

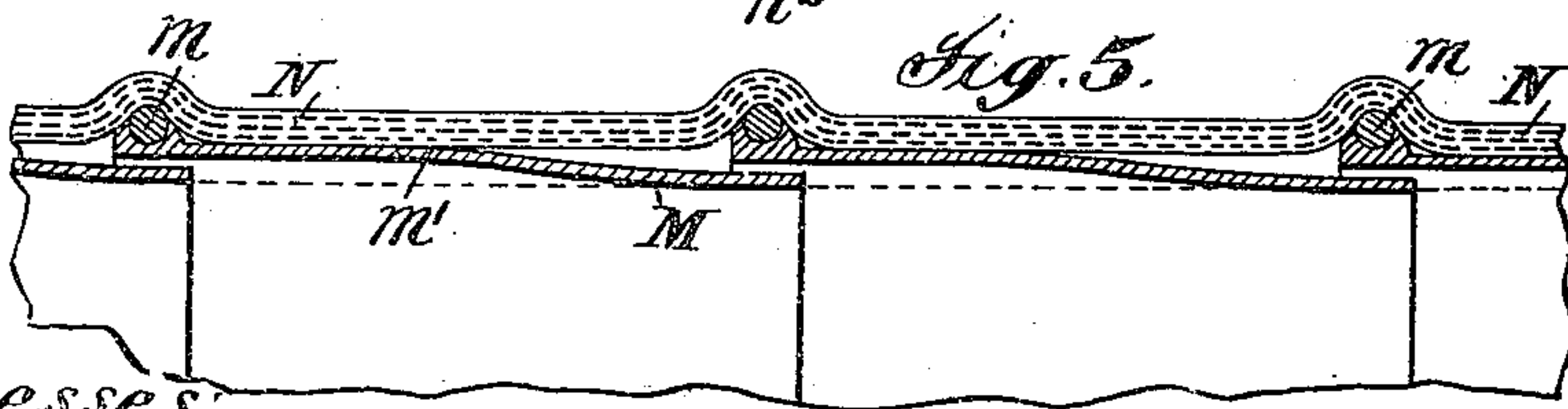
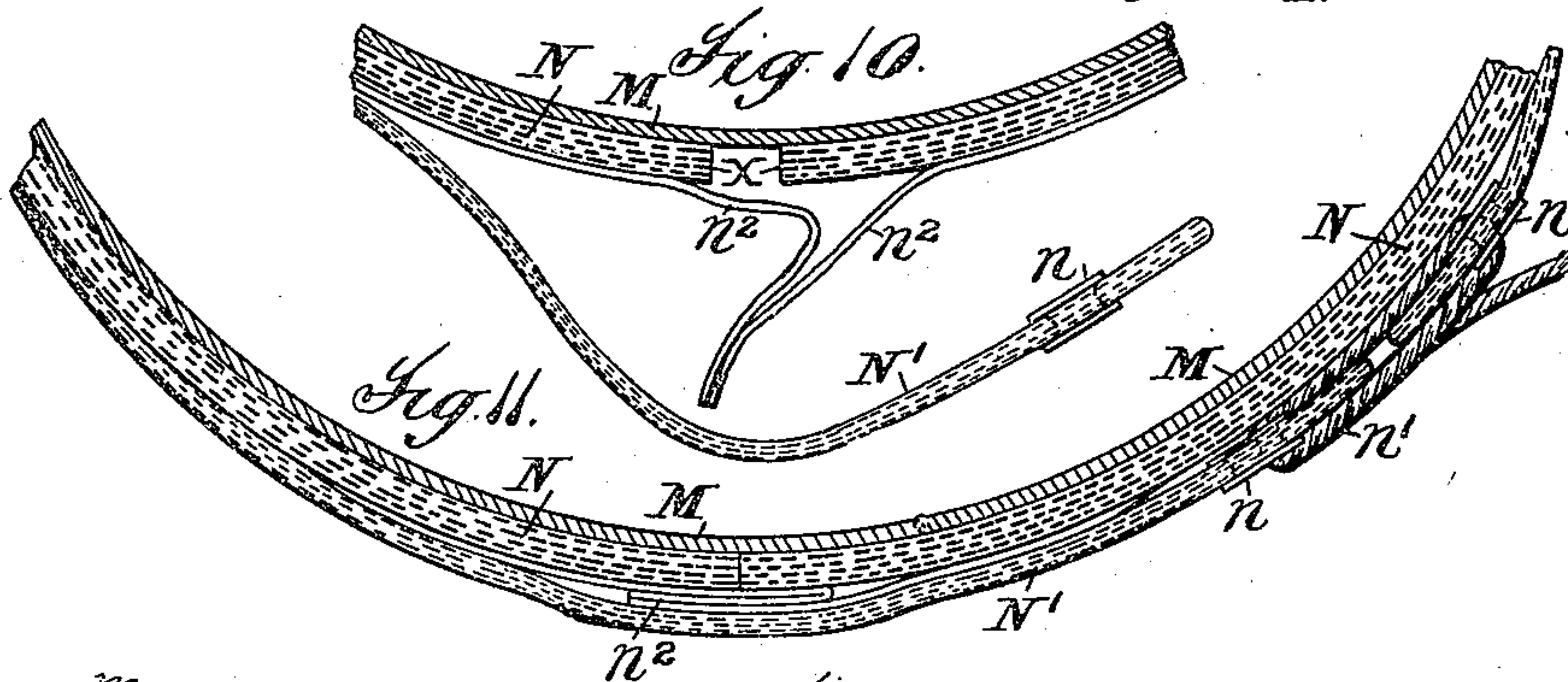
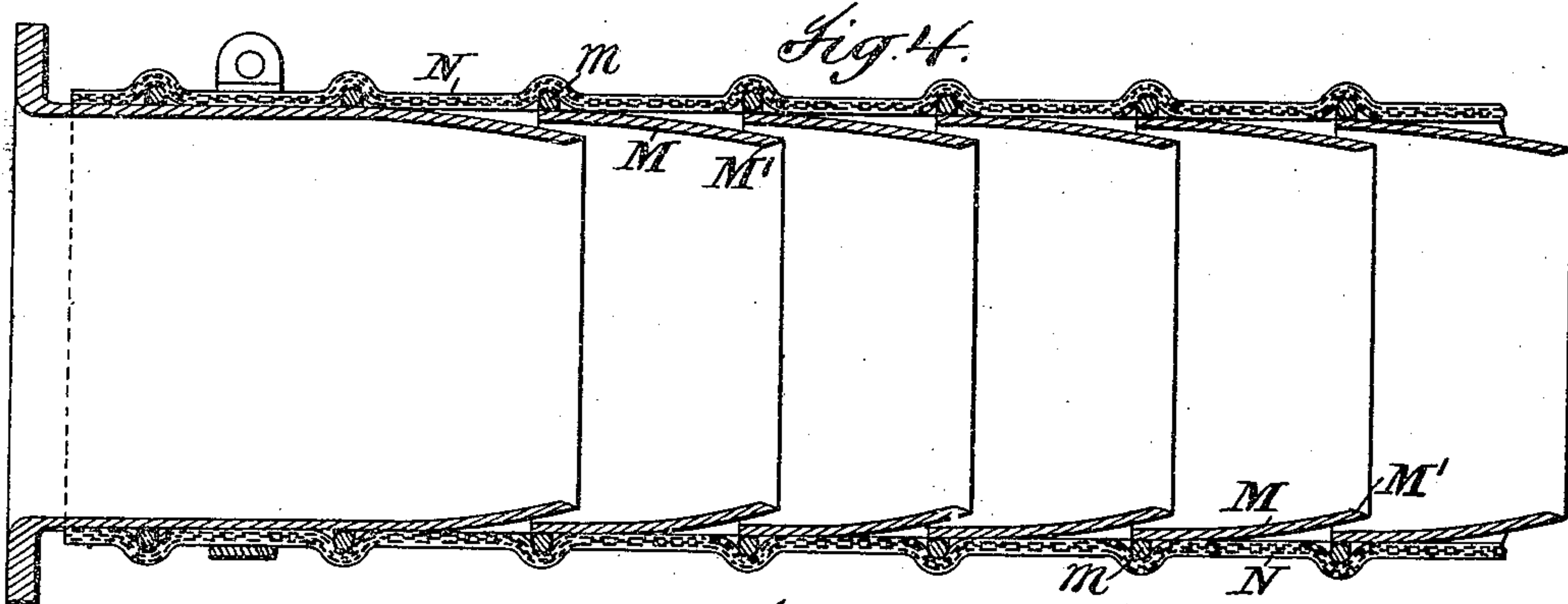
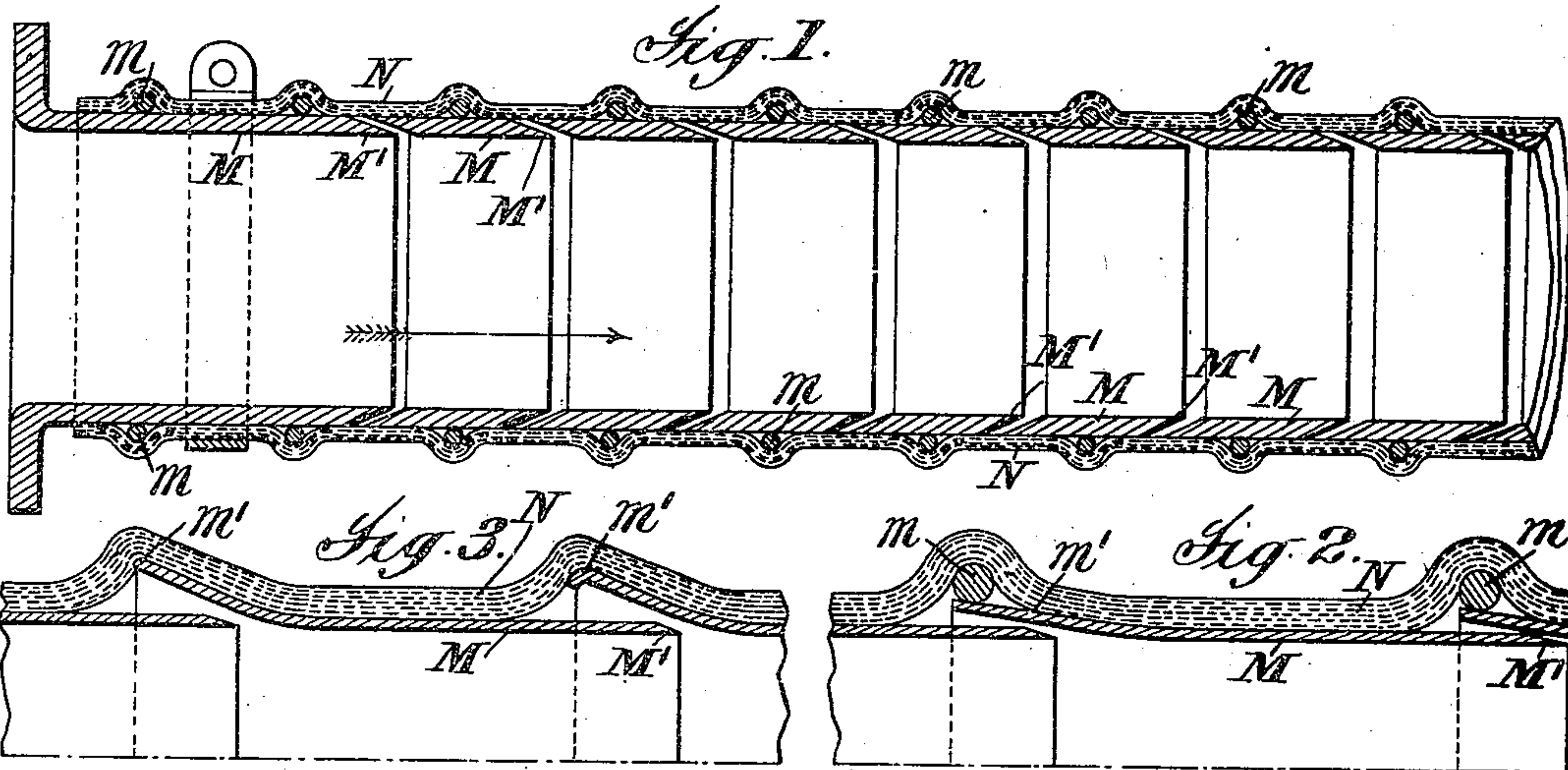
J. & F. H. HAVILAND & J. FARMER.

