

No. 736,507.

PATENTED AUG. 18, 1903.

H. F. DUNHAM.
TUNNEL SECTION.

APPLICATION FILED AUG. 9, 1902.

NO MODEL.

2 SHEETS—SHEET 1.

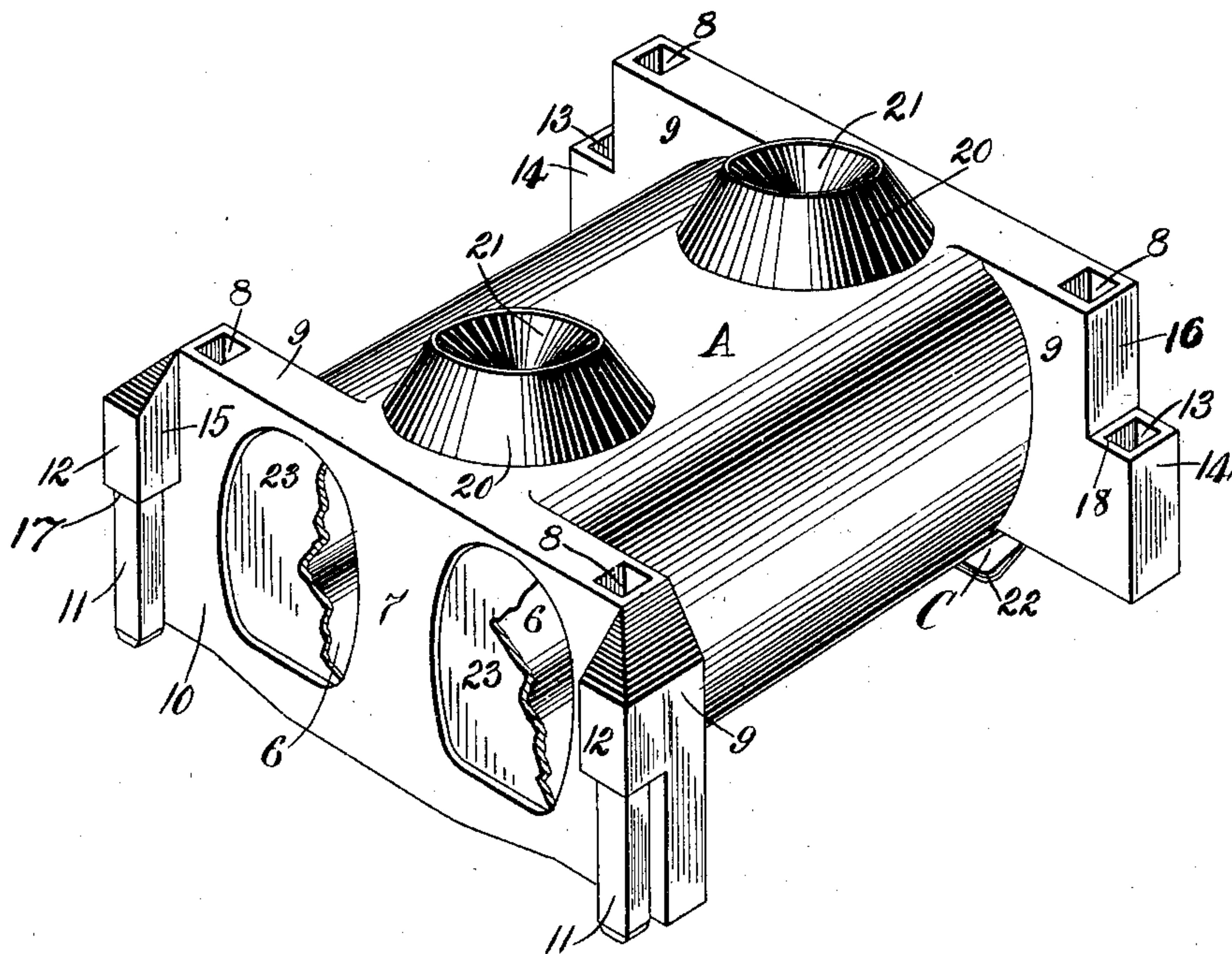


Fig. 1.

Witnesses:

G. Frederick O. Keigler
Herbert J. Smith

Inventor:

