No. 656,582. Patented Aug. 21, 1900.

F. C. LANG.

DRY DOCK.

(Application filed Mar. 21, 1900.)

(No Model.) 3 Sheets—Sheet 1.

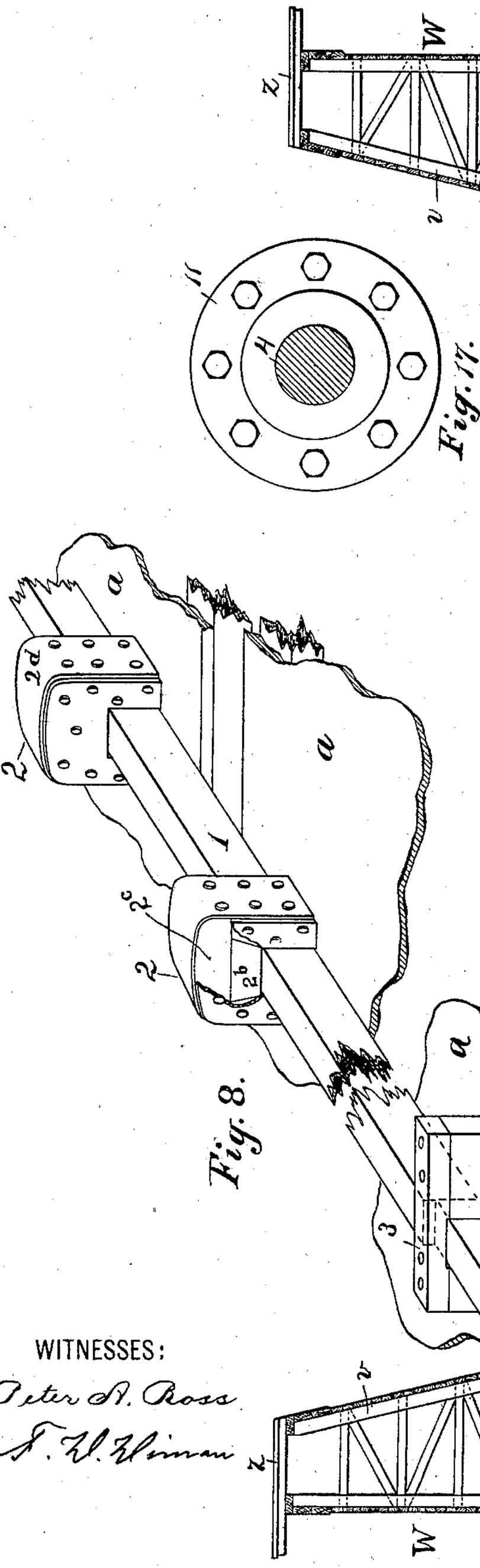

Fig. 8.

Fig. 17.

Fig. 1.

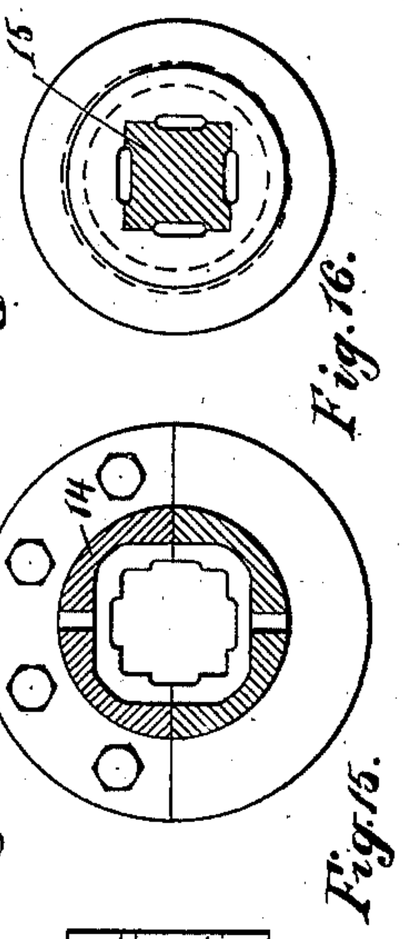

Fig. 15.

Fig. 14.

