(No Model.) 3 Sheets—Sheet 1.

L. FALERO.

APPARATUS FOR THE CULTIVATION OF OYSTERS.

No. 413,503. Patented Oct. 22, 1889.

Fig. 1.

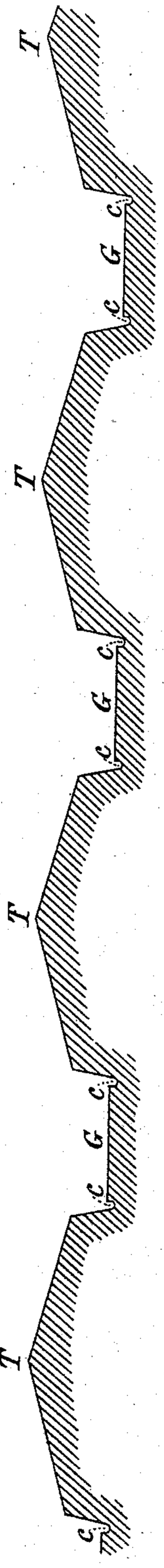

Fig. 2.

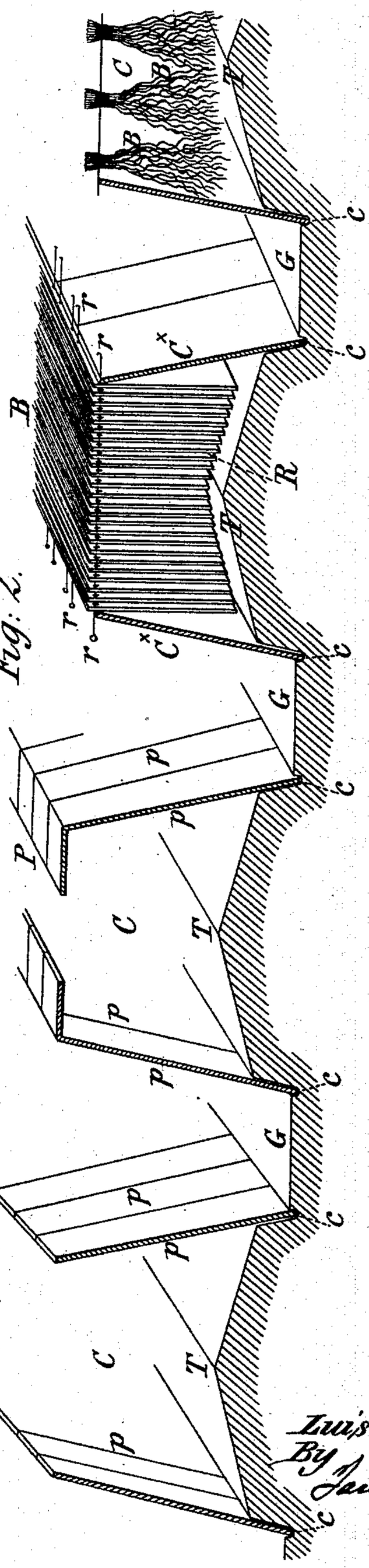

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Fig: 3.