FLEXIBLE PIPING.

(Application filed Nov. 20, 1899.)

(No Model.)

4 Sheets—Sheet 1.



Inventors
John Haviland
Frederick Henry Haviland
John Farmer

Witnesses:
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L. Almqvist

by Howard and Howard
attys

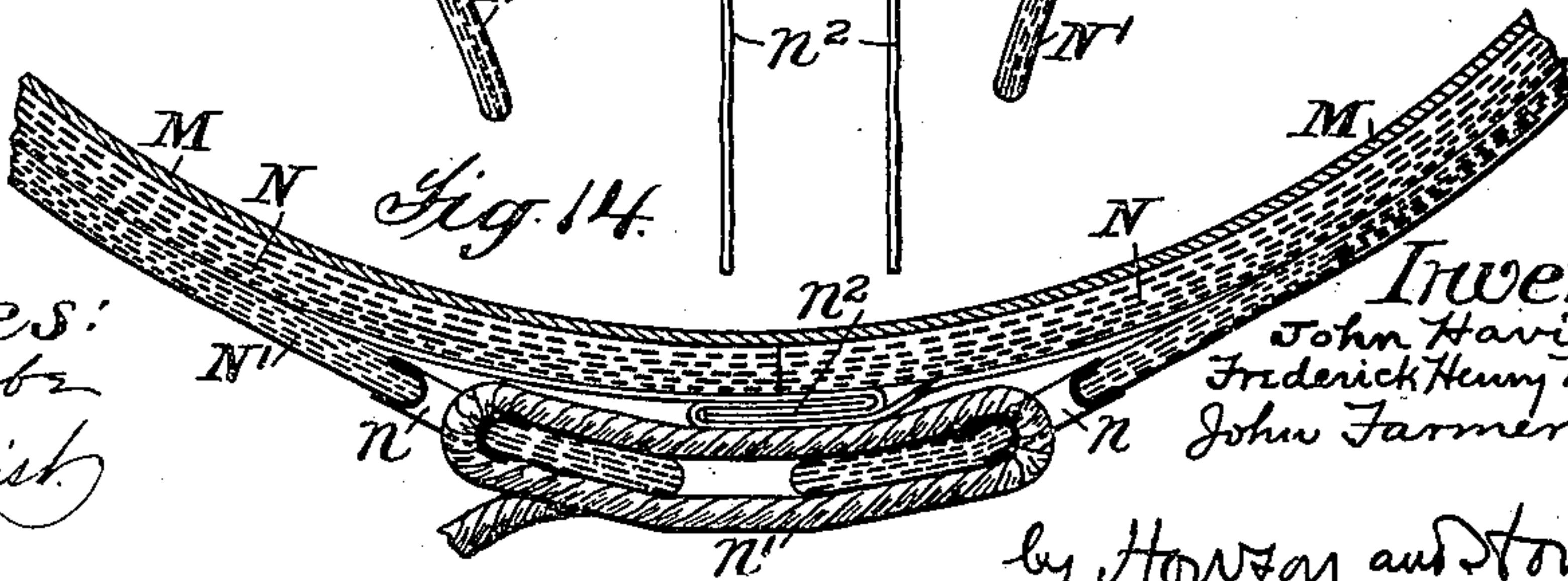