H. F. Dunham
By his Attorney
J. H. Richardson

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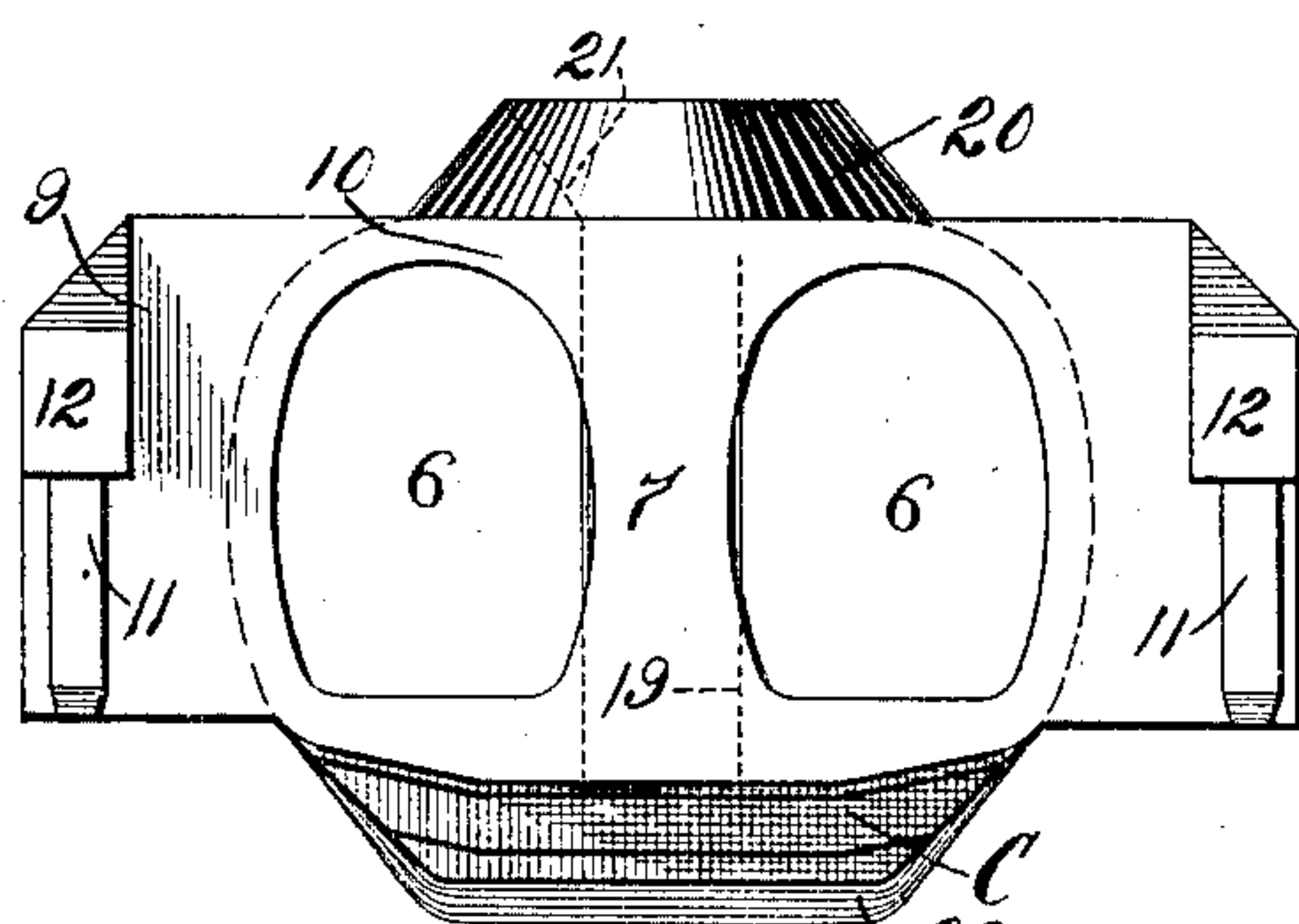