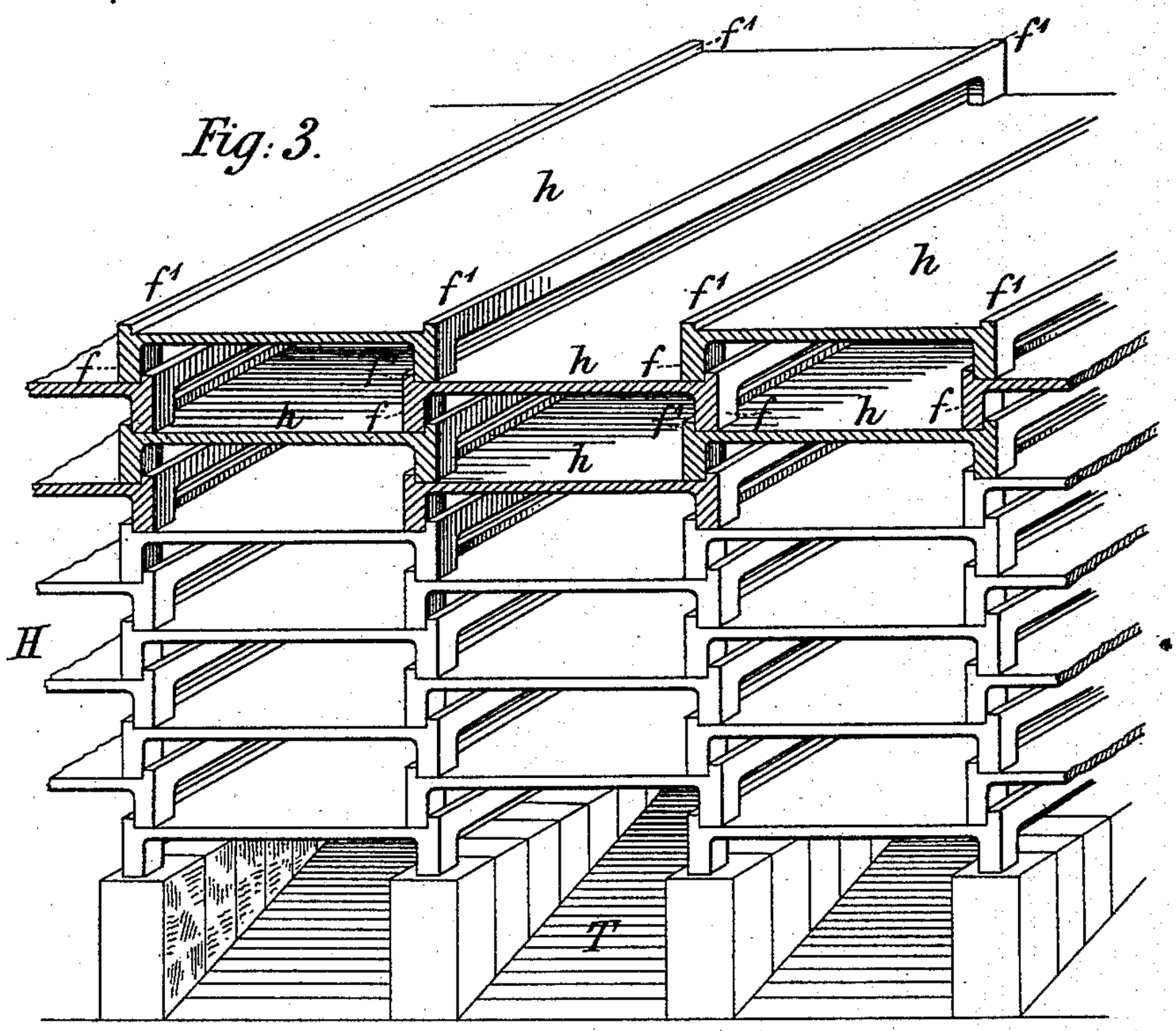


Fig: 3ª.

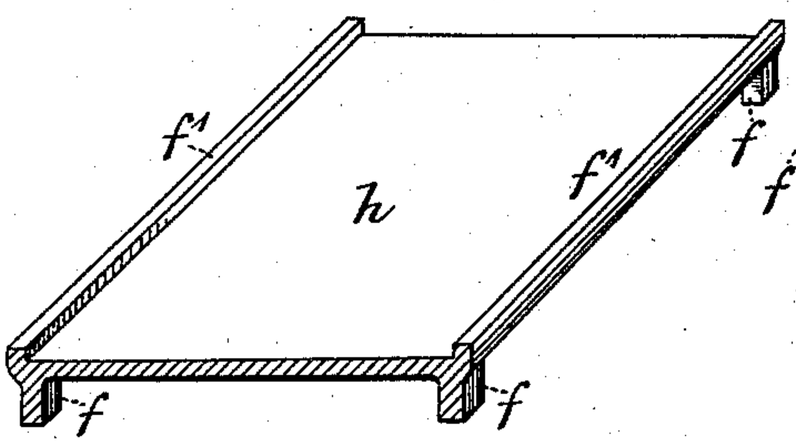


Fig: 3ᵇ.