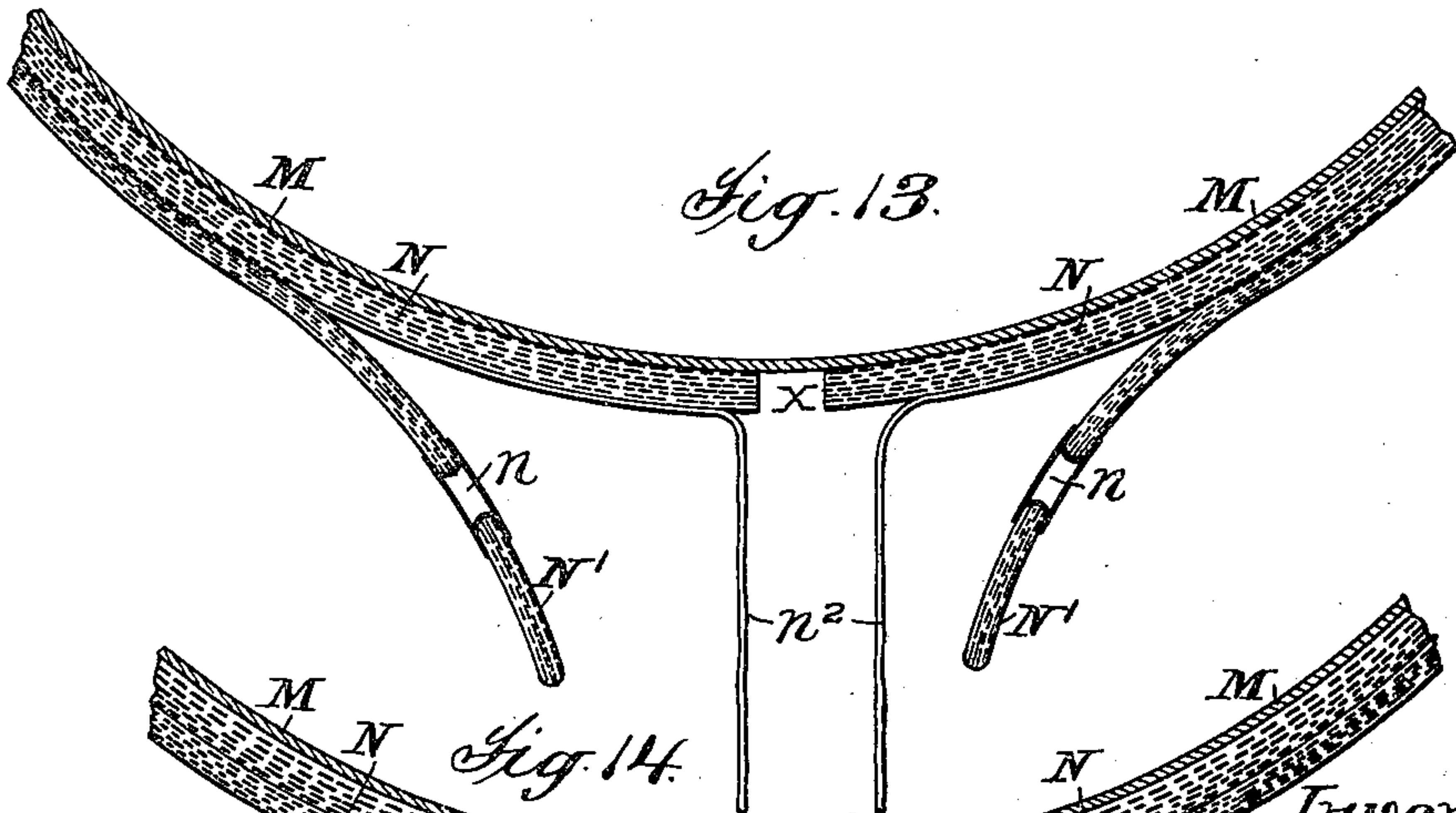
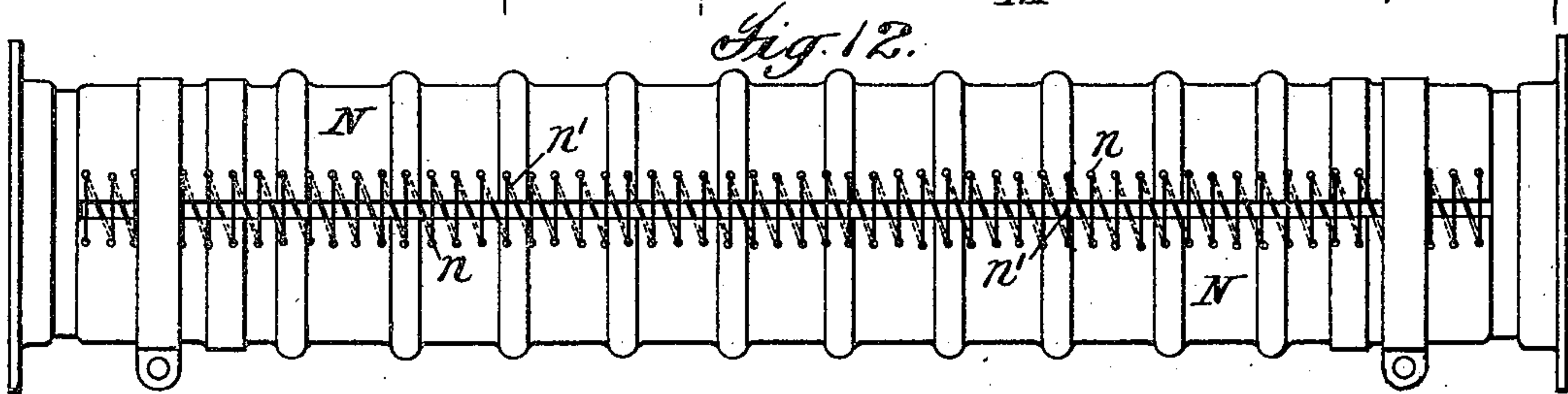
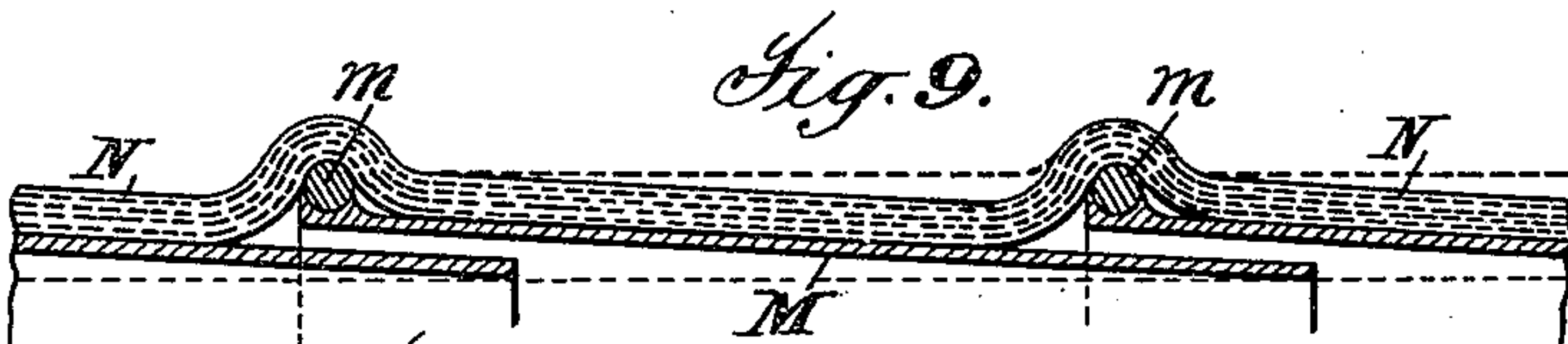
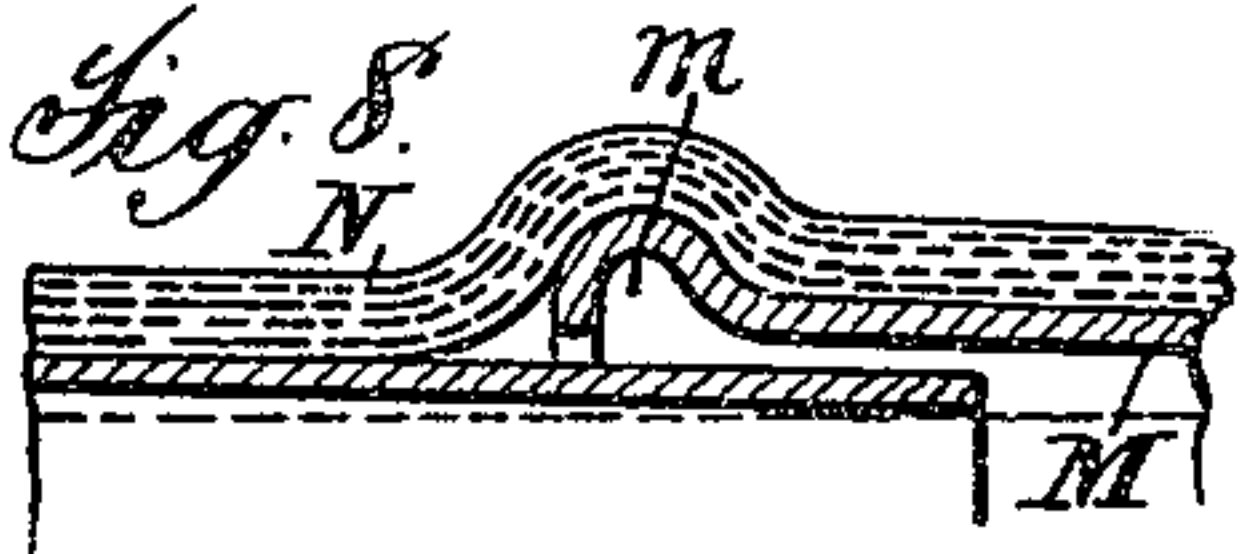
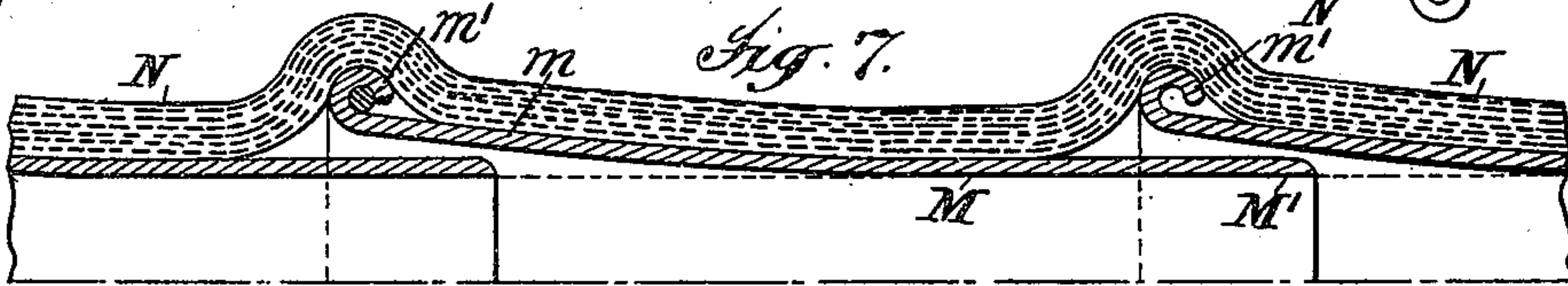
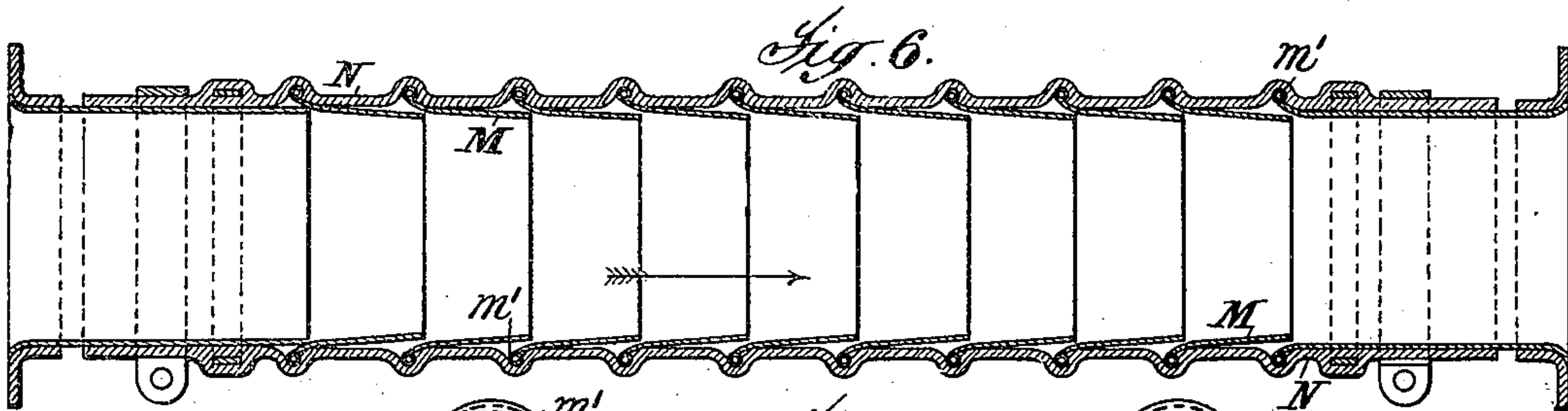
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4 Sheets—Sheet 2.