Fig. 2

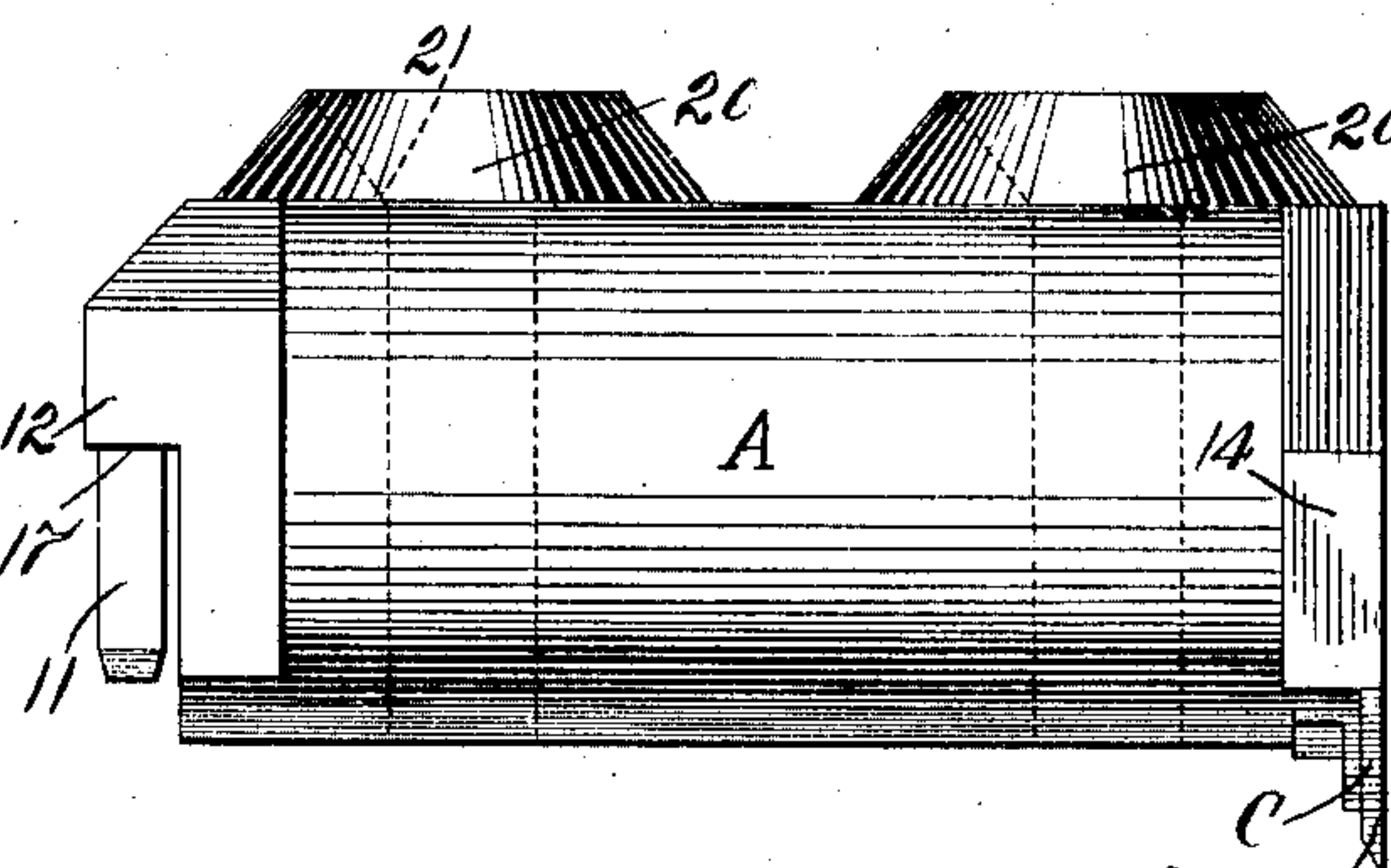


Fig. 3

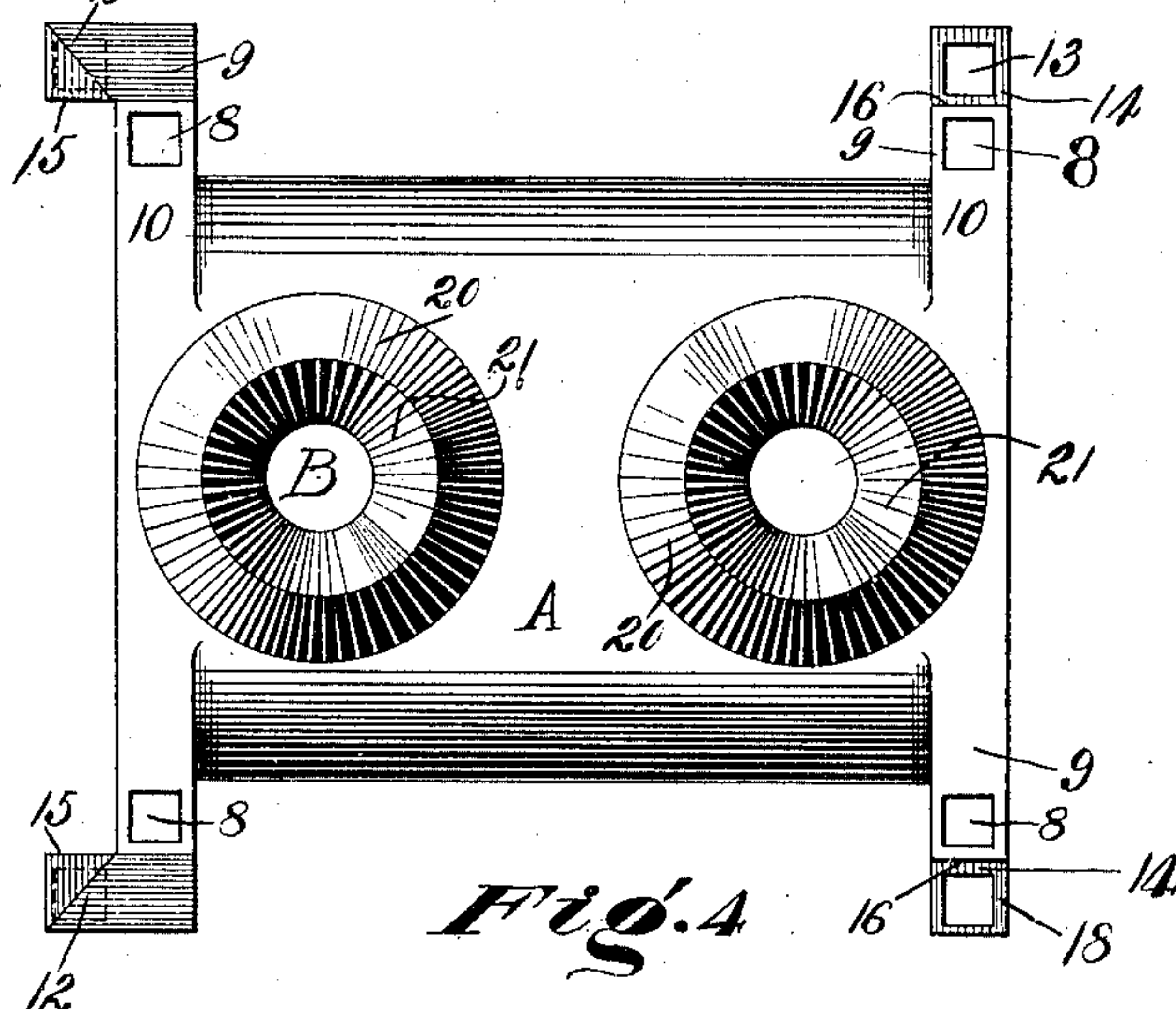


Fig. 4

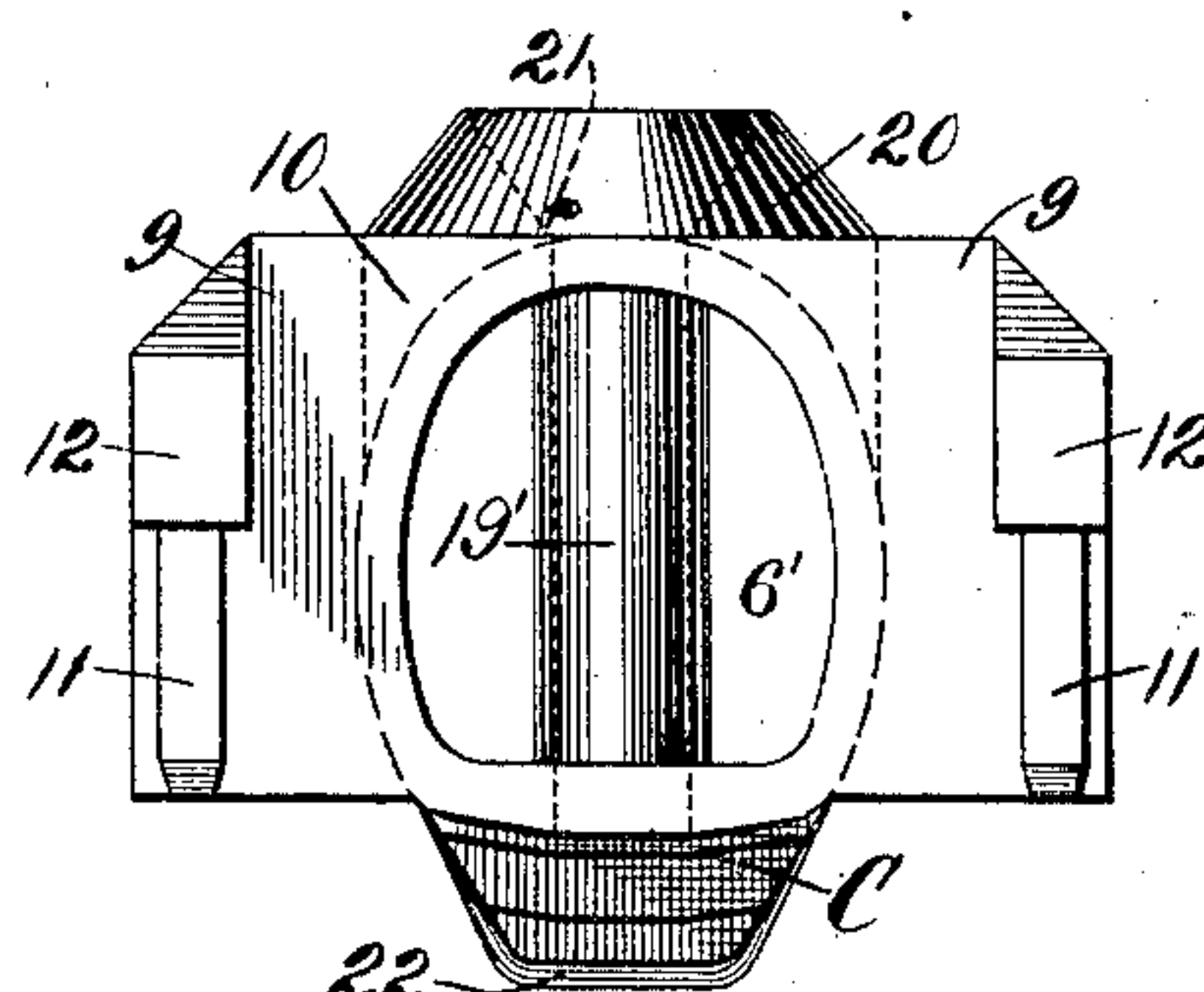


Fig. 5

Witnesses:

G. Frederick A. Zeigler
Herbert J. Smith

Inventor:

H. F. Dunham.
By his Attorney
F. A. Richards.

UNITED STATES PATENT OFFICE.

