No. 667.525.

Patented Feb. 5, 1901.

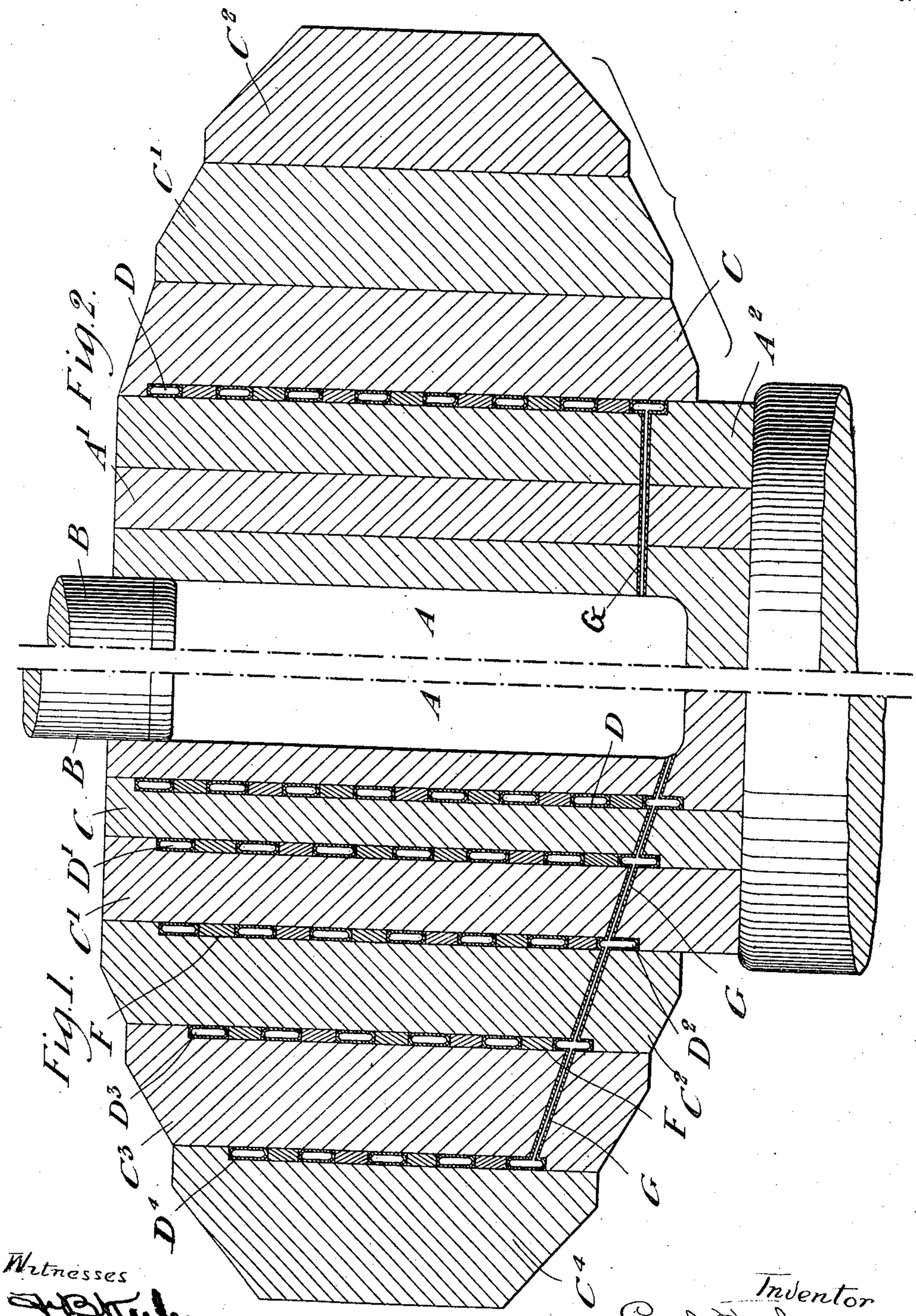
C. HUBER.

INTERNAL PRESSURE RESISTANCE CYLINDER.