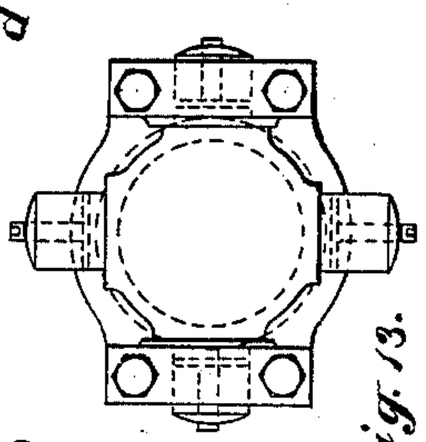

Fig. 13.

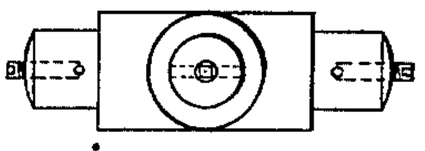

Fig. 12.

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(Application filed Mar. 21, 1900.)

(No Model.) 3 Sheets—Sheet 2.

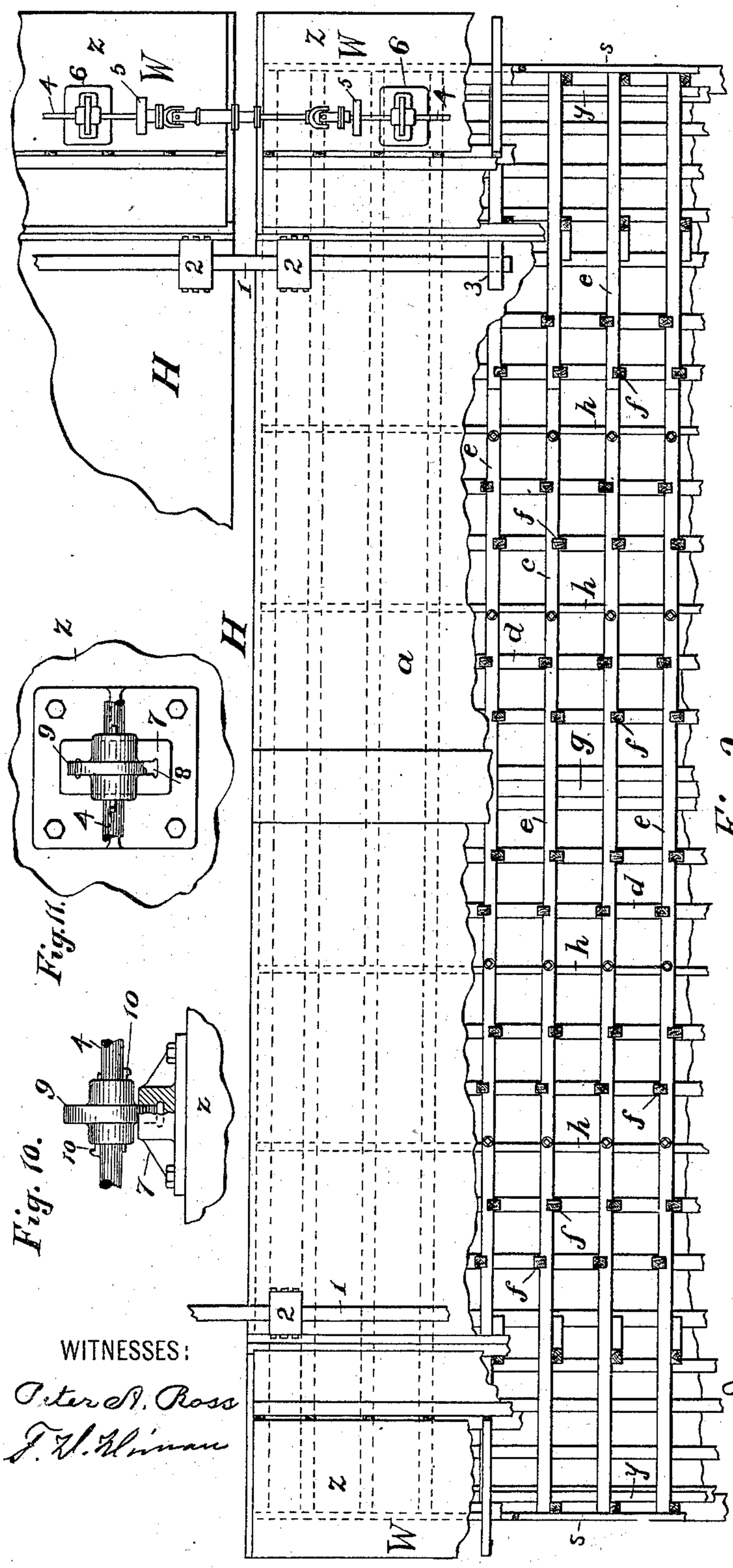

Fig. 2.

