pocket providing a positive head as between the higher level and the bottom of the pocket and inducting water into the throat at the zone of water depression.

2. The method of making the power of a large cross-sectional area of a running stream available for driving a turbine, which consists of converging the cross-section to a narrow open top throat and then spreading the cross-section from the throat whereby to create a pocket or depressed level between the converging passage and the spreading passage, all without materially raising the upstream level and inducting tail water from the turbines into the zone of greatest surface depression.

3. The method of creating a hydraulic head which consists of accelerating a flowing body of water and passing it through an open top throat without flow obstruction along the bottom and decelerating the velocity by passing it into a spreading discharge passage whereby to cause a depression in the water level, and conducting water from the higher level into a turbine and discharging from the turbine into the throat at the point of greatest depression.

4. Apparatus for utilizing the power of a large area of cross-section of stream without materially backing up the upstream level, comprising a passage for converging the flowing stream section, a narrow open topped throat at the smaller end of the passage, and a spreading passage leading from the throat, whereby to cause a pocket to be created at the throat and between the level of the upstream side and the level of the downstream side, such pocket providing a positive head as between the higher level and the bottom of the pocket and means for inducting water into the zone of greatest depression of water.

5. The method of increasing head in a stream, which has a substantially uniform level, by converging stream water into an open top conduit and passing the water from the converged stream immediately into a spreading discharge; whereby to establish a pocket or depression in the surface of the water between the converged part and the diverged or spread part; the depth of de-

pression constituting a head, and utilizing the head by inducting water from a level which is higher than the lowest point of depression.

6. The method of producing a useful hydraulic head in a running body of water by creating a depression in its surface between two points along the line of flow, inducting into the zone of depression water from a level higher than the bottom of the depression, and carrying the inducted water away by the running body.

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