(Application filed June 8, 1900.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses

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(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

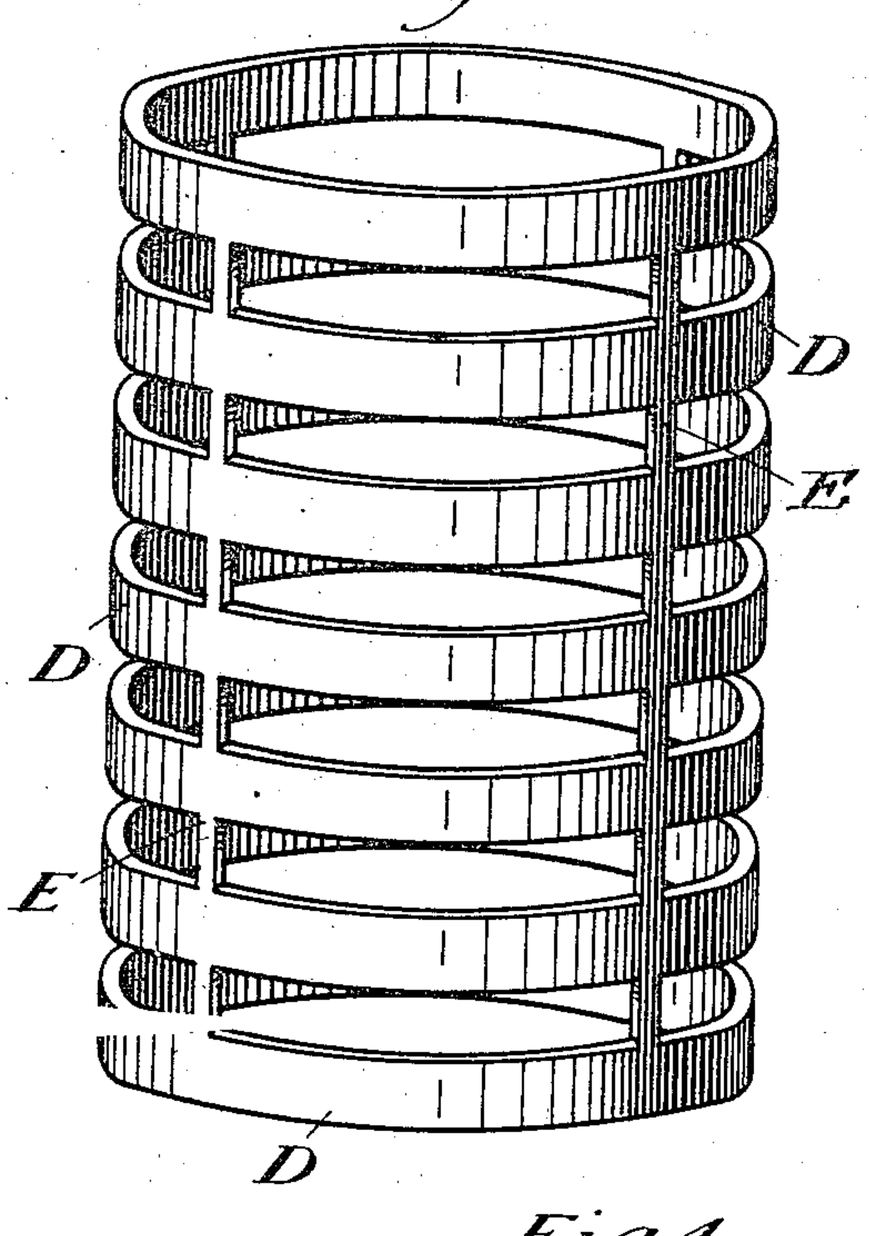


Fig. 5.