Fig. 11.

Fig. 10.

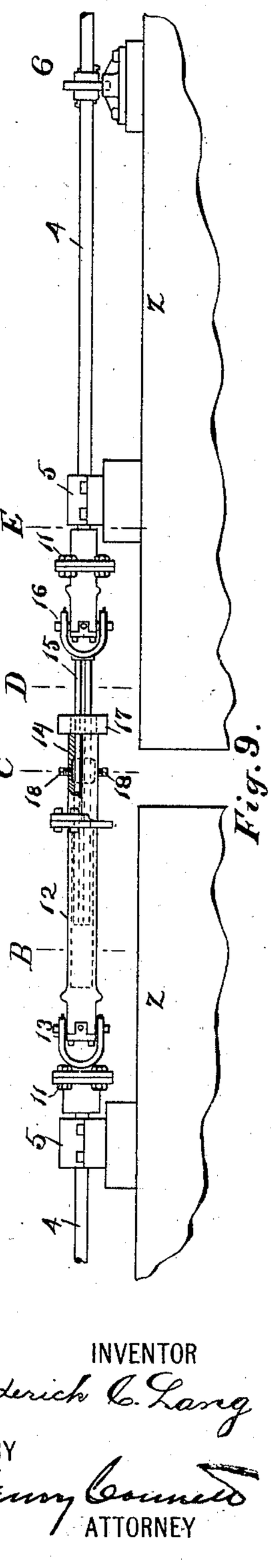

Fig. 9.

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(Application filed Mar. 21, 1900.)

(No Model.) 3 Sheets—Sheet 3.

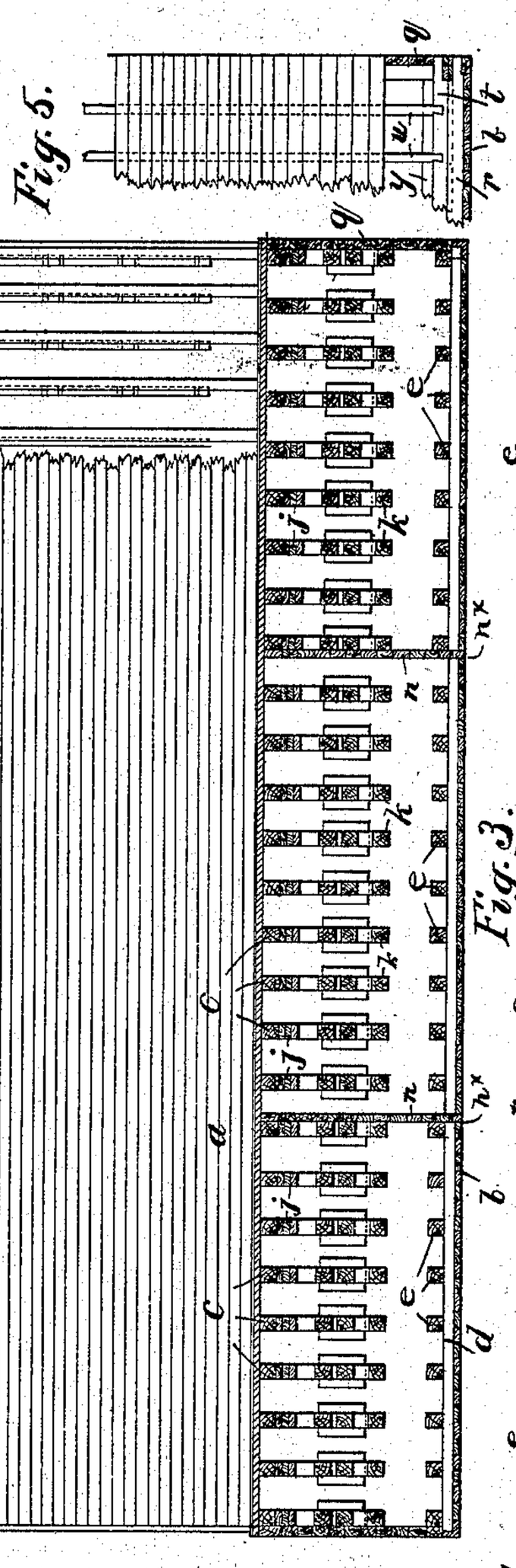

Fig. 5.