HERBERT F. DUNHAM, OF NEW YORK, N. Y.

TUNNEL-SECTION.

SPECIFICATION forming part of Letters Patent No. 736,507, dated August 18, 1903.

Original application filed September 11, 1900, Serial No. 29,626. Divided and this application filed August 9, 1902. Serial No. 119,020. (No model.)

To all whom it may concern:

Be it known that I, HERBERT F. DUNHAM, a citizen of the United States, residing in the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Tunnel-Sections, of which the following is a specification.

This invention relates to subaqueous tunneling, and has for its object to provide an improved section or unit for use in the construction of tunnels.

In constructing tunnels in or upon the beds of streams and other bodies of water many difficulties are encountered, among which is the high pressure in which the workmen are obliged to perform their labor if the carrying out of the operation requires their services under water, and if sections of the tunnel are to be laid the difficulty of dredging a proper place on the bed and keeping it clear till the section has been placed in position renders such procedure not only unduly costly, but the results unsatisfactory.

By my present invention, the subject of this application, which is a division of an application filed by me on September 11, 1900, bearing Serial No. 29,626, for method of constructing and laying subaqueous tunnels, it is made possible to lay a tunnel under water section by section and carry on the operation from a secure working platform above the surface of the water and to dredge, if necessary, the water-bed immediately beneath the section and to sink the section into the dredged channel as fast as the dredging proceeds. To this end sections are constructed upon the land, if desired, and launched upon the body of water and then towed to the point at which operations are in progress. Each section is provided with platform-holding means for receiving the stanchions or uprights for the working platform, which may be placed in position before the section is launched or while it is still floating upon the water. The sections are also provided with mating interlocking devices of such a character that the section while being sunk will interlock with a sunken section, and the in-

terlocking devices will assure a tight joint between the sections and the accurate positioning and alinement thereof.

The most expeditious way of dredging for the reception of a body or structure is to work directly beneath it, and my improved sections are so constructed that hydraulic or other forms of dredging may be carried on, removing the bed directly from under the section as it is being sunk. This form of structure permits the section to be sunk and maintained in the desired position. If the bed is uneven, the highest point will receive the entire weight of the section, whereupon the operation of hydraulic dredging will be facilitated at that point, the interlocking devices and the stanchions, which may be slidably connected, holding and guiding the section, so that one end will not sink faster than the other. The section may be suspended by the stanchions and proper derricks and the excavations thereunder filled with concrete or other suitable material. To prevent longitudinal strain upon the uncompleted tunnel, each section may be so constructed that it will engage securely the bed. Its engaging portion may, if desired, in practice be so formed that it will prevent the filling of the dredged excavation by shifting of the material of the bed.

Referring to the drawings accompanying and forming part of this specification, Figure 1 is a perspective view of a form of tunnel-section embodying my invention. Fig. 2 is an end view, Fig. 3 is a side view, Fig. 4 is a plan view, and Fig. 5 is an end view, of a form of section having a single passage-way.

The section, as shown, comprises a body portion (designated in a general way by A) and may be made of any suitable material. The section is shown as traversed by two passage-ways 6, with a partition or wall 7 therebetween. At convenient points on the section stanchion or platform supporting means may be provided—in the present instance sockets 8, located in wings or extensions 9 from the heads 10. The sockets are designed to receive stanchions for guiding and controlling the section as it is being sunk and for sup-

porting a working platform from which subsequent sections may be supported and guided.

When the section is being sunk and nears its final position, it is well to augment the guiding influence of the stanchions and to positively interlock the sections. Suitable and convenient means for so doing are in the present instance shown in the form of dowels 11, projecting downwardly from extensions 12 from one of the heads 10. The other head is shown as provided with sockets 13 in extensions 14, projecting therefrom, for the reception of the dowels.