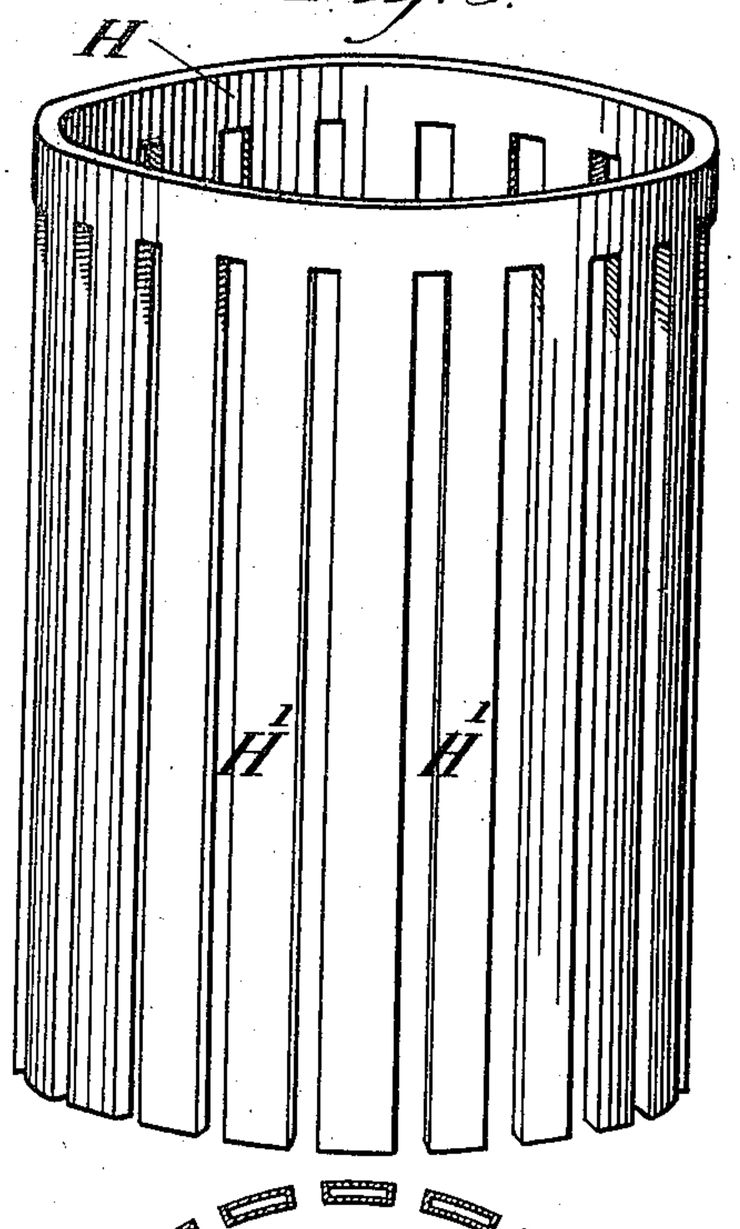


Fig. 4.

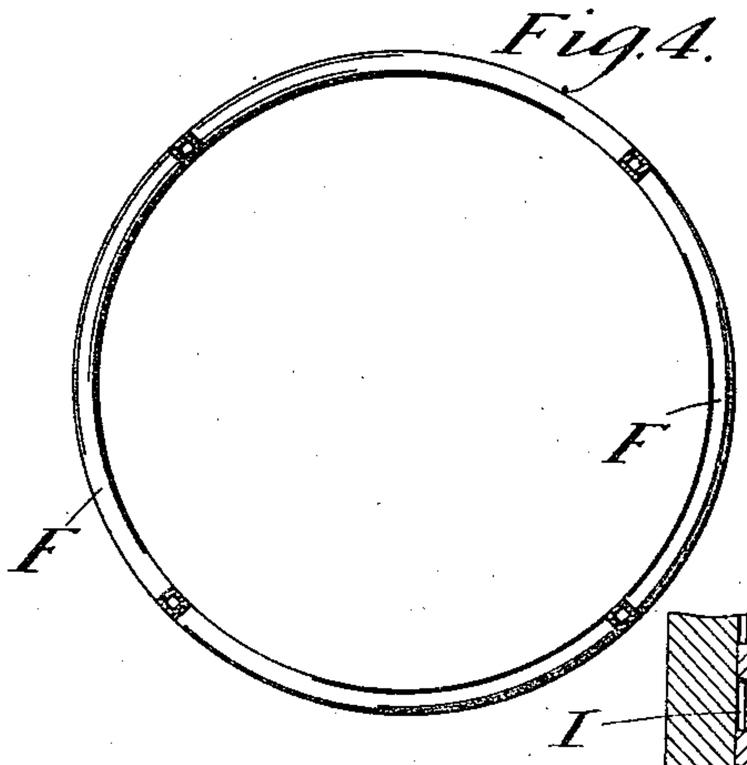
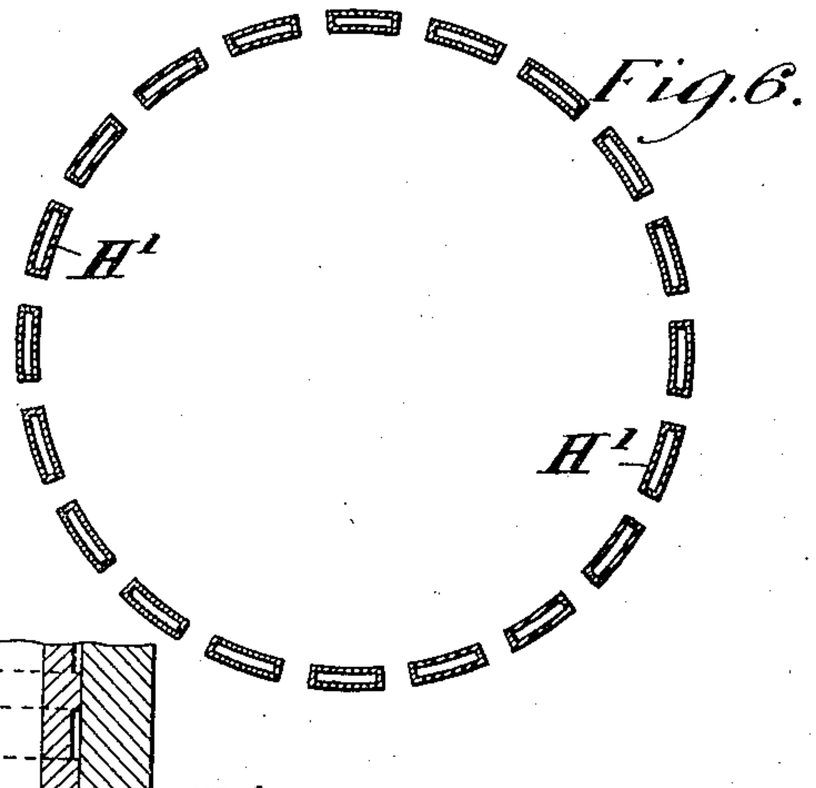