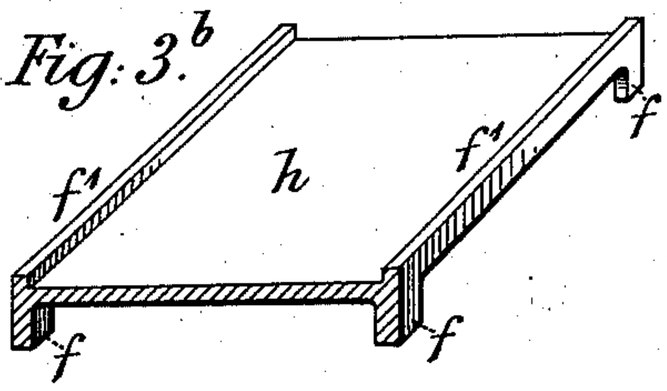
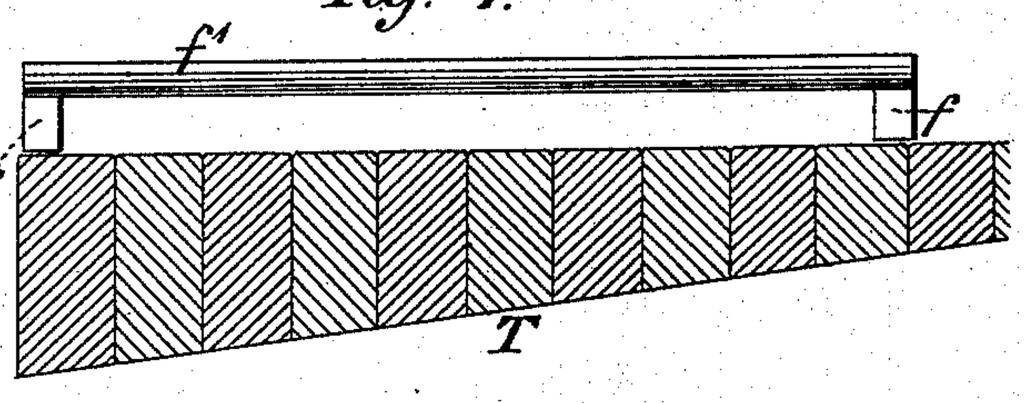


Fig: 4.



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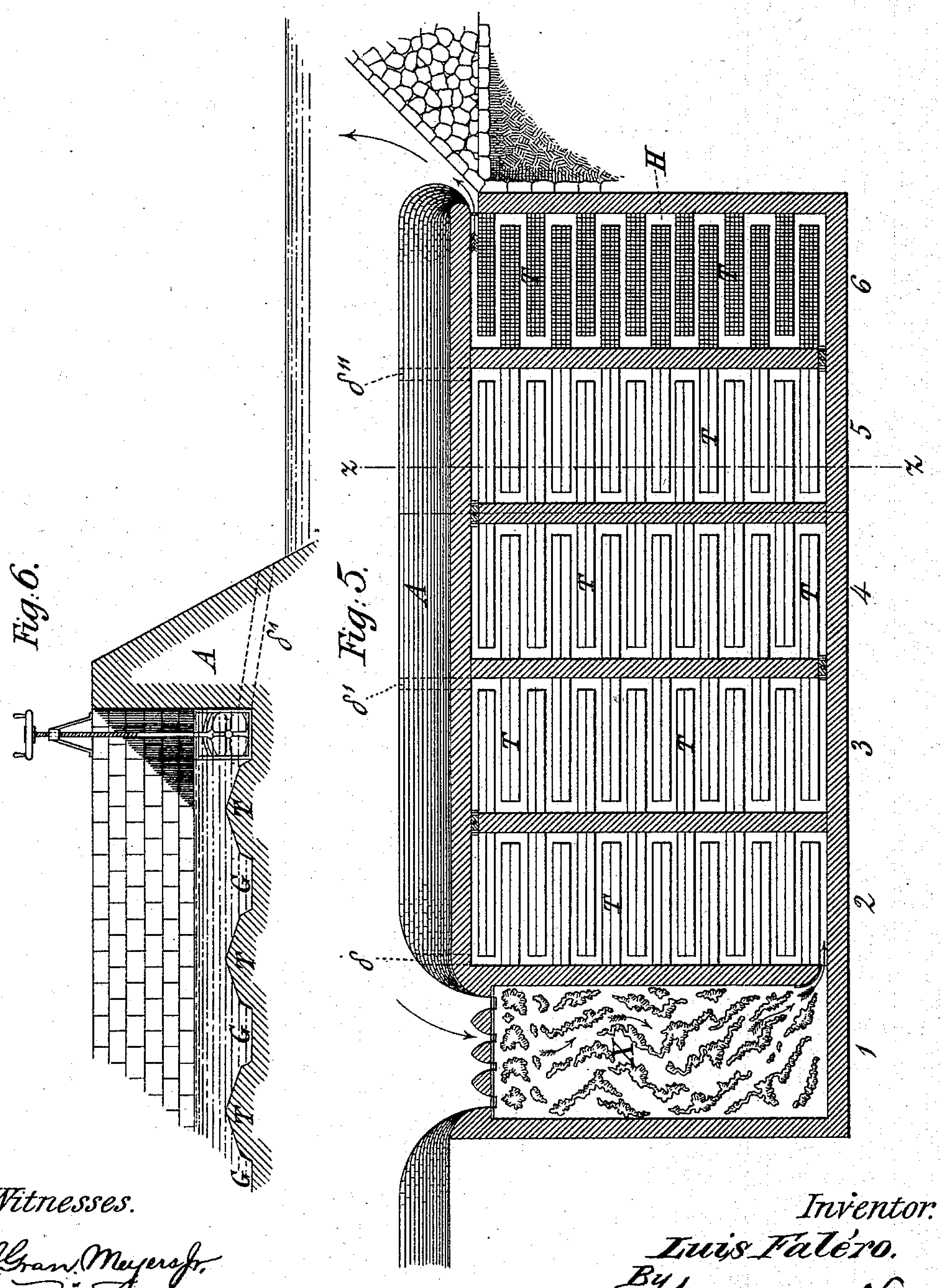