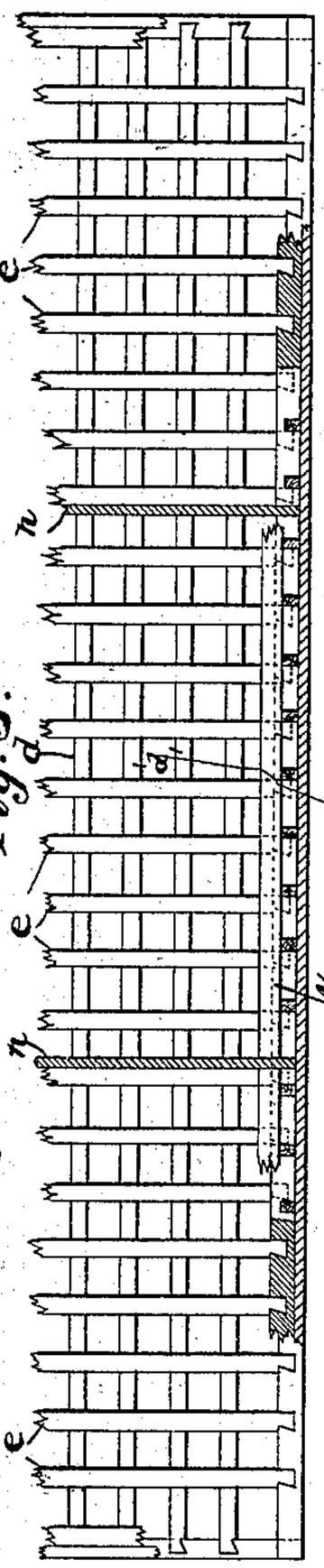

Fig. 3.

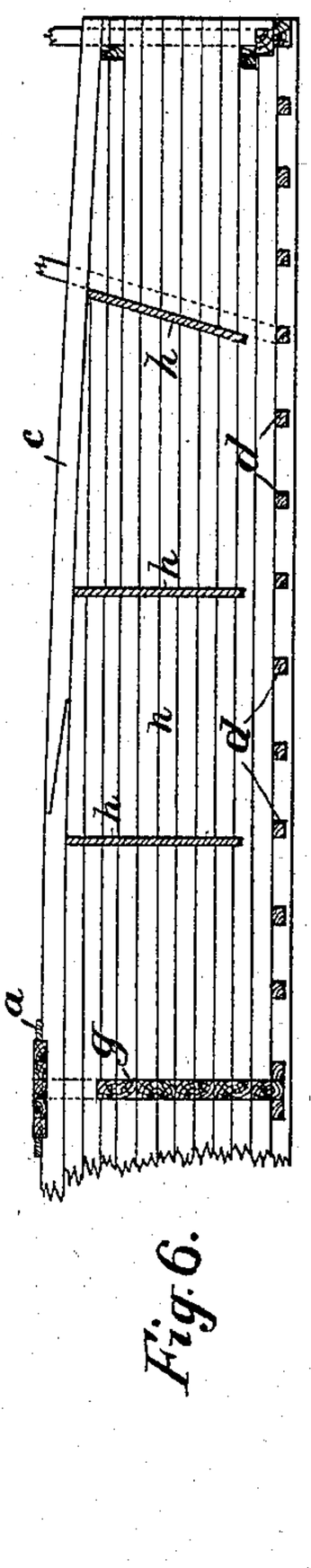

Fig. 4.

Fig. 6.