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4 Sheets—Sheet 3.

Fig. 15.

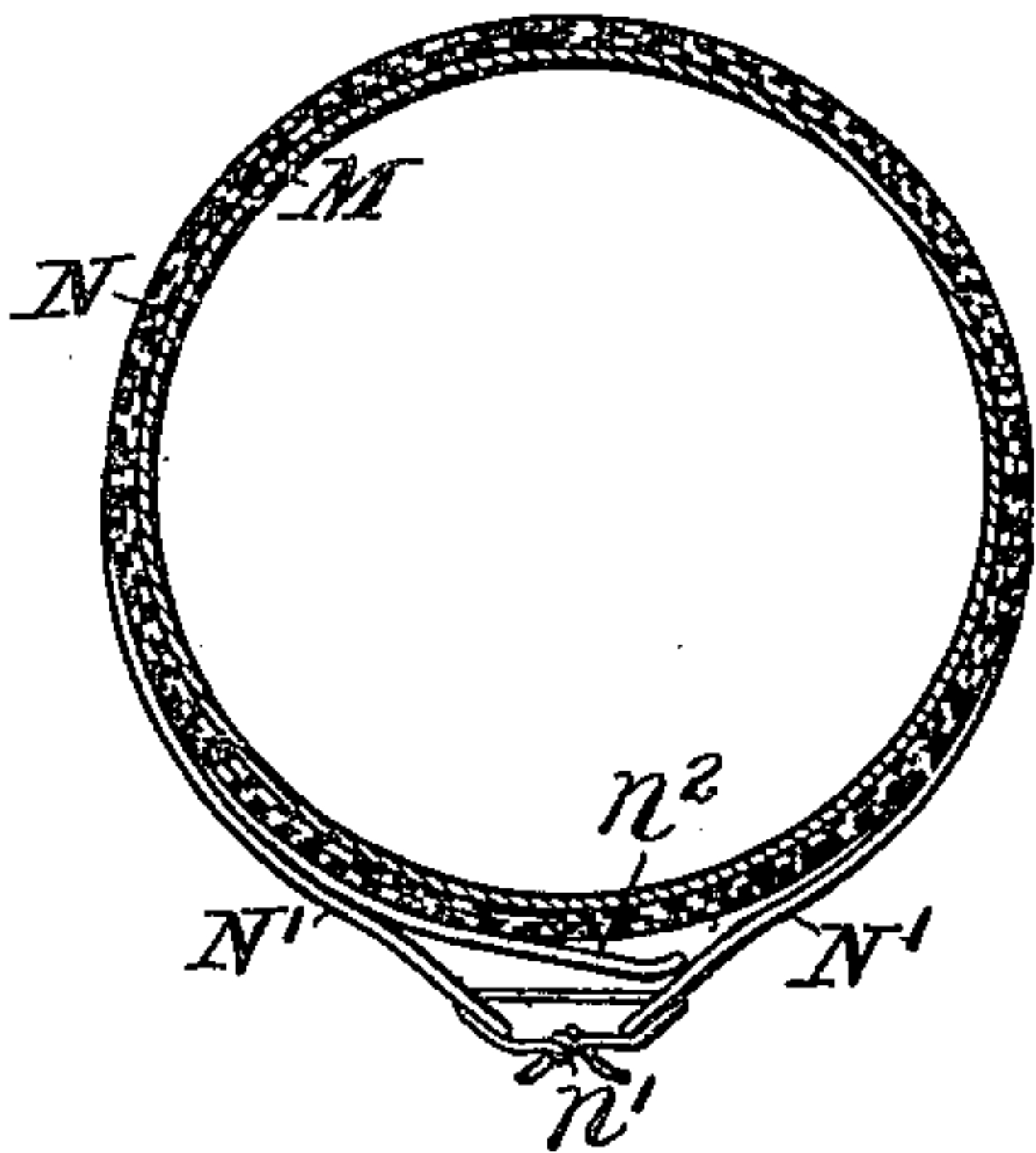


Fig. 16.