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR THE CULTIVATION OF OYSTERS.

SPECIFICATION forming part of Letters Patent No. 413,503, dated October 22, 1889.

Application filed May 23, 1889. Serial No. 311,843. (No model.)

To all whom it may concern:

Be it known that I, LUIS FALERO, a subject of the King of Spain, residing at London, England, have invented new and useful Improvements in Oyster Culture and Means and Apparatus for Use Therein, of which the following is a specification.

My improvements in oyster culture relate to the general installation, as well as to the arrangement of details, of artificial oyster-beds, and are characterized by certain new features, hereinafter described, whereby the breeding, rearing, and fattening of oysters are effected under hygienic conditions, and a greater yield or output for a given bed-surface is obtained. Given a natural or artificial pond or reservoir periodically covered with sea-water at the time of the tides and left dry or partially emptied, when required, by means of water gates and locks, the first condition for a good rearing consists in the construction of a bottom upon which mud cannot accumulate, (at least in places where the oysters are deposited,) and which permits by its disposition of the easy and thorough cleansing of its whole extent without disturbing the oysters—disturbance being very prejudicial to them. Mud being the most mortal enemy to the oyster, the spat can successfully develop even among the mother oysters, provided the bottom be always free from mud, especially in closed spaces or ponds where the mollusks while still young are protected from their marine enemies.

Artificial oyster-beds are, as a rule, at present made with a flat or curved bottom with slight inclines in whatever manner the bottom may be prepared upon which the oysters are deposited in more or less uniform layers. All these bottoms ultimately tend to silt up, even in the most perfectly-constructed installations, and the accumulated deposits will at last smother the oysters if care be not taken to clean the bottom frequently. This operation, which is always difficult and costly, generally necessitates the disturbing of the oysters and always renders difficult or prevents the collection of the spat.