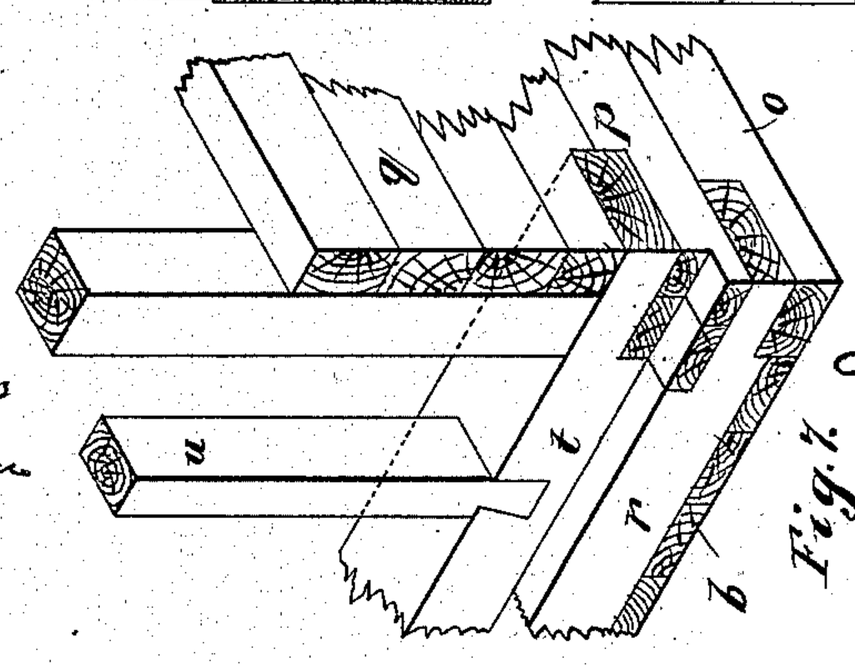

Fig. 7.

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DRY DOCK.

SPECIFICATION forming part of Letters Patent No. 656,582, dated August 21, 1900.

Application filed March 21, 1900. Serial No. 9,554. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK C. LANG, a citizen of the United States, residing at Hoboken, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Dry Docks, of which the following is a specification.

This invention relates to the construction of floating wooden dry-docks, and particularly to the class of sectional docks of which that illustrated in my pending application, Serial No. 715,808, filed May 6, 1899, is an example. These docks are made up of independent sections adapted to be fitted together end to end and secured together firmly, but separately, and each section has elevated wings at its sides, which are adapted to extend above the level of the water when the dock is submerged. Each dock-section is subdivided by bulkheads into compartments, and means are provided for flooding and pumping out said compartments, as well as for regulating communication between them.

A dock-section of the general character described above is necessarily of such extended horizontal dimensions proportionately to its depth that it is difficult to impart sufficient stiffness and strength to the structure in the construction, and it is in the special construction, framing, bracing, and planking that one feature of my invention resides.

Other features of the invention reside in the construction of the keepers for the locking-logs and in the means for securing the sections of the dock together and in coupling together the driving-shafts of the dock-sections when the latter are connected together.

In the accompanying drawings, which illustrate an embodiment of the invention, Figure 1 is a vertical transverse section of the dock. Fig. 2 is a fragmentary plan view of the same, showing parts of two dock-sections and the coupling and securing devices therefor. Fig. 3 is a vertical longitudinal section taken in the plane indicated by line A A in Fig. 1. Fig. 4 is a fragmentary plan of the bottom at one side, illustrating the framing. Fig. 5 is a fragmentary side elevation, partly broken away, showing the framing at the corner; and Fig. 6 is a face view of one of the transverse bulkheads. Fig. 7 is an enlarged perspective detail showing how the timbers are framed together at the corners of the dock. Fig. 8 is an enlarged perspective view of the means for coupling together two dock-sections, so as to keep them in proper alinement. Fig. 9 is a side elevation of the alined pump-shafts of the dock-sections, showing the coupling devices therefor. Figs. 10 and 11 are respectively a side elevation and a plan of the device for taking the end thrust of the shaft. Figs. 12 and 13 are detail views of the universal joint in the shaft-coupling. Figs. 14, 15, 16, and 17 are cross-sections of the shaft and coupling, taken, respectively, at the points indicated by B, C, D, and E in Fig. 9, but drawn to a larger scale than the latter.

H is the hull or body of the dock-section, and W are the wings or elevated structures at the respective sides of the same.

In order that the following description may be the better understood, it may be explained here that the dock-section may be wider than it is long and that by "transversely" of the section is meant from one wing W across to the other wing and by "lengthwise" is meant parallel with the wings and with the axis of the vessel being docked.

a is the deck or floor, the planking of which extends lengthwise of the dock, and *b* is the bottom-planking, which extends transversely or widthwise of the dock and at right angles to the planking of the deck.

c are the transverse deck-beams.

d are the longitudinally-extending bottom timbers or beams, to which the bottom-planking is spiked.

e are foot-beams extending transversely across the bottom-timbers parallel with the deck-beams, and *f* are upright stanchions between the deck-beams and bottom beams or timbers.