Fig. 6.



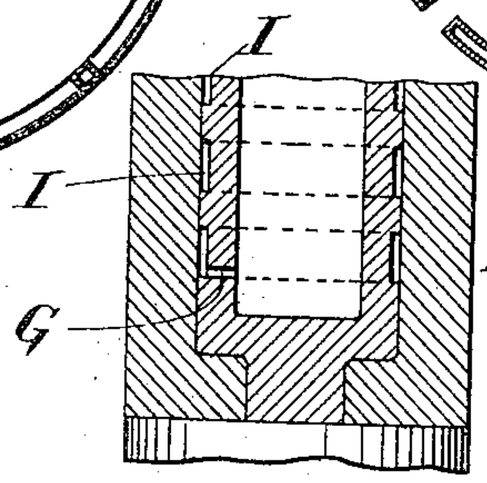


Fig. 7.

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UNITED STATES PATENT OFFICE.

CARL HUBER, OF CARLSRUHE, GERMANY.

INTERNAL-PRESSURE-RESISTANCE CYLINDER.

SPECIFICATION forming part of Letters Patent No. 667,525, dated February 5, 1901.

Application filed June 8, 1900. Serial No. 19,605. (No model.)

To all whom it may concern:

Be it known that I, CARL HUBER, a citizen of Germany, residing at 38 Beiertheimer Allee, Carlsruhe, Baden, in the Empire of Germany, have invented a certain new and useful Internal-Pressure-Resistance Cylinder, (for which application has been made for a patent in Great Britain, dated January 22, 1900, No. 1,372; in Germany, dated April 23, 1900; in France, dated May 4, 1900; in Austria, dated April 30, 1900; in Hungary, dated April 30, 1900; in Switzerland, dated April 30, 1900; in Italy, dated May 5, 1900, and in Russia, dated April 25, 1900,) of which the following is a specification.