And in order that my invention may be clearly understood, I will proceed to describe the same with reference to the accompanying drawings, in which—

Figure 1 represents in transverse section the improved bottom for oyster-beds, specially designed to effect the object of my invention and forming tables upon which the oysters are deposited. Fig. 2 represents a similar section with the addition thereto of certain alternative contrivances, hereinafter fully referred to, for the collection and retention of the spat. Fig. 3 represents in perspective view and end section a specially-devised receptacle or hive, being a cellular structure, which is hereinafter fully referred to as being employed for the reception, accumulation, and development of the oysters. Figs. 3^a and 3^b are perspective views of two forms of elements constituting the said hive or cellular structure. Fig. 4 is a side elevation of one of the before-mentioned elements and the base upon which they are placed, such base preventing any accumulation of mud deposits underneath. Fig. 5 is a diagrammatic view or general plan of my improved installation comprising, by way of example, six equal ponds formed by five inside partitions of masonry and provided with the necessary sluices for permitting the communication of the water from one pond to the next. Fig. 6 is a transverse section, on a larger scale, taken on the line *z z* of Fig. 5, and showing one sluice-gate and the sea-wall.

Now, in carrying out my system or invention, and in order to remedy the evils above mentioned, my first improvement consists in constructing or forming the bottom of inclined tables or slabs T, which are built up at sufficient height above the soil, and are separated from each other by gutters or working-passages G, constructed at a lower level. In these gutters or passages the mud from the tables will accumulate and can therefore be removed with the greatest facility. All these gutters are arranged to discharge at certain points—such as S S′ S″, (see Fig. 7)— where the mud can be washed out automatically through the external wall A to the sea or removed mechanically. By this construction or formation the mud will be readily carried off the surface of the inclined tables by the lightest currents of water and will fall into the gutters G, thus securing a perfect limpidity of the water in which the oysters are bathed, and the tables which serve them as a bottom

will be always sufficiently clean, even when the surrounding water is charged with mud. This improved bottom for ponds, beds, parks, or the like for the culture of oysters may be economically made with argillaceous earths rammed between two planks, then leveled to the desired inclination by the use of molding-boards or other suitable means, and finally covered or faced (as well as the gutters which separate them) with a layer of concrete, hydraulic cement, or conglomerate, being of a silicious character for the gutters and calcareous for the tables, in order to encourage the growth of the mollusks. A groove or furrow *c* is formed at each side of the base of the tables or slabs to hold what I respectively term "plain" and "compound" collectors, and which are hereinafter fully described. The tables or slabs T being molded as a solid mass in block of conglomerate, as well as the gutters G, according to a constant profile determined by the molding-board, the whole may be faced with a vitrified material, which has the hardness of granite, and is more unchangeable in sea-water, thus constituting thereafter a suitable bottom of practically unlimited durability; but cement or any other substance unaffected by sea-water may be used where it is found more economical or convenient to do so. The oysters placed on these tables or slabs will thus be protected always from mud, which, as before stated, will accumulate in the gutters or working-passages G, and will flow off naturally either by the slope of the gutter or by the cleansing, easily effected, as may be found necessary, as there will there be no oysters to smother. The profile of the tables, instead of being inclined, as shown, may be convex, pyramidal, or of any other projecting form that will provide the required inclined surfaces for receiving and retaining the oysters.

A stagnation-pond is shown in Fig. 5, and is marked X. It serves also as a feeding-pond, and at its bottom is laid a bed of rock-work or an artificial labyrinth of vitrified material so arranged as to create currents and give motion to the sea-water, the result of which is the withdrawal of the mud held in suspension in the water by the sea-water itself. This stagnation-pond also acts as a filter or purifier of the water previous to its entering the oyster-beds.

The second, third, fourth, and fifth ponds are respectively the fecundation-pond, the one-year-oyster pond, the two-year-oyster pond, and the three-year-oyster pond.

In the sixth pond is the fattening-hive or cellular receptacle, which is hereinafter fully referred to, and in which the output of the establishment or the whole harvest of the year is brought to the state of fully-grown-up oysters, which are fattened and kept in good hygienic condition and stored in great numbers, ready for sale during the year. Through this pond a suitable proportion of fresh water can be advantageously directed at the time of fattening without altering the normal conditions of the other ponds. The production of the establishment is thus made continuous and equal annually, as every year the contents of one pond will arrive at maturity and will be stored in the "hive" for fattening, and will be kept there ready for consumption, while every year another pond will be furnished with my collectors, on which the prolific oysters will deposit their spat in entirety, and consequently in great excess of the annual production.