The units organized as illustrated herein are provided with faces 15 upon the extensions 12, which are in a plane coincident with the line of movement of the sections when properly sinking to their mating positions and which faces are adapted to embrace the sides or faces 16 upon the opposite head or end of a similarly-formed section and serve to guide and position the section, guiding it laterally and producing axial justification. The projections 12 are also provided upon their lower sides with faces 17, adapted to rest upon faces 18 of the extensions 14 to positively and accurately limit the descent of the section when it has reached its final position. The dowels 11 are shown in the present instance as square in cross-section and beveled on their free ends and the sockets also as square in cross-section. The beveling of the dowels will assist in their ready entrance into the sockets. The faces of the heads 10, constituting the meeting or abutting ends, are also shown as matching to assist in guiding the sections to position and to make a flush and tight joint between the sections. Thus it will be seen that each section is provided with its own guiding means—to wit, the dowels entering the sockets, the abutting ends of the section-heads constituting guiding-faces to guide the section to place, and also the lateral or side-embracing guiding-faces, which force the section to sink in a straight line, prevent axial rotation of the section, and remove strain from the dowels to a large extent.

For providing convenient access to the bed beneath the section while it is in a position approaching its final position one or more openings (designated in a general way by B) may be constructed in the section and in the present instance are shown comprising tubular portions 19, and upon top of the section conical bosses 20 may be placed to provide flaring mouths 21 for the openings.

In Figs. 1 to 4 the openings are shown as located in the wall or partition dividing the passage-ways and in Fig. 5 as traversing the passage-way.

It is intended that the bed will be dredged through the openings as the section is being lowered and, if desired, pits or pockets dredged from beneath the section, which pits or pockets and the openings will be filled with hy-

draulic cement, concrete, or other suitable material and the tops and side of the tunnel be covered with similar material. The form shown in Fig. 5 will after the hardening of the filling-in material have removed therefrom the portion of the tubular opening 19 which is an obstruction to the passage-way 6'.

For the purpose of preventing longitudinal movement of the tunnel during construction or afterward the section may be provided with retaining means, (designated in a general way by C,) and in the present instance is shown as comprising a reinforced depending leaf 22, which leaf not only prevents lateral movement of the tunnel, but also keeps loose or shifting material from gaining access to the excavation beneath the section.

Each end of the passage-ways may before the section is launched be provided with removable bulkheads 23 for excluding water and rendering the section buoyant. These bulkheads will of course be removed at the proper time in the construction of the tunnel.

The section illustrated in Fig. 5 is for a single-passage-way tunnel and that of the other figures the section is for a twin conduit or double-passage-way tunnel. Any number of conduits or passage-ways may be provided, and the organization of the openings for reaching the bed beneath the section may be differently constituted as in practice may be necessary.

Although but one form of section has been shown herein, yet it will be apparent that such is for the purpose of illustration of the invention and that in practice many changes in details of construction may be had without departure from the spirit of my invention.

Having thus described my invention, what I claim is—

1. A conduit or tunnel section having sockets at one end and complementary dowels at the other end.

2. A conduit or tunnel section having lateral reinforcements provided with sockets, one of said reinforcements also having dowels.

3. A conduit or tunnel section provided with dowels, in combination with a second tunnel-section having sockets to receive said dowels.

4. A conduit or tunnel section having a tunnel passage-way therethrough and transversely thereto a work-passage through the walls of said section and opening at the under part of such section.

5. A conduit or tunnel section having a passage-way, and an inclosed opening extending entirely through such section transversely to the tunnel passage-way, and opening at the under part of such section.

6. A twin conduit or tunnel section having a longitudinal partition separating the passage-ways, and a passage in said partition open at the top and bottom of the section for the entrance of a dredge.

7. A twin conduit or tunnel section having

a longitudinal partition separating the passage-ways, and tubes in said partition extending entirely through the section for permitting the entrance of a dredge.

5 8. A subaqueous tunnel-section having sockets at each end for the reception of columns or posts, and also having at one end at each side a depending projection or dowel.

10 9. A subaqueous conduit or tunnel section having a tube passing through its body, and a boss located on the tunnel-section adjacent to the upper end of said tube.

15 10. A conduit or tunnel section having a socket at each corner and having at two of its corners depending projections or dowels.

20 11. A conduit or tunnel section having sockets at each of its corners, other sockets at two of its corners for the reception of posts, and dowels at two of its corners adapted to enter the sockets in an adjacent tunnel-section.

25 12. A tunnel-section comprising a body and means to receive and support a removable framework carried above such section and from which a similar tunnel-section can be lowered and guided to the proper position to form a part of the tunnel.

30 13. A tunnel-section comprising a body and means located at the ends of such body for receiving and supporting removable posts or columns for supporting a platform from which a similar tunnel-section can be lowered and guided to the proper position to form a part of the tunnel.

35 14. In a device of the character specified, the combination of a body, a wall dividing the body into conduits or passage-ways, and an opening in the wall for the purposes set forth.

40 15. In a tunnel-section, the combination with a body constituting the exterior walls of the tunnel, end members upon the body, securing means carried by the end members, and an opening from the top to the bottom of the section for the purposes set forth.

45 16. In a tunnel-section, the combination with a body portion constituting the exterior walls of the tunnel, ends upon the body portion having laterally-projecting wings, sockets in the wings at one end, and dowels carried by the wings at the other end and organized to cooperate with sockets in a similar section for the purpose of guiding and uniting the sections.