In the axis of the dock-section is the main solid bulkhead *g*, and parallel with this main bulkhead are auxiliary bulkheads *h*, which subdivide the space within the body or hull longitudinally. At these bulkheads are upright straining-rods *i*, which connect the deck-beams *c* and foot-beams *e*.

The lateral trussing is effected, as best seen in Figs. 1 and 3, by laminated arches *j*, the crowns of which are at the main bulkhead *g* and the feet of which are stepped in the respective foot-beams *e* near the ends of same.

Beneath each of the respective arches *j*, at each side of the bulkhead *g*, is a series of braces *k*, set at different angles, their upper ends abutting at the bulkhead *g* and their lower ends stepped in the foot-beam *e* below. Anchor-stocks *m* are secured to the foot-beam and the stepped extremities of said arches and braces, as shown in Fig. 1. Preferably there will be a brace *k* for each auxiliary bulkhead *h*, and the brace will be stepped at said bulkhead, as shown.

The stanchions *f* are gained at their sides to embrace the transverse beams and timbers and are set alternately on opposite sides of the latter, as seen in Fig. 2, where the floor-planks are broken away to show the structure beneath.

The hull is divided transversely by bulkheads *n*, (seen in Figs. 3, 4, and 6,) and these bulkheads extend down through the bottom-planking, as indicated at $n^{\times}$ in Fig. 3, so as to afford facilities for calking them. This construction is effected without cutting across the bottom-planking by reason of the latter extending transversely.

Fig. 7 shows the sill and corner construction and framing. In this view *o* is the lower end sill or log, *p* is the upper end sill or log, and *q* is the heavy end planking, which extends up to the deck-planking *a*, as seen in Fig. 3. The side bottom sill or log *r* and the sill *o* are gained together at the corner, so as to be flush at the top and leave space for the planking *b*. The sill *p* is gained at the end to receive the side-planking *s* in Fig. 1, and the upper side sill *t* is gained therewith and rests on the sill *r*. The upright studs *u* are dovetail-tenoned into the sill *t*. The bottom-beams *d* and the foot-beams *e* are dovetail-tenoned at their ends into the respective sills or logs, as clearly shown in Fig. 4.

The inner sloping wall of the wing W is framed of studs *v*, which extend down to the bottom-beams *d*, and this wall, as well as the outer wall of the wing, are planked water-tight. Above the deck *a* the wing is braced by horizontal and zigzag braces and by knees *w*, and below the deck there are braces *x*, which are stepped at their upper ends in the respective deck-beams *c* and abut at their lower ends against a sill or plate *y*, which rests on the side sill *t* and is backed by the studs *u*. On the wing is a platform *z*.

To secure the sections of the dock together and keep them alined, like locking devices are employed, which are best illustrated in Figs. 1 and 8. This device comprises locking-logs 1. On the deck of the dock, close to the wing and near one end thereof, is fixed a keeper 2, constructed of two blocks 2^{a}, which are secured rigidly to the deck, a dovetailed bridge-piece 2^{b}, fitted into said blocks, a cap-piece 2^{c}, and a metal casing 2^{d}. Another keeper 3 to serve as a tail-lock is set farther inboard and alined with the main keeper 2. Each dock-section will be provided with four sets of these keepers, two sets at each end, and with two locking-logs. Figs. 2 and 8 show clearly the manner of connecting and alining two dock-sections provided with these locking devices. The tail-lock is of importance in this device, partly in maintaining a more accurate alinement and parly in relieving the lateral twisting strains on the main keepers caused by the swaying or rocking of the sections of the dock, which tends constantly to move the sections out of alinement and to strain the keepers.

The shafting which drives the pumps is mounted on the platform *z* on the wing, so as to be always above water, and this point of support being farthest from the water of flotation it follows that the swaying and rocking of the hull or body of the dock will be magnified at the point where the said shaft is mounted. Hence it is necessary to provide coupling devices for the shaft-sections which will permit of some lateral play and also of some endwise movement. The means for accomplishing this will now be described with especial reference to Figs. 9 to 17.