In commencing to work an installation such as I have described I may purchase spat, likewise oysters of one year's growth, oysters of two years' growth, and oysters of three years' growth of still under commercial value. Then at the end of the first year I would be able to supply oysters of commercial size, which have improved for one year in my beds. The sales of the second year would be of oysters having been two years improving in the beds. The sales of the third year would be of oysters improved during three years, and consequently the fourth year's sales and the following yearly sales would be of oysters bred and grown in the establishment; or I may commence differently—that is to say, I start by laying on one of the beds a certain number of prolific oysters, so that the beds may be stocked entirely with their first fecundation. In such case the oysters bred in the establishment would take four years before reaching commercial size; or I may purchase only spat and stock the entire establishment, the hives excepted, with the same. In such a case it would take four years to bring the oysters to commercial size. The sea-water, aerated and cleansed by the feeding-pond, enters through sluices into the second pond, where the "tables" are arranged in alternate order in such a way as to cause and preserve a constant direction to the current. After its rapid circulation along all the tables of this pond the water is directed into the second pond, and so on, until it is discharged through the locks of the sixth pond, facing an open space of at least the same cubic capacity as the six ponds together, and protected from the direct flood and furnished with a lock. This space is not shown in the drawings, it being of variable disposition according to the locality, and its shape having no importance, provided the capacity be sufficient. By these means the sea-water always circulates through the whole extent of the ponds in strong or slow currents at will, and in one direction during the whole time of the rise of the tide. Then the water is kept in the ponds at a suitable level in accordance with the conditions of the atmosphere until the current is reversed some time before the next tide, thus keeping the oysters in the normal condition of nature, and then at the return of the tide the same operations are repeated.

Spat-collectors.—As soon as the lacteous con-

dition of the oysters has been proved the collectors C may be prepared. These collectors are formed of an assemblage of surfaces so disposed as to shut in the tables within an inclosure or continuous wall, which will prevent the scattered or emitted spat from being carried off laterally by the currents or by its own motion and falling into the gutters G and being lost, but, on the contrary, will compel such spat to remain upon the surface of the tables circumscribed by the collectors C, my object being to form a continuous wall surrounding the bed of the mother oysters and high enough to prevent the spat and young oysters from escaping over it. The means for providing such a barrier—necessary for the preservation of the spat—are numerous and all very simple. For instance, for the plain collectors a row of tiles placed vertically along the edge of the tables or slabs will in some cases suffice, as seen at C, Fig. 2; but for these I find it advantageous to substitute a series of plates *p* or planks of sufficient height and of any suitable width, limited only by the weight or stiffness of the material employed. These plates take into the grooves *c*, which run at the base of the tables or slabs, and are supported against the edge of these tables or slabs simply by their own weight, said plates being placed one beside another in the manner shown in Fig. 2, so as to form a continuous wall. The so-called plates may be slabs of stone, slate, glass, metal, wire-gauze, terra-cotta, or vitrified earthenware, or may be of conglomerate or of artificial material—such as cement—or of basket-work or cloth cemented in frames; or they may be of planks of wood tarred and then coated with cement, and, in fact, of any material possessing the necessary resistance to sea-water and of suitable surface to encourage the growth of the spat. In cases where it may be necessary to increase the surface for the fixation of the spat compound collectors may be advantageously employed and formed of plates whose inner surface are furnished with projections or additions destined to increase such surface. Rectangular or curved plates R, as shown in Fig. 2, adjacent one to the other, fill up the space between the two walls, and may be kept in position by means of rods *r*, extending from one large plate $C^{\times}$ to another, or by any other suitable form of supports. Wire-gauze coated with any suitable substance—such as cement, which is not liable to be injured by sea-water—may be used, but is not recommended. It should be folded upon itself, so as to offer very large surfaces. In some cases I form a roof P of large surface, (see Fig. 2,) which may be of basket-work coated with a protecting substance; or other like devices may be used, especially those in the form of plates suspended above the oysters and which will insure the fixing of the spat on their surfaces. Squares of cloth or other fabric, thin sheets of cellulose, coated with cement and suspended by wires, may be employed, as may likewise besoms B or bunches of twigs suitably arranged, as shown, with reference to Fig. 2. These surfaces, as well as the interior walls of the lateral plates, will become charged with the whole of the annual spat of the oysters, and will thus permit of its ready collection. The use of a collector arranged as above described constitutes an important feature in my improvements, and it has for its object, as before stated, to furnish a bed for receiving and holding the spat and to interpose an obstacle by means of a wall, so as to obviate the danger of such spat being carried away.