This invention relates to certain new and useful improvements in molds in which are placed objects adapted to be forced to the shape of the mold by internal pressure, although tubular structures, cylinders, and large guns, which are subjected to high internal pressure, can be constructed in accordance with my invention. It has been the custom to build up such structures of a central cylinder or tube the strength of which of itself was insufficient to bear the high internal pressures to which it was to be subjected, such central cylinder or tube being strengthened by shrinking on it one or more rings or cylinders, which were thus made to exert an inward or, so to speak, "minus" pressure upon the outer surface of the central cylinder. This pressure is of course exercised not only when the structure is in operation, but also when it is at rest—that is, when there is no pressure in the central cylinder. With this arrangement when the central cylinder is subject to internal pressure this is first counteracted by the said minus pressure to which the cylinder is subjected externally by the shrunk rings, and if the internal pressure is only raised so as to become equal to such minus pressure it will be seen that the cylinder will not be subjected to strain in either direction. If the internal pressure is increased beyond this point, the cylinder will then be subjected to a corresponding outward or positive strain. By the above means it will be seen that the central cylinder will be made capable of withstanding a greater internal pressure than if it were made of a single thickness of metal equal to that of its own thickness and that of the shrunk rings combined; but it will also be seen that there is a limit to the degree to which the cylinder can be strengthened by this means against internal pressure, because as the shrunk rings exercise the said minus strain upon the central cylinder also when this is not subject to any internal pressure it will be evident that such minus strain must not exceed the crushing strain which the central resistance-cylinder can safely bear without detriment when it is not subject to internal pressure.

The present invention has for its object to enable such pressure cylinders or tubes to effectually withstand much higher degrees of internal pressure than was possible heretofore by a method of construction whereby the central cylinder is not necessarily subjected to any minus pressure from the external rings when it is not subjected to internal pressure, such minus or inward pressure being only exerted when the cylinder is subjected to internal pressure, the arrangement being such that the minus pressure is made to increase in more or less exact proportion to such internal pressure, so that this may thus be raised to a very high degree without injury to the central cylinder.

The essential feature of the invention for effecting the above purpose consists in causing the fluid-pressure that is at any time acting in the central cylinder to be simultaneously transmitted through a suitable channel or channels to the interior of hollow spaces or channels formed between the outer surface of the cylinder and the inner surface of the surrounding strengthening ring or rings, so that the pressure exercised in such channels in being exercised in an inward or minus direction against the outer surface of the cylinder will more or less counteract or neutralize the outward or plus strain to which it is being subjected.

A practical mode of carrying out the said invention is to construct a strong tubular metal receptacle which is fitted into correspondingly-shaped recesses or channels formed in the outer surface of the central cylinder or the inner surface of the outer strengthening-ring, such tubular receptacle being made to communicate at one or more points by means of a channel passing through

the sides of the central cylinder with the interior of the latter, so that on this being subjected to high fluid-pressure this will be transmitted through the said radial channel to the interior of the tubular structure. By this means the walls of the tubular structure, which are more or less elastic, are expanded by the internal pressure, so as to press on the one hand against the outer surface of the central cylinder and on the other hand against the internal surface of the strengthening ring or rings, thereby subjecting the central cylinder to an inward or minus strain which will be more or less exactly proportional to the outward or plus strain to which it is at the time subjected internally by the pressure-fluid.

On the accompanying drawings are shown by way of example several constructions for carrying out the above-described invention.

Figure 1 shows a part-vertical section of a chamber in which liquid is subjected to very high pressure for various purposes and a series of tubular bodies and strengthening-rings surrounding the same. Fig. 2 shows a part-vertical section of a modified form in which but one tubular body is employed for the pressure-chamber. Fig. 3 shows a perspective view of a tubular structure suitable for carrying out the invention. Fig. 4 shows a plan of the filling-pieces employed in connection with the construction at Fig. 3; and Fig. 5 shows a perspective view, and Fig. 6 a sectional plan, of another form of tubular structure. Fig. 7 shows a part-vertical section of a modification in which the tubular structure is dispensed with and the pressure-channels are formed in the outer surface of the cylinder itself.