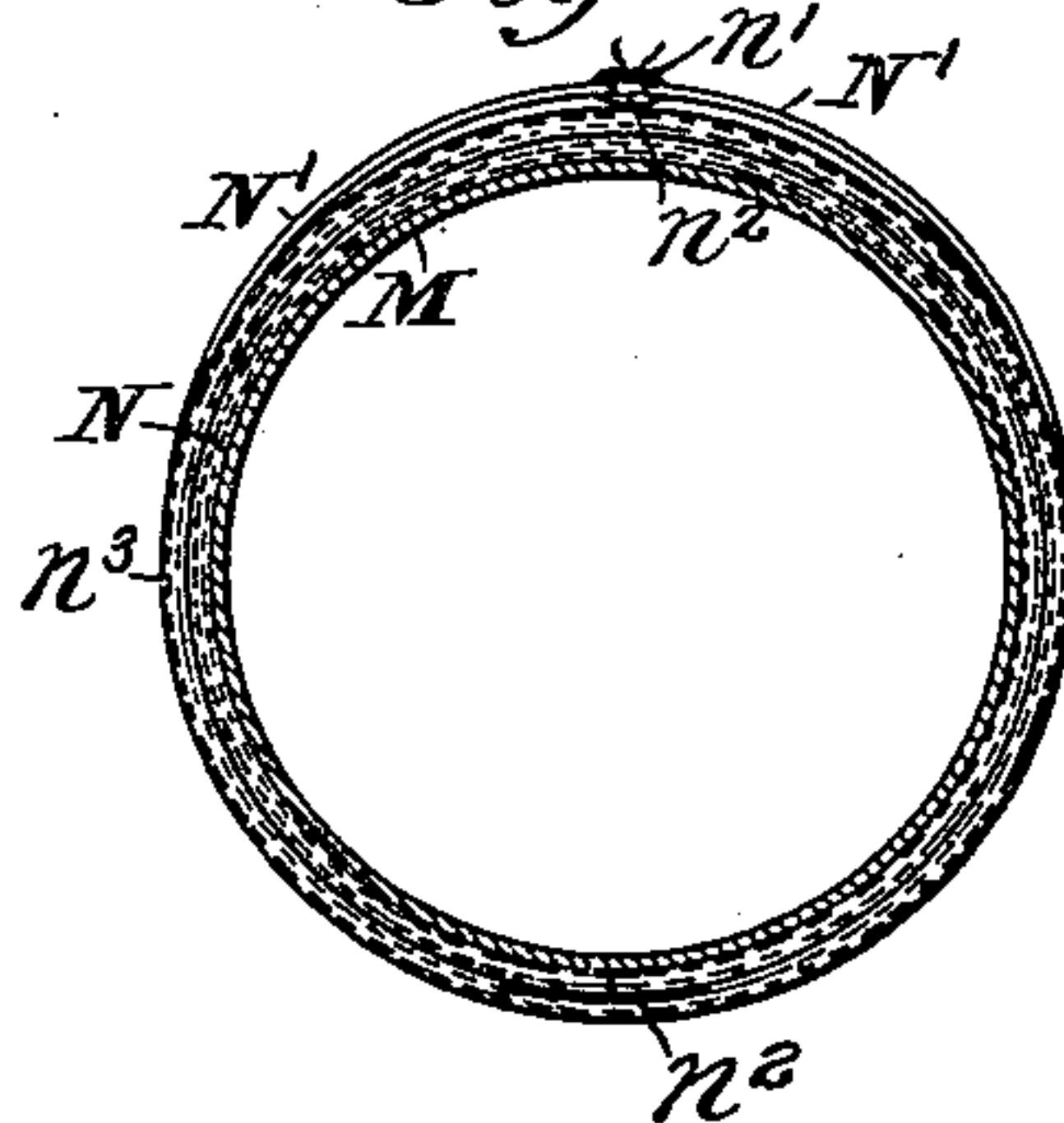


Fig. 18.

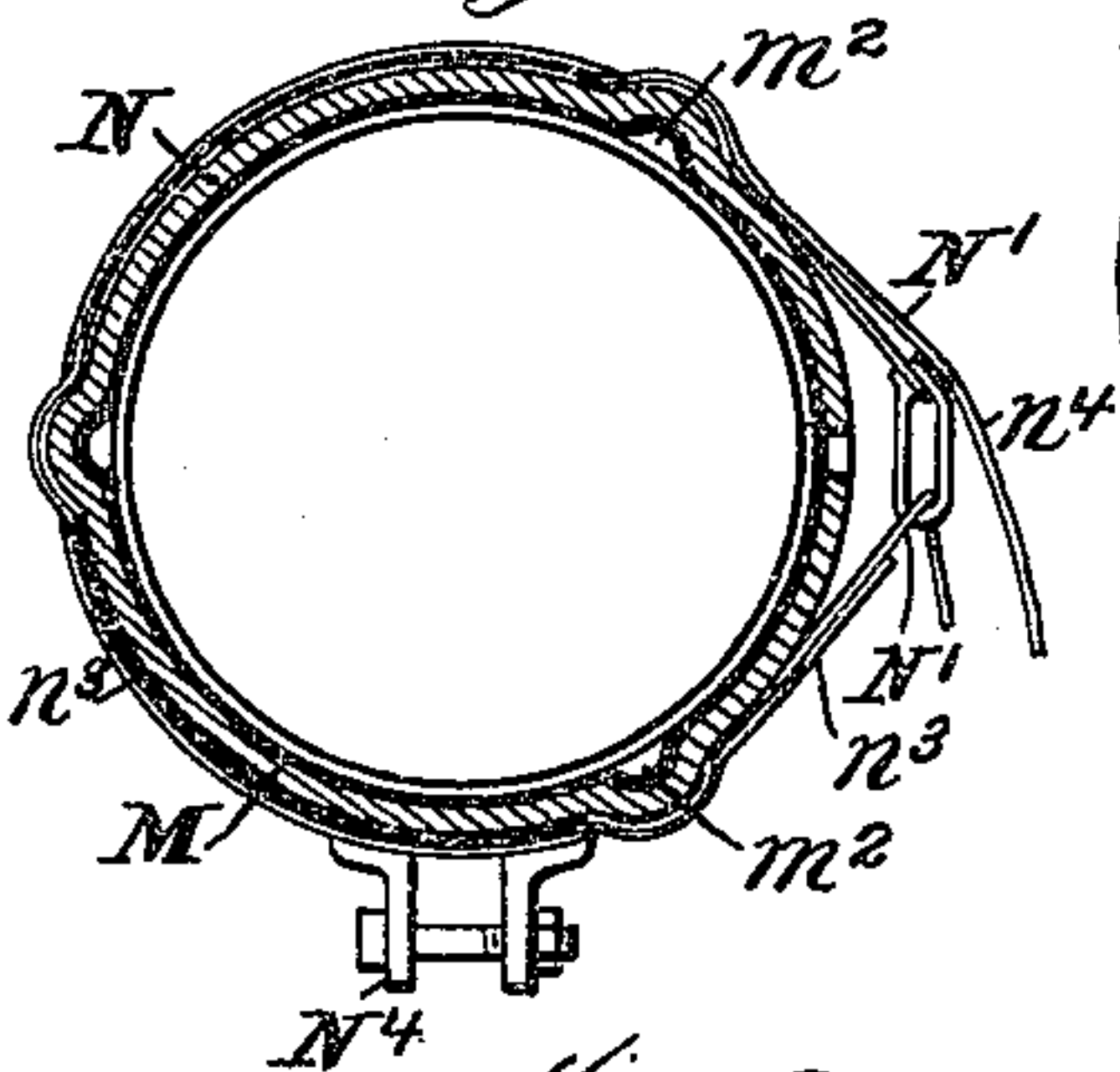


Fig. 17.

