May 25, 1926. 1,585,669

G. T. HANSEN

PUMP

Filed April 8, 1921 2 Sheets-Sheet 1

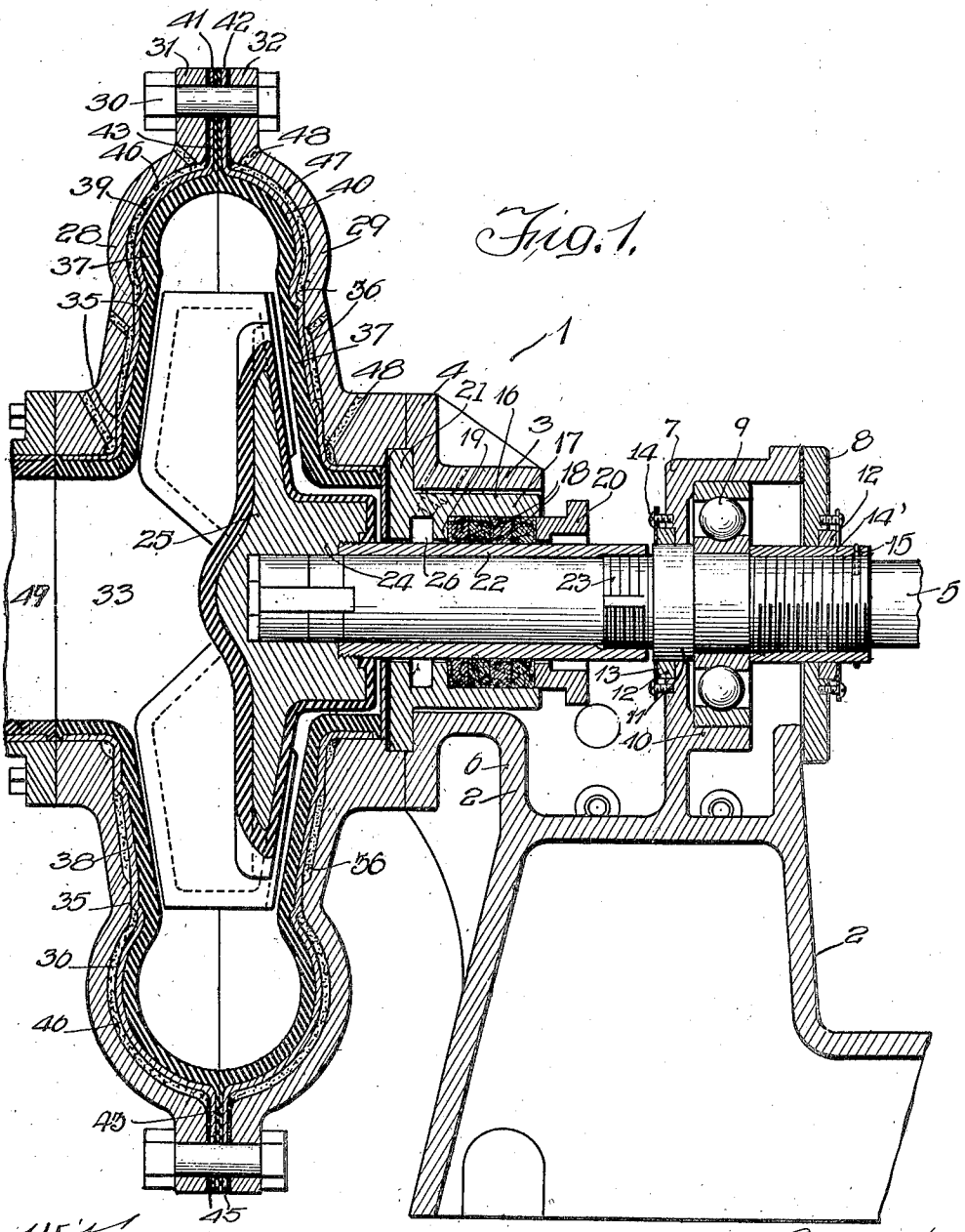


Fig. 1.

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May 25, 1926.

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2 Sheets-Sheet 2

Fig. 2.

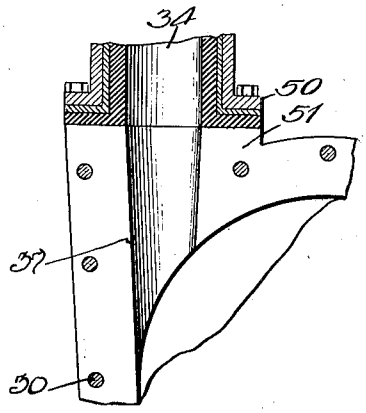


Fig. 3.