50 17. A tunnel-section provided at its ends with laterally-projecting wings, the wings at one end provided with parallel sockets and a plane face above and in line with each socket, the other end provided with projections having plane faces matching the plane faces above the sockets at the other end, and dowels projecting from the projections, the organization being such that the dowels and faces upon the projections of the section will mate with the plane faces and sockets upon the end of a similarly-formed section.

65 18. In a device of the character specified, the combination of a body portion, a trans-

verse opening from the top to the bottom thereof for the purpose of permitting the carrying on of the operation of dredging and filling therethrough, and a funnel for the opening upon the top of the section. 70

19. A tunnel-section comprising a body portion, a conical boss upon the top of the section constituting a flaring mouth, and an opening passing from the mouth to the lower part of the section as and for the purposes specified. 75

20. In a tunnel-section, the combination with a body portion constituting the exterior walls of the tunnel, of ends upon the body portion having laterally-projecting wings, stanchion-sockets in each wing, dowels carried by the wings at one end, and dowel-sockets carried by the wings at the other end. 80

21. A tunnel-section having at its ends laterally-projecting wings, stanchion-sockets in each wing, the wings at one end provided with projections having parallel plane faces upon their sides and dowels depending from the projections parallel with the faces, the wings at the other end provided with parallel dowel-sockets and a plane face above and in line with each side, the organization being such that the dowels and faces upon the projections of the section will mate with the plane faces and the sockets upon the end of a similarly-formed section. 85

22. A tunnel-section having at its ends laterally-projecting wings, stanchion-sockets in each wing, the wings at one end provided with projections having parallel plane faces upon their sides and bottoms and dowels depending from the projections parallel with the faces, the wings at the other end provided with parallel dowel-sockets and a plane face above and in line with each side, and a plane top face, the organization being such that the dowels and faces upon the projections of the section will mate with the plane faces and the sockets upon the end of a similarly-formed section. 90

23. A tunnel-section having plane faces upon its sides at one end and projections at its other end provided with plane faces organized to embrace and mate with the plane faces upon the end of a similarly-organized section. 100

24. A tunnel-section having plane faces at one end and projections at its other end provided with plane faces organized to embrace and mate with the plane faces upon the end of a similarly-organized section, and means for interlocking one section to the other. 105

25. A tunnel-section having plane faces at one end and projections at its other end provided with plane faces organized to embrace and mate with the plane faces upon the end of a similarly-organized section, and means constituting dowels and dowel-sockets for uniting one section to the other. 110

26. In a tunnel-section, the combination with a body portion; laterally-projecting wings at the ends thereof; projections at the 115

upper part of the face of the wings at one end; plane faces upon the lower portions of the projections; square dowels depending therefrom; lateral projections upon the lower portions of the wings at the other end; plane faces upon the top of the projections; and square dowel-holes in the projections.

27. In a tunnel-section, the combination with a body portion; end members upon the body; laterally-projecting wings upon the ends; projections upon the upper part of the face of the wings at one end; plane faces upon the under portions of the projections; dowels depending therefrom; lateral projections upon the lower portions of the wings at the other end; plane faces upon the top of the projections; dowel-holes in the projections; a working opening traversing the body from top to bottom; a conical boss upon the top of the section constituting a flaring mouth for the working opening; and a leaf depending from the end of the section for positioning the section and protecting an excavation below the section.

28. A tunnel-section provided at each end with guiding-faces in transverse planes, the faces on one end organized to embrace the guiding-faces of the dissimilar end of a similar section.

29. A tunnel-section provided at each end with guiding-faces in transverse planes organized to embrace complementary guiding-faces of a similar section, and interlocking guiding means cooperative therewith.

30. A section for a subaqueous tunnel provided with interlocking guiding means, and means for engaging the water-bed for maintaining the section in position.

31. A tunnel-section provided with means for engaging the water-bed for protecting an excavation below the section.

32. In a device of the character specified, the combination with a body portion; guiding-faces at one end thereof and other guiding-faces at the other end thereof organized to embrace the guiding-faces of a similar section; interlocking guiding means cooperative therewith; and an apron depending from the lower portion of the section.

33. A conduit or tunnel section having a tube passing through its upper and its lower walls and open at each end and constituting a working passage-way through the section.

34. A conduit or tunnel section having a transverse work-passage extending there-through and opening at its under side, and provided at its upper end with a flaring mouth.

35. A tunnel-section comprised of a conduit unit organized at one end to be united to an incomplete conduit and at its other end having a depending apron effective to contact with the water-bed in advance of the contacting therewith of the lower portion of the section to the end that an excavation made below the section will be protected by

such apron from the shiftable material constituting the water-bed.