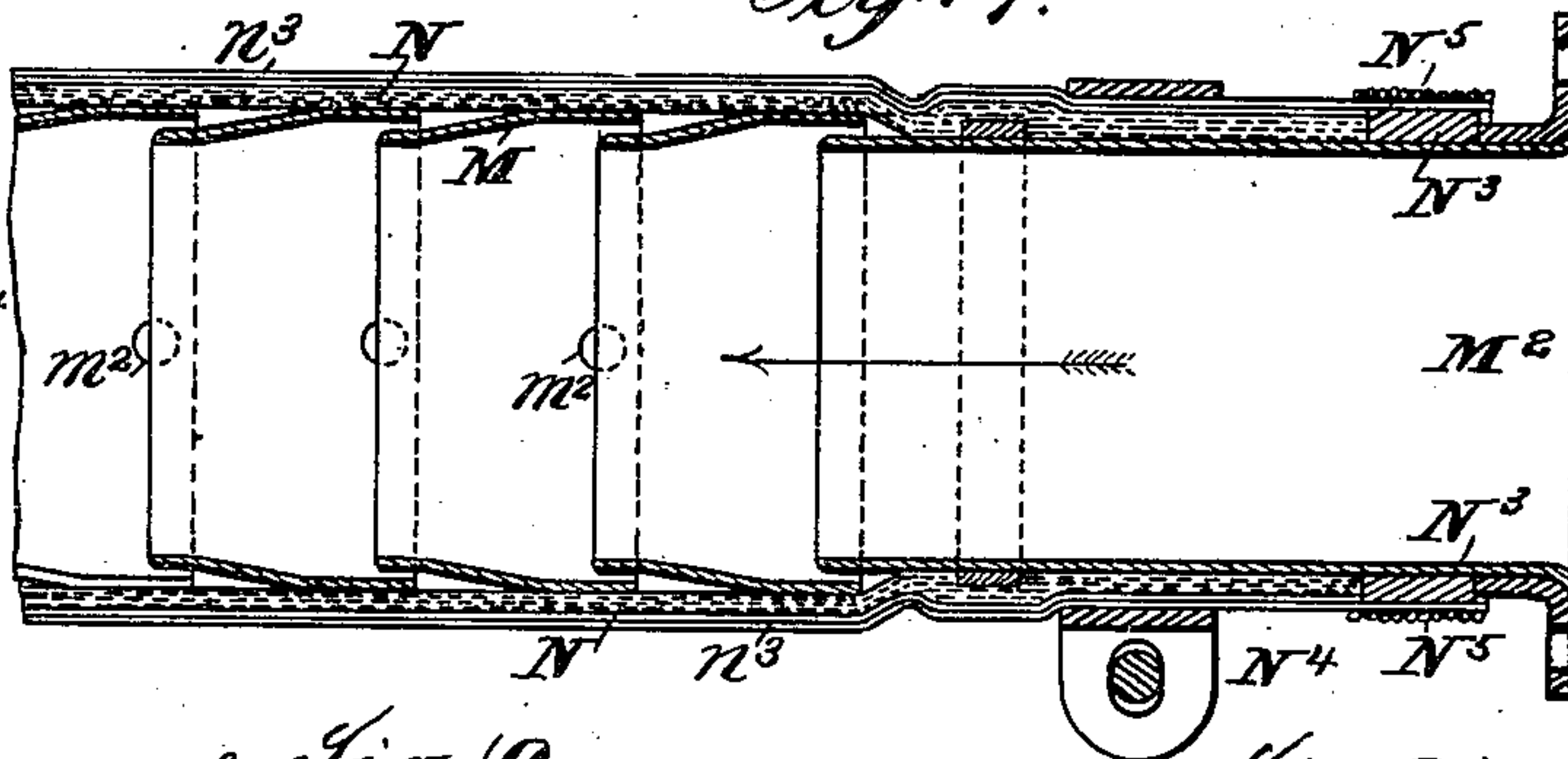


Fig. 20.

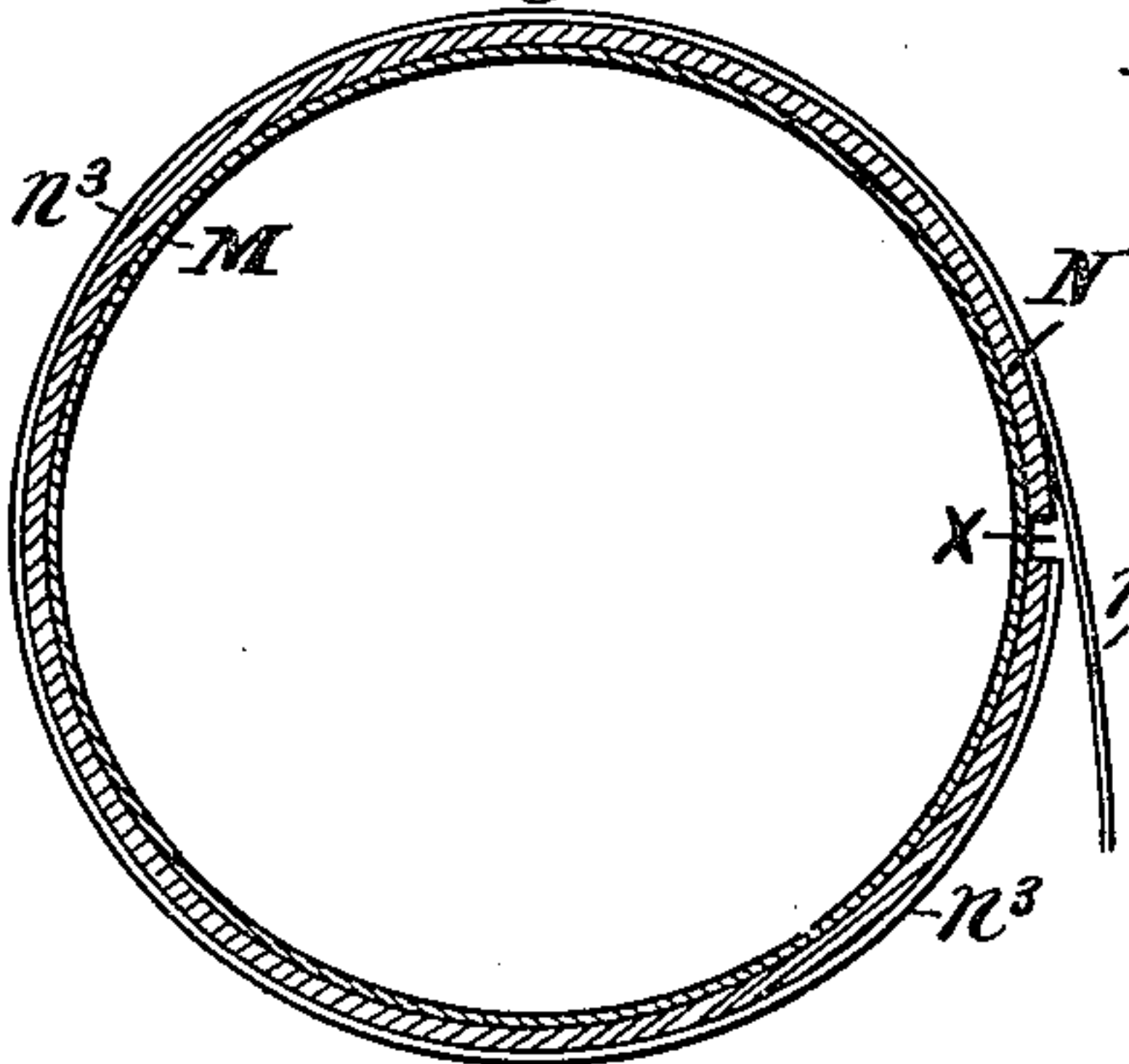


Fig. 19.