The shaft-section 4 is supported rotatively in bearings 5 on the platform *z* of the dock-section, as seen in Fig. 9, and said shaft-section has an end thrust and lubricating-bearing. (Seen at 6 in Figs. 2 and 9.) Figs. 10 and 11 show this bearing in detail. A bearing-block 7 is rigidly bolted down to the platform and has in its upper face an oil-recess 8, the sides of which form two shoulders or cheeks, between which and in the oil rotates a disk 9, provided with a long boss and keyed on the shaft by two oppositely-driven keys 10 to prevent it from slipping in either direction along the shaft.

Each shaft-section has fixed on its extremity a coupling-frame 11, Fig. 9, and between these two flanges is a universal coupling device. This device, as seen in Fig. 9, comprises, first, a tubular portion 12. (Seen in cross-section in Fig. 14.) This portion or member 12 is coupled at one end, through a universal joint 13, with the flange 11 on one of the alined shaft-sections 4, (seen at the left in Fig. 9,) and has at its other end a sleeve-piece 14, (seen in cross-section in Fig. 15,) which has a square cross-section interiorly that fits and receives a square portion or member 15. (Seen in cross-section in Fig. 16.) This member 15 is coupled, through the medium of a universal joint 16, with the other shaft-section 4, as seen at the right in Fig. 9. It will only be necessary to say that the square member 15 cannot rotate in the sleeve-piece 14, and therefore they must rotate together, and that the two universal joints 13 and 16 (which are or may be alike) permit of driving one shaft-section from the other even when the two sections are considerably out of alinement. Figs. 12 and 13 are detail views illustrating the universal joint, these views serving to show the construction of both the joints seen in Fig. 9. The sleeve-piece 14 is split axially, one half being inte-

gral with the member 12 and the other half being separable. It has a reinforcing-collar 17, shrunk on its outer end, and two oil-holes stopped by screws 18. The separable section of the sleeve-piece is not intended to be removed after the parts are put together. It is provided to permit of shaping the squared interior surface of the sleeve. The squared member 15, fitting into the squared sleeve 12, provides a coupling which will resist distortion from lateral oblique strains to a degree which cannot be attained with any form of splining.

In the drawings only one end of each shaft-section 4 is shown; but it will be understood that each section of the shaft will be provided at one end with the tubular members 12 14 of the coupling device and at the other end with the other member 15, so that when the sections of the dock are brought together the pumping-shafts may be coupled, as seen in Fig. 9.

It will be noted in Fig. 1 that the anchor stocks or blocks *m* are placed over the stepped footings of the braces *k* under the longitudinal bulkheads *h* and that the tie-rods *i* extend down through them. This makes it impossible for the braces to spring or jump out of their steps. The blocks *m* over the feet of the arch *j* are held down by diagonal braces *x*, which are stepped in the deck-beam above at the outer longitudinal bulkheads and have also retaining blocks or stocks to hold them in place. The arch *j* is notched into the partition *g*, and the upper braces *k* extend through said partition and abut against each other. The lower braces *k* abut against hardwood blocks on the opposite faces of the central bulkhead.

To keep the dock-sections properly distanced when connected together by the locking-logs *l*, the latter are gained and shouldered at their ends, where they fit in the keepers 3, as indicated in dotted lines in Fig. 8.

It may be proper to explain that the load in the dock tends to depress it along its axis, thus tending to press together the seams of the longitudinal planking of the deck and to distand any longitudinal seams in the bottom. Hence the planking of the bottom is made to extend transversely, as described. The longitudinal deck-planking extends uniformly across the deck from wing to wing.

I am well aware that floating docks have before been provided with transverse trusses, with locking-logs, and with pump-operating shafts coupled together by universal and sliding joints, and these features I do not broadly claim. I am also well aware that laminated arches are not new, broadly speaking, they having been used for other purposes for many years, and I make no claim to such an arch in itself. The object here is to utilize an arch which forms a continuous truss member, and the laminated arch serves this purpose very well. This continuous member must resist both tensile and crushing strains, and it is braced against vertical yielding by the longitudinal bulkheads.

A section of a floating dry dock is subjected from the manner of its use to peculiar strains and such as no other structure with which I am acquainted is submitted, and it is to overcome the difficulties arising from these peculiarities that the construction herein shown and claimed has been invented. Under some conditions the pressure is upward under the wings or lateral margins and downward along the axis of the section. At another time the pressure is upward along the axis and downward along the lateral margins. If the sections of a large dock be made wide enough between the wings to take in another section sidewise for docking the latter, as is usually the case, the excessive width calls for a peculiar trussing and framing that has not been found heretofore, so far as I am aware, in a dock of any kind.