My third improvement relates to cellular structures, which I term "fattening-hives." By means of my fattening-hives (shown in Fig. 4) it is possible to fatten the oysters until they reach the required size and condition, while keeping them ranged side by side without touching each other. I find that about two thousand oysters, and in some cases more, may be fattened in each square meter of the whole surface of the bed, with a depth of only about eight feet of water, giving over twenty millions oysters to the hectare, (two and one-half acres.) I construct the fattening-hive H (see Fig. 3) with horizontal or other suitably-arranged shelves, stages, trays, or cells, upon or in which the oysters are disposed in as many stages as may be desired, the only limit being the depth of water covering the mollusks in the ponds, basins, or the like, and which may be anything, provided such depth does not exceed thirty feet. The shelves or trays or stage may be advantageously made of glazed earthenware or other like suitable substance. (See Figs. 3 and 3^{b}.) They are provided with feet or ledges *f* on their under side, and with lateral flanges or rims *f'* on their upper surface. The said feet or ledges and the flanges or rims are so contrived as to interlock, and to thus form a cellular structure of any number of superimposed stages, feet, or tiers, suitable for receiving and retaining the oysters. These stages thus disposed permit the water to circulate freely and allow the light to penetrate to any depth, even through forty stages. These hives may also be used as collectors, as the spat emitted inside the hive cannot escape from such a structure.

The proper distance from the shore at which such an installation as I have described should be placed must be such that the walls circumscribing the same just emerge from the water at spring tides, while they are low enough to be touched by the water at neap tides.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An artificial bed for the culture of oysters in sea-water, comprising a series of tables having inclined top surfaces extending downward in opposite directions, a series of gut-

ters, one between each pair of tables, and spat-collecting walls rising upward from the opposite sides of each table, substantially as described.

2. An artificial bed for the culture of oysters in sea-water, comprising gutters alternating with tables having top surfaces inclining downward in opposite directions, and provided at their bases with grooves or channels and spat-collecting walls resting at their lower edges in the grooves or channels and rising above the highest portions of the tables, substantially as described.

3. An artificial bed for the culture of oysters in sea-water, comprising gutters alternating with tables, each having inclined top surfaces and a groove or channel at each side of its base, and spat-collecting walls arranged in the grooves or channels resting against the sides of the tables and rising above the highest portion of the latter, substantially as described.

4. An artificial bed for the culture of oysters in sea-water, comprising mud-receiving gutters alternating with tables, each having its top surface inclined downward in opposite directions from the center, and two spat-collecting walls rising, respectively, from the opposite sides of each table for holding the spat thereupon, substantially as described.

5. An artificial bed for the culture of oysters in sea-water, comprising gutters alternating with tables, each having its top surface inclined downward in opposite directions from the center, and two spat-collecting walls rising, respectively, from the gutters at opposite sides of each table, and each wall consisting of a series of plates arranged one beside the other to form a continuous wall rising above the highest portions of the table, substantially as described.

6. An artificial bed for the culture of oysters in sea-water, comprising a series of inclined tables, alternating gutters, spat-collecting walls rising from each table, and a fattening-hive composed of a series of superposed trays with intervening spaces in which the oysters are disposed, substantially as described.

7. An artificial bed for the culture of oysters in sea-water, comprising a series of ponds having inclined tables with side gutters, spat-collecting walls rising above each table, and one pond containing a fattening-hive composed of superposed trays having interlocking rims and feet, and intervening spaces in which the oysters are disposed, substantially as described.

8. An artificial oyster-bed comprising a series of ponds each containing a table T, having inclined surfaces, a mud-receiving gutter G between each pair of tables, the spat-collecting walls rising above the tables, the stagnation-pond X, the fattening-hive H, composed of a cellular structure in one of the ponds, and sluices for connecting the several ponds with the sea, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

LUIS FALERO.

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