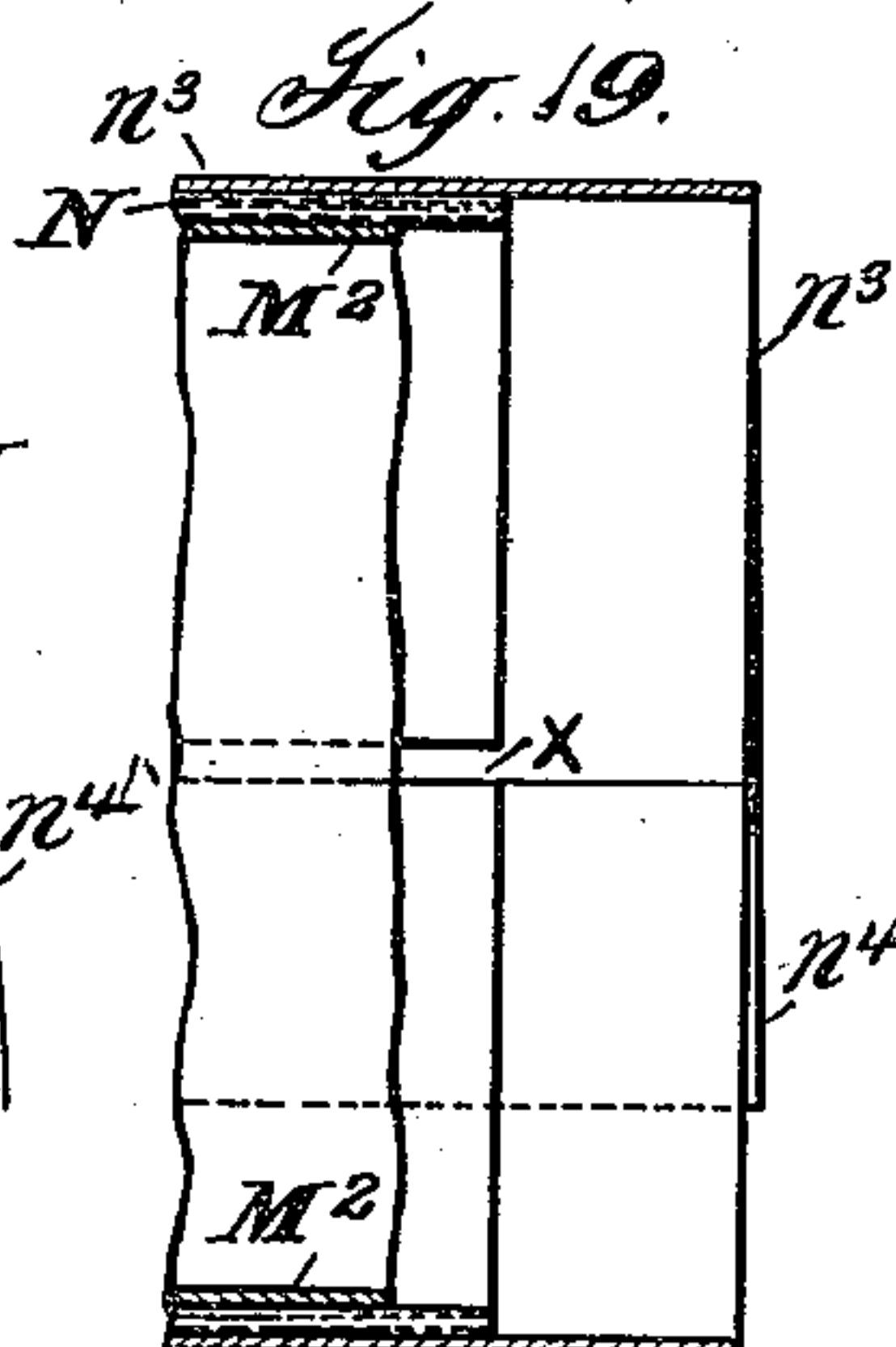


Fig. 21.

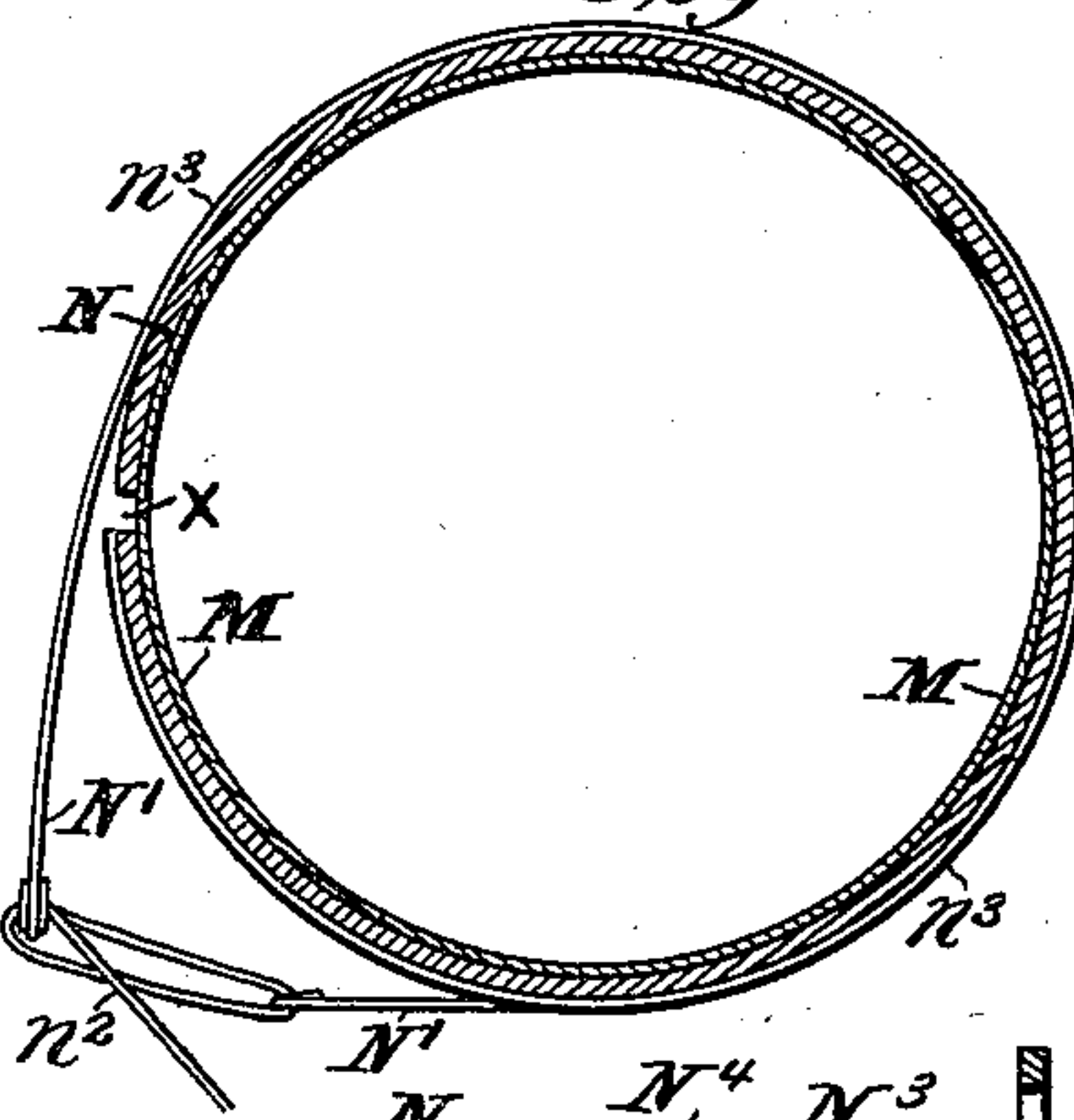
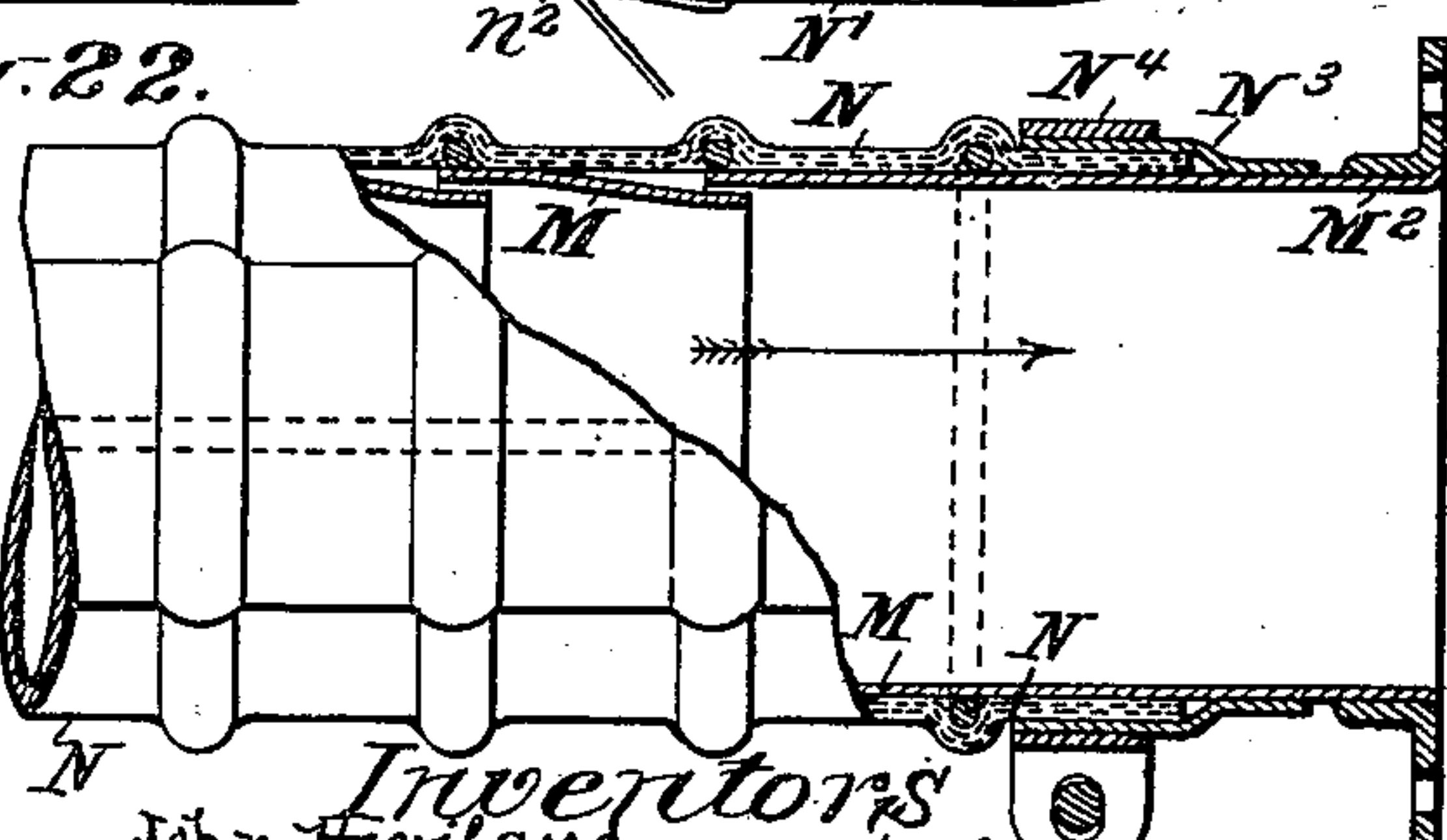
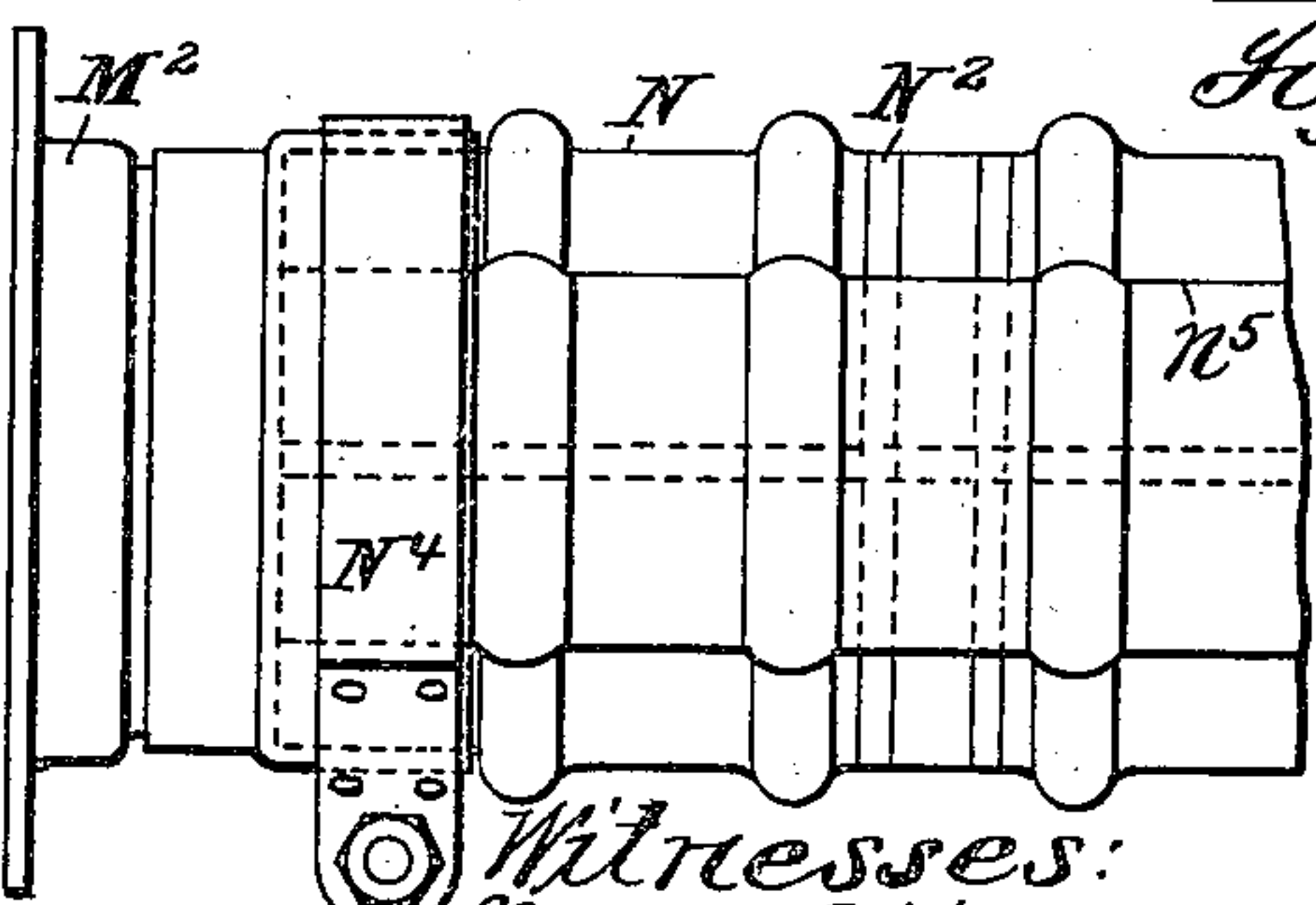