36. A length of structure for sectionally-preconstructed subaqueous building comprising outer walls, an inner wall, the walls embracing or surrounding conduit-passages, and a passage-way at each end of the length passing through the outer walls in the region of the inner wall and traversing the inner wall.

37. A tunnel-section provided with interlocking guiding means, and guiding-faces cooperative therewith to remove the strain of justification from the interlocking guiding means.

38. A tunnel-section provided at one end with sockets and plane guide-faces above the socket parallel to the socket, dowels at the other end to enter similar sockets, and guide-faces above the dowels parallel with the axis thereof to engage faces similar to the faces above the sockets.

39. A conduit or tunnel section having at each corner of each of its ends means for receiving columns or posts for supporting a platform above such section.

40. A conduit or tunnel section provided at each corner of each of its ends, with a socket for the reception of platform-supporting means.

41. A conduit or tunnel section having sockets at its ends for the reception of platform-supporting means.

42. The combination with a unit for a sectional tunnel, of dowels at one end thereof and sockets at the other end thereof, limiting-faces above the dowels and limiting-faces above the sockets.

43. A conduit or tunnel section comprising a body having square dowels at one end thereof and square complementary sockets at the other end thereof.

44. A conduit or tunnel section comprising a body having square dowels at one end thereof and square complementary sockets at the other end thereof, and flat faces above the sockets and above the dowels.

45. A conduit or tunnel section having a socket at each end for the reception of a stanchion or post and also having at one end at each side a depending projection or dowel and at the other side a complementary socket adapted to receive a similar dowel.

46. A conduit or tunnel section having a socket at each corner thereof and having at two of its corners depending projections or dowels and at two of its corners sockets corresponding to such dowels.

47. A conduit or tunnel section carrying at each end thereof means adapted to interlock with the end of a companion section.

48. The combination with a length of conduit or tunnel, of a dowel at each of two of its corners and a dowel-socket at each of two of its corners.

49. A length of conduit or tunnel provided with sockets at one end and complementary

dowels at the other end, the organization being such that the section may be united at one end with a similarly-arranged section and guided to position by the uniting means, and a depending leaf or apron upon the end opposite to the end which will engage such similarly-arranged section.

50. A length of conduit or tunnel comprising a body portion, dredge-passages passing therethrough from the top to the bottom, and a depending apron upon the body for protecting excavations made by a dredge beneath such length.

51. A length of structure for subaqueous construction provided with a dredge passage-way therethrough, and means for shielding the excavation made by the dredge.

52. A length of structure for subaqueous construction provided with a dredge passage-way opening beneath the length, and means for shielding the excavation made by the dredge.

53. A length of structure for sectional subaqueous construction provided with guiding interlocking means, a working passage therethrough from the top to the bottom, and means for engaging the water-bed to relieve strain upon the uniting means.

54. A length of structure for sectional subaqueous construction provided with guiding interlocking means, a working passage therethrough from the top to the bottom, and means to engage the water-bed to protect and shield excavations and work carried on beneath the length.

55. A length of structure for sectional subaqueous construction provided with interlocking means, a working passage to the bottom, and means to engage the water-bed to protect and shield excavations and work carried on beneath the length.

56. A length of structure for sectional subaqueous construction provided with guiding interlocking means; a working passage therethrough from the top to the bottom; means for engaging the water-bed to relieve strain upon the uniting means and to engage the water-bed to protect and shield excavations and work carried on beneath the length.

57. A unit for sectional subaqueous construction comprising a body portion and a depending leaf for engaging the water-bed below the unit.

58. A unit for subaqueous sectional construction comprising a body portion and a depending leaf transverse to the line of said unit which will be parallel to the general line of the completed structure.

59. A unit for sectional subaqueous construction comprising uniting means, and a depending leaf of relatively large area occupying a plane transverse to the contemplated general line of the structure and adapted to engage the water-bed beneath the section.

60. A length of structure for unital construction on water-beds embracing a body portion, means thereon constructed to receive and support removable stanchions or columns, and a member for engaging the water-bed and of considerable area in a plane parallel to the lines in which the columns are to be supported.

61. A length of structure for unital construction on water-beds embracing a body portion; sockets thereon constructed to receive and support removable stanchions or columns; a working passage-way through the length; and a member for engaging the water-bed and of considerable area in a plane parallel to the lines in which the columns are to be supported organized to protect work performed upon the bed below the length through the passage-way.

62. A length of structure for unital construction on water-beds embracing a body portion; means carried by the length to engage a preceding length and join the same thereto; sockets thereon constructed to receive and support removable stanchions or columns; a working passage-way through the length; and a member for engaging the water-bed and of considerable area in a plane parallel to the lines in which the columns are to be supported organized to protect work performed upon the bed below the length through the passage-way and to relieve the joining means of strain.

63. A member for unital subaqueous construction provided with a work-passage having an opening at the lower portion thereof.

HERBERT F. DUNHAM.

Witnesses:

CAROLINE I. GESSNER,
S. A. FOLEY.