Having thus described my invention, I claim—

1. A floating, wooden dry dock, having transverse deck-beams, longitudinal bottom-beams, deck-planking extending longitudinally, bottom-planking extending transversely, and transverse trusses with continuous members between the deck and bottom beams.

2. A floating, wooden dry dock, having deck and bottom-beams, a longitudinal, axial bulkhead, transverse foot-beams, and transverse arches with the crown at the axis of the dock under the deck and their feet stepped in the respective foot-beams.

3. A floating, wooden dry dock, having deck and bottom-beams, longitudinal bulkheads, laminated transverse arches having their crowns under the deck at the axis of the dock and their feet stepped in transverse foot-beams near the respective sides of the dock.

4. A floating, wooden dry dock, having deck and bottom beams, foot-beams, an axial, longitudinal bulkhead, transverse arches having their crowns under the deck at the axis of the dock and their feet stepped in said foot-beams near the respective sides of the dock, and braces *k*, inclined at different angles, said braces abutting to the central bulkhead at their upper ends and stepped at their lower ends in said foot-beam.

5. A floating, wooden dry dock, having deck and bottom beams, foot-beams, arches extending transversely and stepped in the foot-beams near the respective sides of the dock, inclined braces *k*, and upright stanchions *f*, having gains in their sides to receive the transverse truss members.

6. The combination with the water-tight deck and bottom of the dock, of the upper, transverse deck-beams, the foot-beams beneath the respective deck-beams, the transverse, laminated arches stepped in the respective foot-beams, and the series of inclined

braces *k* under the respective arches and also stepped in the foot-beams, of the stanchions *f*, gained to take in the transverse members, substantially as set forth.

7. A wooden, floating dry dock, having its deck-beams extending transversely, its bottom-beams extending longitudinally, its bottom-planking extending transversely, and having transverse bulkheads the planking of which extends down flush with the outer surface of the bottom-planking, substantially as and for the purpose set forth.

8. A wooden, floating dry dock, having between its deck and bottom a series of transversely-extending trusses, and stanchions arranged alternately on opposite sides of each truss, said stanchions being gained to receive the truss members, substantially as set forth.

9. A wooden, floating dry dock having transverse trusses with continuous members to resist tensile strains, wings at its respective sides, and longitudinal bulkheads bracing said continuous members, substantially as set forth.

10. A wooden, floating dry dock, having longitudinally-extending bulkheads, a foot-beam, truss-braces stepped in said foot-beam under the respective bulkheads, and anchor stocks or blocks *m*, over the stepped foot of said braces, substantially as set forth.

11. A keeper for a locking-log of a sectional dock, formed of the wooden members 2^a, 2^b, 2^c, and inclosed in a metal casing, substantially as set forth.

12. A keeper for a locking-log of a sectional dock, comprising the fixed blocks 2^a, the dove-tail bridge-piece 2^b, the cap 2^c, and the metal casing 2^d, substantially as set forth.

13. In a sectional dock, the combination to form a coupling-section for the pumping-shafts, of a tubular member having a square, sectional sleeve and coupled to the shaft by a universal joint, and another member having a square section which fits telescopically into the said sleeve and is coupled to its shaft-section by a universal joint, substantially as set forth.

14. A sectional dock, having a pump-shaft mounted in bearings on the wing thereof and provided with a disk 9 fixed thereon, and a block 7, fixed rigidly to the platform of the wing and having in it an oil-recess with shoulders to embrace said disk and prevent end thrust, substantially as set forth.

15. A wooden, sectional dry dock, having its bottom end sill *o* gained with the bottom side sill *r* and extending below the same to the extent of the thickness of the transverse bottom-planking, *b*, the said planking, the upper end sill *p*, gained at its end to receive the side planking and flush at its outer face with the sill *o*, and the upper side sill *t*, gained with the sill *p* and its outer face flush with the inner face of the side-planking, and the said planking.

In witness whereof I have hereunto signed my name, this 15th day of March, 1900, in the presence of two subscribing witnesses.

FREDERICK C. LANG.

Witnesses:

WILLIAM T. DONNELLY,

FREDK. N. EBERHARD.