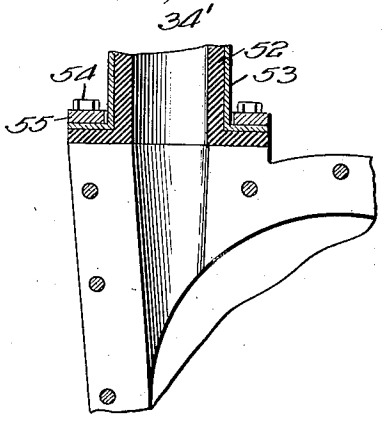


Fig. 4.

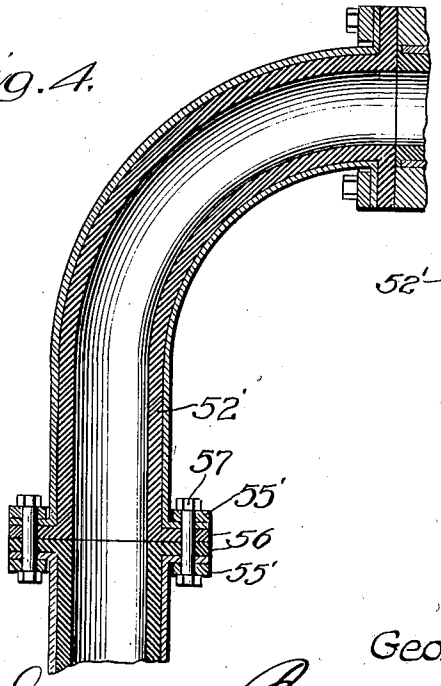
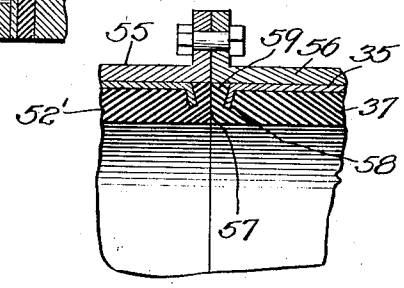


Fig. 5.



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Patented May 25, 1926. 1,585,669

UNITED STATES PATENT OFFICE.

GEORGE T. HANSEN, OF SALT LAKE CITY, UTAH, ASSIGNOR TO HANSEN RUBBER PRODUCTS COMPANY, OF SALT LAKE CITY, UTAH, A CORPORATION OF DELAWARE.

PUMP.

Application filed April 8, 1921. Serial No. 459,522.

My invention relates to pumps.

More particularly, my invention has reference to that class of pumps known as sand pumps, and designed to pump material of an abrasive nature, as, for instance the handling of sludges and tailings in mineral separation processes. The interior surfaces of the pumps are subject to a rapid erosion. This invention is primarily an improvement upon the construction disclosed in Patent Number 1,380,798, granted on June 7, 1921, to me and Charles F. Sherwood, wherein a resilient lining carried by a sheet metal backing was set forth.

In the general development of pumps of this class, it has been found that in order to maintain the original clearances between the impeller and casing, and prevent undue wear, due to the erosive action caused by constant impinging of the abrasive particles, the use of linings within the pump is essential to the end of preserving the same for any length of time. The general trend along these lines was first to employ a comparatively hard metallic lining, such as manganese steel, which was later substituted by lining possessing some resiliency, such as rubber or other soft material. This resilient lining has been attended with marked success, which may be explained by the fact that rubber will yield at each point of impact before it will suffer abrasion by the impinging particles of ore. In the above mentioned application, it is proposed to employ a sheet metal backing for facilitating the seating of the resilient lining to permit of a greater application and eliminate unnecessary machining of the interior surfaces of the casing.

The pump casing is formed in sections so that the metallic backing and rubber facing may be laterally inserted and removed. The metallic backing is intended to fit accurately the interior of the pump casing, but it is a very difficult matter to keep the backing in shape to fit the casing accurately, even though the backing is originally properly formed. If the metallic backing is not properly seated, the clearances between the impeller blades and the casing calculated to give the greatest efficiency will not be obtained. Moreover, in such instances, pockets or annular spaces are often left between the pump casing and metallic backing, and in these pockets acids from the pulp or other material eventually work their way, causing corrosion of the metallic backing.