In the construction shown at Fig. 1, A is the pressure-chamber, adapted to be charged with pressure-fluid which is subjected to a high degree of pressure by the plunger B. Between the wall of the chamber A and the inner surface of the strengthening-ring C is fitted the tubular structure D, which is assumed to be of the same construction as that shown at Fig. 3. It consists of a number of hollow rings D D of rectangular cross-section, which are made to communicate with each other by means of vertical connecting-channels E E, the spaces between which rings are filled in by segmental filling-pieces F F, as shown in plan at Fig. 4 and in section at Fig. 1. The lowest ring D communicates with the pressure-chamber A by means of the tubular channel G, and assuming all the rings D to be filled with a suitable liquid the pressure to which the liquid in A is at any time subjected will at once be transmitted through G and E to all the rings D, so that the walls of these will be pressed with a proportionate pressure both against the outer surface of the wall of chamber A and the inner surface of ring C, the extent of the external pressure to which the cylinder is thus subjected being determined by the extent of its outer surface, which is covered by the rings D, so that if these were placed close together the minus strain exerted thereby would more nearly approach the plus strain upon the wall of chamber A than when the rings are farther apart. The portion of the plus strain to which the wall of chamber A is subjected which is not balanced by the said minus strain will be resisted partly by the wall of chamber A itself and partly by the strengthening-ring C, assuming that there is only one tubular body D; but if, as shown in Fig. 1, there are provided a number of other similar tubular bodies D′ D^2, &c., and strengthening-rings C′ C^2, &c, all of which bodies are in communication with the chamber A by the channels E, it will be obvious that as D′ will exert a minus strain upon C, so as to relieve it from the plus strain exercised by D, while D^2 will exert a minus strain upon C′, relieving it of the plus strain of D′, and so on, the arrangement may be made such that even with the highest possible pressure in the chamber A the plus strain exerted upon the outer strengthening-ring C^4 may be rendered comparatively insignificant.

Fig. 2 shows a construction in which only one tubular body D is employed, the wall of chamber A having strengthening-rings A′ A^2 shrunk on it in the usual manner, so as to put a certain minus strain upon the wall. Upon the outer ring A^2 is fitted the tubular body D, communicating with the chamber A by the channel G, and upon this is fitted the ring C, which together with the rings C′ C^2, shrunk one upon the other, forms a separate compound outer ring, which exercises no minus pressure on A A′ A^2 and which only serves to resist the plus pressure exercised by the tubular body D when the chamber A is subjected to pressure.

In the construction of tubular body shown at Figs. 5 and 6 a single ring-shaped tube H has fixed or formed on it a number of straight tubes H′, arranged in a circle, closed at the lower ends and communicating with H at the upper end, so that if either the ring H or one or more of the tubes H′ be connected by a channel, such as G, Fig. 1, to the chamber A the fluid-pressure produced in the latter will be transmitted in the before-described manner to the tubes H H′. The spaces between the tubes H′ are filled in with straight filling-pieces. It will be obvious that the tubular bodies D or H H′ may be constructed in variously-modified forms for the purposes of this invention. Thus instead of a number of tubular rings, such as D, a continuous helical tube might be employed; also, that in some cases the tubular bodies may be replaced by channels formed either in the outer surface of the central cylinder itself or in the inner surface of the strengthening-rings C, these being in that case shrunk on, so as to form closed channels, which are made to communicate with each other and with the chamber A, Fig. 1, by means of branch channels

in a similar manner to that described with reference to the tubular bodies D and H H'.

Fig. 7 shows a vertical section of such an arrangement, where I I are channels formed in the outer surface of the wall of chamber A and communicating with the interior of the latter by a channel G.

Having thus described the nature of this invention and the best means I know of carrying the same into practical effect, I claim—

1. A body provided with a chamber adapted to be subjected to internal high fluid-pressure, strengthening means fitted externally to the wall of said chamber, a series of closed intercommunicating channels situated between the outer surface of said body and the inner surface of said strengthening means, and a duct establishing a communication between said chamber and the said channels, so that when the chamber is subjected to high fluid-pressure such fluid-pressure will be transmitted through said duct into said channels, thereby exerting an inward pressure upon the outer surface of the wall of said chamber that will more or less counterbalance the outward strain exerted thereon, substantially as described.

2. A body provided with a chamber adapted to be subjected to internal high fluid-pressure, strengthening means fitted externally to the wall of said chamber, a structure composed of a number of tubular channels interposed between the outer surface of the wall of said chamber and the inner surface of said strengthening means, and a duct establishing a communication between said chamber and the channels of said interposed structure, substantially as and for the purpose herein described.

3. A body provided with a chamber adapted to be subjected to internal high fluid-pressure, a strengthening-ring fitted externally to the wall of said chamber, a structure composed of a series of tubular channels interposed between said ring and the wall of said chamber, and a duct establishing communication between said chamber and structure.

4. A body provided with a chamber, a strengthening means surrounding said body, and a structure composed of a series of channels interposed between said means and body and in suitable communication with said chamber.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CARL HUBER.

Witnesses:
JACOB ADRIAN,
H. W. HARRIS.