It is an object of my invention to provide means whereby the metallic backing, together with the rubber facing, when inserted in the pump casing, will be accurately centered and rigidly held in position. To do this, I provide means for holding the edges of the backing in place, and then I support the rest of the backing by providing gauge points or gauge contacts which line up the backing. This preferably comprises peripheral flanges formed upon the metallic backing and rubber facing, the peripheral flanges of the latter lying between the flanges of the former to form a rubber to rubber joint. The flanges of the pump casing are gasketed and rendered tight by this rubber to rubber joint, and as the sections of the pump casing are clamped together, the gasket joints will accurately seat the rubber lining and its sheet metal backing, and as a result secure the proper clearances.

A further object of my invention is the provision of a pump which may be employed for the handling of erosive materials, such as sand or corrosive material such as acid.

In the seating of the sheet metal backing in the pump casing, I contemplate providing "high spots" on the interior surfaces, which are machined to provide the gauge points or contacts referred to. This has been found to ensure accurate setting of the abrasive proof linings within the pump casing and permit otherwise enough clearance to allow for any necessary adjustment due to inaccuracy in construction. The pockets created by the "high spots" may be left unfilled when the pump is used to circulate fluid of a nonacid character. A further feature of this invention is providing means whereby the pump may be readily converted into an acid-proof pump. This is attained by injecting a cement or acid-proof mastic in these pockets, which, when hardened, will prevent acid leaking thereinto.

I have also devised an improved method of gasketing joints between the fittings in the line. As an alternative to the present construction, it is proposed to employ flexible hose having the inner lining of rubber to prevent abrasion. At the ends of each section in the line, the rubber lining is flanged so as to provide a rubber to rubber joint; and metallic clamping rings are used to

prevent tear or wear of the resilient flanges by the clamping bolts.

In the accompanying drawings, the invention is illustrated as embodied in a "tailings" pump, though, as above stated, the invention is broadly applicable to pumps in general for pumping abrasive material. In the drawings:

Figure 1 is a transverse vertical sectional view of a rotary pump embodying my invention;

Figure 2 is a fragmentary sectional view of a flanged joint between the pump casing and discharge conduit;

Figure 3 is a similar view, but illustrating the use of a flexible piping;

Figure 4 is a sectional view of a flexible hose which I contemplate using; and

Figure 5 is a fragmentary sectional view of a modified form of sealing means for use on the intake or discharge of the pump.

In the embodiment shown, the pump 1 is supported upon the pedestal 2 provided with a vertical supporting flange 6, which terminates in the formation of an annular bearing collar 3, having at its outer end a peripheral flange 4. The impeller shaft 5 passes concentrically through the collar 3, and is driven at its outer end by any suitable driving means. Adjacent this drive, and supported upon the pedestal 2, is an anti-frictional bearing arrangement comprising an integral housing 7 formed upon the pedestal 2, with the cover plate adapted to close off the housing, and thereby prevent foreign matter from entering. An anti-frictional ball bearing 9 is provided, having its outer race borne partially by the inner periphery of the upper part of the housing, and the integral arcuated flange 10 which continues the opening formed thereby. The inner race of the ball bearing 9 bears the shaft 5, and adjacent this portion, the shaft is formed with an enlargement 11, journaling itself in the housing 7. A packing ring 12 surrounds this end, and is held in a recessed seat in the housing by the ring 13 held thereagainst under tension of the screws 14. At the opposite side of the anti-friction ball bearing 9, the impeller shaft is threaded to carry a bearing sleeve 14′ projecting out of the housing in journaled relation, and in like manner a similar packing ring 12 is provided, thereby preventing any leakage of lubricant contained within the housing. The bearing sleeve 14′ is preferably threaded upon the impeller shaft 5 and held from relative movement, which might occur accidentally, by a pin 15.

The impeller shaft 5 is carried in the collar 3 by means of a packing arrangement comprising preferably a packing cup 16 formed with a concentrical sleeve 17, in which a recess is provided to retain the packing rings 18, being held at one end against an integrally formed internal flange 19 by a gland 20. The gland 20 seats tightly in the end of the sleeve 17, preferably by a wedged fit. The inner end of the cup 16 is provided with an external flange 21, which seats partly in the flange 4 and partly in the pump casing. It is to be noted that the shaft 5 does not directly bear against the packing ring and cup 16, but bears through a sleeve 22, which is held thereon in fixed relation, as, for instance, at one end by the threaded portion 23 of the shaft 5, and at the other end by the sleeve itself threading into the hub 24 of the impeller 25. The shaft 5 is secured in driving relation to the impeller 25 in any manner desired. In order to prevent abrasion of the impeller vanes, and to reduce the friction of flow, a rubber coating has been provided, which forms a relatively thick, resilient coating upon the active surfaces of the impeller, and in fact forms a complete covering for the same.

A water seal for the packing gland is provided to wash the bearing free of grit by permitting a constant inflow of clear liquid. A water connection indicated in dotted lines passes through an opening in the collar 3 to the cup 16, and communicates with an annular groove 26 in the cup. Water is fed through this connection into the groove 26 and passes through the clearance provided between the bearing sleeve 22 and adjacent portion of the cup 16 into the interior of the pump. There is a natural tendency, due to the suction created by the centrifugal action of the impeller 25, to create a flow into the interior of the pump, and carry with it the water that is fed to the gland. In this way the gland is constantly washed by clear liquid moving inwardly, and grit and abrasive matter is effectively excluded from the gland.

The metallic casing of the pump is split into the front and rear halves 28 and 29 respectively, which are joined by bolts 30 passing through the bolting flanges 31 and 32 extending around the circumference of the casing section. The front section 28 of the casing is provided with a central intake opening 33. The usual intake pipe leading from a separator box, or other source, has communication with the intake 33, and may be bolted in any suitable way to the casing of the front section 28. A discharge outlet leads tangentially from the circular chamber in the interior of the pump, and has suitable connection with a discharge conduit 34.

The interior surfaces of each half of the pump casing is machined at a plurality of gauge points 35, which project a slight distance from the unfinished portions 36. A protective lining is provided within this casing to prevent erosion of the interior of the pump by the abrasive material passing

therethrough. This protective lining comprises resilient material 37, such as a relatively thick coating of relatively tough elastic rubber, which is carried by a metallic backing 38 stamped so as to conform itself to the interior of the pump when inserted therein. The metallic backing 38 is preferably divided into two separate sections 39 and 40, each of these sections being stamped out of sheet metal to conform to the interior configuration of the respective halves of the pump casing. By the term "sheet metal" I intend to include thin sheets of metal imperforate or non-foraminous, such as screen and slitted metal. Co-operating surfaces are provided on the exterior face of the sheet metal backings to seat upon the machined surfaces 35 of the casing. These gauge points or surfaces are preferably in the form of rings, which may easily be machined on a lathe. This backing 38 is made of the same size or slightly larger than the interior of the pump, and, being comparatively thin and ductile, will snugly seat itself thereon, conforming its shape to that of the interior of the pump, and leaving annular spaces between itself and the casing. Each section 39 and 40 thereof is formed with an annular flange 41 and 42 respectively, which flanges are clamped between the flanges 31 and 32 of the casing.

The resilient material 37 is preferably composed of rubber or the like, and is carried upon the sheet metal backing 38 in form of a facing, being suitably secured to it in any manner, although vulcanizing has been found to be most suitable for the purpose. In fact, the thin sheet metal backing permits the liner to be completely formed and secured to the metal in the factory, so that the liner is self-supporting, and it may be shipped complete and ready to attach by the user or field man. The rubber 37 is provided with peripheral flanges 43, which lie between the flanges 41 and 42, these flanges forming a tight seal for the interior of the pump casing. Distortion of the metallic flanges is prevented by a pair of annular clamping rings 45, which reenforce the flanges 31 and 32.

The annular spaces 46 created by the metallic backing 38 seating against only the machined surfaces 35, and remaining free of the unfinished portions 36, would tend to pocket acid or other corrosive material passing through the pump. The acid would soon corrode the sheet metal backing. In order to obviate this destructive action, I contemplate injecting an acid proof mastic, cement or other cementitious material 47, into the spaces 46, through the openings 48. The openings are preferably drilled into the pump casing at the highest point of the space between gauge rings or contacting surfaces, so that the cementitious material will fill the pocket completely. It will thereafter harden and prevent the entrance of acid. It will be here noted that should the pump be used solely as a sand pump, this acid proofing of the sheet metal backing is not essential. But if it be desired to use or convert the pump into an acid pump, this simple means of acid proofing may be advantageously resorted to with very little expense.

In assembling the pump, the protective lining may be inserted as unit, that is, the sheet metal backing 38 can be faced with the rubber 37 before inserting, the peripheral flange 43 being inserted between the flanges 31 and 32, with the bolt holes of these flanges in registry with each other. The unit may then be seated in the section 29 of the casing, while the cover section 28 is clamped thereto by the bolts 30. As these flanges 31 and 32 are clamped together and gasketed by the flanges 41, 42 and 43, the flexible sheet metal backing with the rubber facing 37 will readily adjust itself, and compressibly seat against the machined surfaces 35. At the same time, the flanges thereof will cause centering in the pump, and leave the unit rigidly positioned in its seat as soon as the bolts 30 are drawn up.

The metal backing 38 terminates short of the intake 33, the edge thereof being anchored in the rubber lining 37. This rubber lining abuts and forms an edge to edge joint with the resilient lining of the intake pipe 49. When the sections 28 and 29 of the pump casing are clamped together, the rubber 37 at the intake may protrude slightly. Thus, when the intake 49 is bolted in place, the lining thereof will abut this protruding edge and form a tight joint. Hence the sheet metal backing 38 at this point is securely sealed from contact with acid, or other liquid handled.

In Figure 5 I have illustrated a manner of forming a sealing joint between the lining of the pump, as for instance at the intake 33, with a cooperating pipe 55, or the like.

The edge of the sheet metal lining 35 cannot be flanged outwardly, as the lining must be inserted axially through the tubular opening of the intake 33. I provide means for compressing the outer edge 57 of the rubber lining 37 against the edge of the adjacent rubber lining 52', by flanging the edge of the sheet metal inwardly, whereby a flange backs up the rubber back of said edge 57, as shown at 58. This flange may be flat, but preferably is slightly inclined to hold the rubber liner outwardly by a dovetail action. The compressed rubber between the flange 58 and the adjacent edge 57 tends to expand laterally, thereby forming a seal against the side walls of the metal intake 56, as indicated at 59, effectively preventing the

contents of the pump from getting back of the sheet metal lining 35.

The discharge conduit 34 is clamped to the rotary pump by a flanged connection. The sheet metal backing 38 and the rubber facing 37 of the pump, and the similar parts of the conduit, are clamped between the flange 50 of the conduit and edge of the casing. Thus, these two parts are drawn up tightly toward each other, forming a liquid tight joint.

In Figure 3 there is shown a modified form of discharge conduit 34'. In this construction, the discharge opening of the pump is identical, but the conduit is made flexible to permit the connection of which it consists to flex into the various bends and turns that is required to complete the connection. The conduit 34' is protected from erosion caused by the impact of the abrasive particles in the pulp, by a resilient lining 52, comprising a suitable grade of soft, tough rubber. The rubber lining 52 is encased by a suitable fabric covering 53, which prevents undue wear, and prevents expansion and stretching of the rubber. The flexible hose thus formed is attached to the discharge connection by clamping bolts 54. A metallic ring 55 is provided for the clamping bolts 54 to bear against, so as to prevent tearing of the fabric cover 53 or rubber 52.

I propose to employ a similar flexible connection for the intake 33 of the pump, and further contemplate the use of such a flexible connection wherever the danger of eroding metal pipes by the impingement of abrasive particles against the interior surfaces is apparent. Such rubber lined hose is made in suitable lengths with the fabric casing and the rubber lining flanged out at the ends, just as shown in Figures 3 and 4. The employment of this kind of flexible hose dispenses with elbows, so that the hose may itself be bent. Suitable Y, T and the like fittings, all with flanged fabric and rubber ends, may also be provided. In joining the different sections of this flexible hose, a clamping bolt connection is employed. The rubber lining 52' at the end of each section is formed with an annular flange 56, which permits clamping bolts 57 to pass therethrough, and clamp thereagainst, through the medium of metallic backing rings 55.

From the foregoing description, it is to be noted that I avail myself of the advantage secured by extending the metallic backing as well as the resilient lining between the flanges of the casing, and allow the clamping bolts to pass therethrough. By this arrangement, the protective lining is rigidly held in its proper position within the pump casing, the centering of it with the impeller being assured. Providing finished high spots or rings greatly reduces the cost of manufacture, but it primarily assists in securing accurate seating, and insuring that proper clearances are obtained. The rings of filling material, such as cement, mastic and the like, present complete barriers to the flow or seepage of corrosive liquids back of the lining, and form a complete solid backing over the back of the lining. Even if the liner did not contact completely with all the gauge surfaces, the filling will enter such places and form a complete backing for the liner. It is to be understood that the particular structure shown may be modified considerably, without departing from the spirit and scope of the invention.

I claim:

1. In a centrifugal pump, a casing having an axial inlet and a peripheral outlet, said casing being divided on a plane substantially at right angles to the axis and having flanges for securing the two parts together, an impeller for said pump, a lining for the interior of said pump comprising a relatively thin flexible metal backing stamped to the configuration of said interior, each section of said casing being provided with finished gauge surfaces for seating said metallic backing, said metallic backing being centered to provide the usual clearance for said impeller blade by being pressed upon its seat when the casing sections are clamped together.

2. In a pump casing, a lining for the interior of the pump comprising a relatively thin flexible sheet metal backing and a rubber facing, a plurality of finished surfaces on the interior of said casing, said lining pressably seating on said finished surfaces.

3. In a centrifugal pump for pumping abrasive material, a casing being divided on a plane substantially at right angles to the axis and having flanges for securing the two parts together, an impeller for said pump, a protective covering for the interior of said pump comprising a liner of resilient material, said liner covering substantially the entire exposed interior surface, a plurality of finished high spots on the interior of said casing, said liner being pressably seated upon said high spots to center itself when the casing flanges are clamped together.

4. In a pump casing, a lining for the interior of the pump comprising a relatively thin flexible sheet metal backing and a rubber facing, a plurality of finished surfaces on the interior of said casing, said lining pressably seating on said finished surfaces, the remaining unfinished portions providing pockets between the casing and sheet metal backing, and an acid proof filling in said pockets.

5. In a centrifugal pump, a casing having an axial inlet and a tangential outlet, a lining for substantially the entire surface of the casing, said lining comprising a press-

ably seated thin sheet metal backing adapted to lie against the inside of the casing and a rubber facing, each of the parts of said lining having a tangential portion fitting the tangential outlet of the casing and provided with co-extensive flanges, a discharge conduit having a protective rubber lining comprising a thin sheet metal backing and a rubber facing and each formed with a peripheral flange co-extensive with the other, the flanges of the conduit and pump linings abutting each other to serve as a gasket for the tangential outlet and discharge conduit thereby forming a liquid seal against the sheet metal backing in each instance and the flanges of said casing and said conduit.

6. In a centrifugal pump, a casing having an axial inlet and a tangential outlet, a lining for substantially the entire surface of the casing comprising an inner and outer layer, said casing being divided on substantially a plane at right angles to the axis, and said outer layer of the lining being divided into two parts on substantially the same plane and being flexible to be self seating in said casing, flanges formed on said casing at said divide, flanges formed on said lining at said divide and at said outlet opening, a conduit having a protective lining with similar flanges for said outlet, and said liner flanges forming a gasket for the casing flanges and conduit flanges, said outer lining being flexible to be self seating in said casing as said liner flanges are drawn between said casing flanges and said conduit flanges.

7. In a pump, the combination of a casing having inlet and outlet openings and conduits therefor, a protective lining for the interior of said pump casing and conduits comprising a relatively thin metal backing and a rubber facing, the rubber facing of each abutting to form a liquid sealed joint, said metal backing terminating short of the joint with the ends flanged inwardly, said flanges anchored in said rubber facing and inclined to hold the latter outwardly at the joint by a dovetail action.

8. In a pump, the combination of a casing having inlet and outlet openings and conduits therefor, a protective lining for the interior of said pump casing and conduits comprising a relatively thin metal backing and a rubber facing, the protective liner of each abutting to form a liquid sealed joint, said metal backing terminating in inwardly turned flanges anchored in the rubber facing for reinforcing the latter by holding it outwardly against the abutting end of the liner of the adjacent connection of the joint.

9. Means for protecting the interior of a device through which material of an abrasive character is conveyed, comprising, a plurality of finished surfaces on the interior of said device, and a protective flexible lining pressably seating on said finished surfaces to center itself in said device.

10. In a casing for hydraulic apparatus having tubular inlet and discharge openings and an additional opening, a lining for the interior of said casing comprising a rubber facing and a relatively flexible sheet metal backing therefor, the inner wall of said casing having a plurality of spaced seating portions raised upon its interior surface, one of said raised portions being disposed adjacent one of said openings, and said lining pressably seating on said spaced raised portions.

In witness whereof, I hereunto subscribe my name this 30th day of March, 1921.

GEORGE T. HANSEN.