Fig. 22.



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No. 663,570.

Patented Dec. 11, 1900.

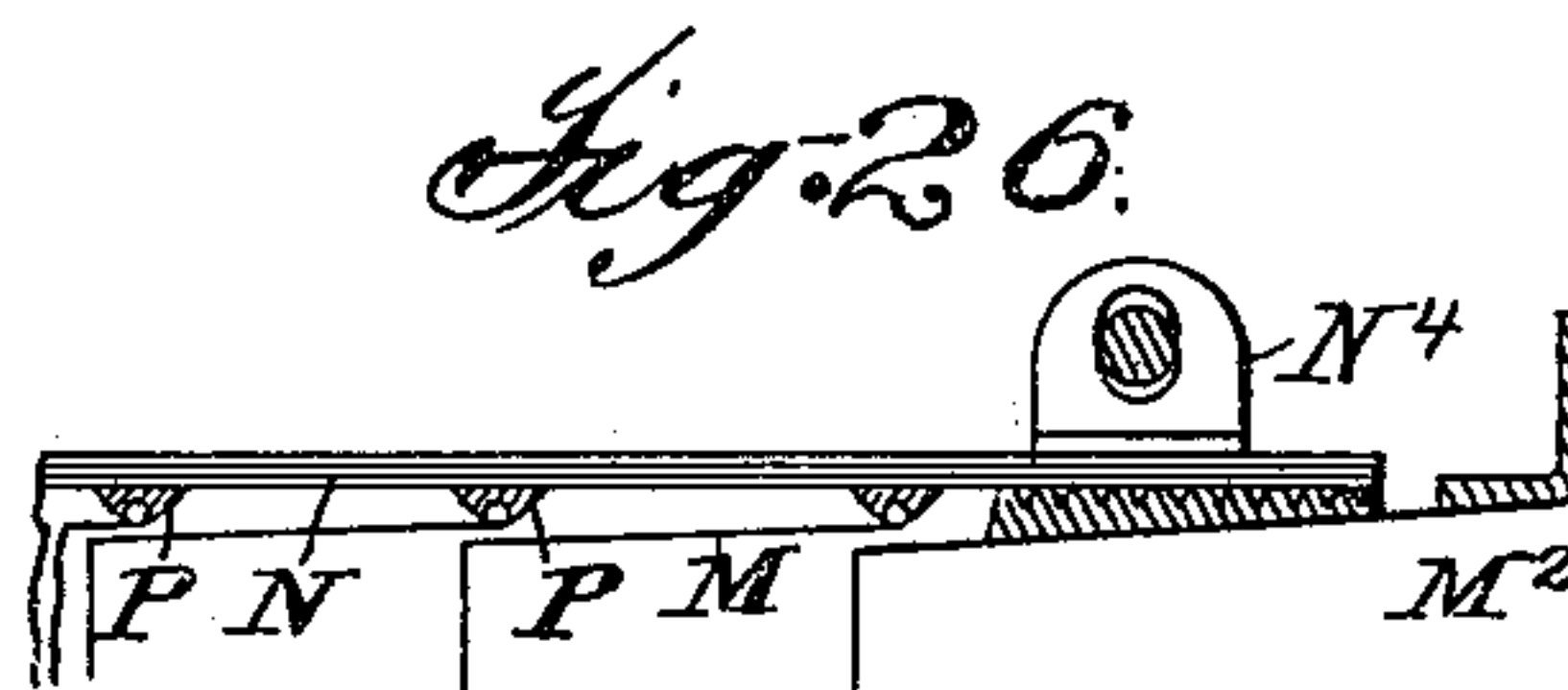
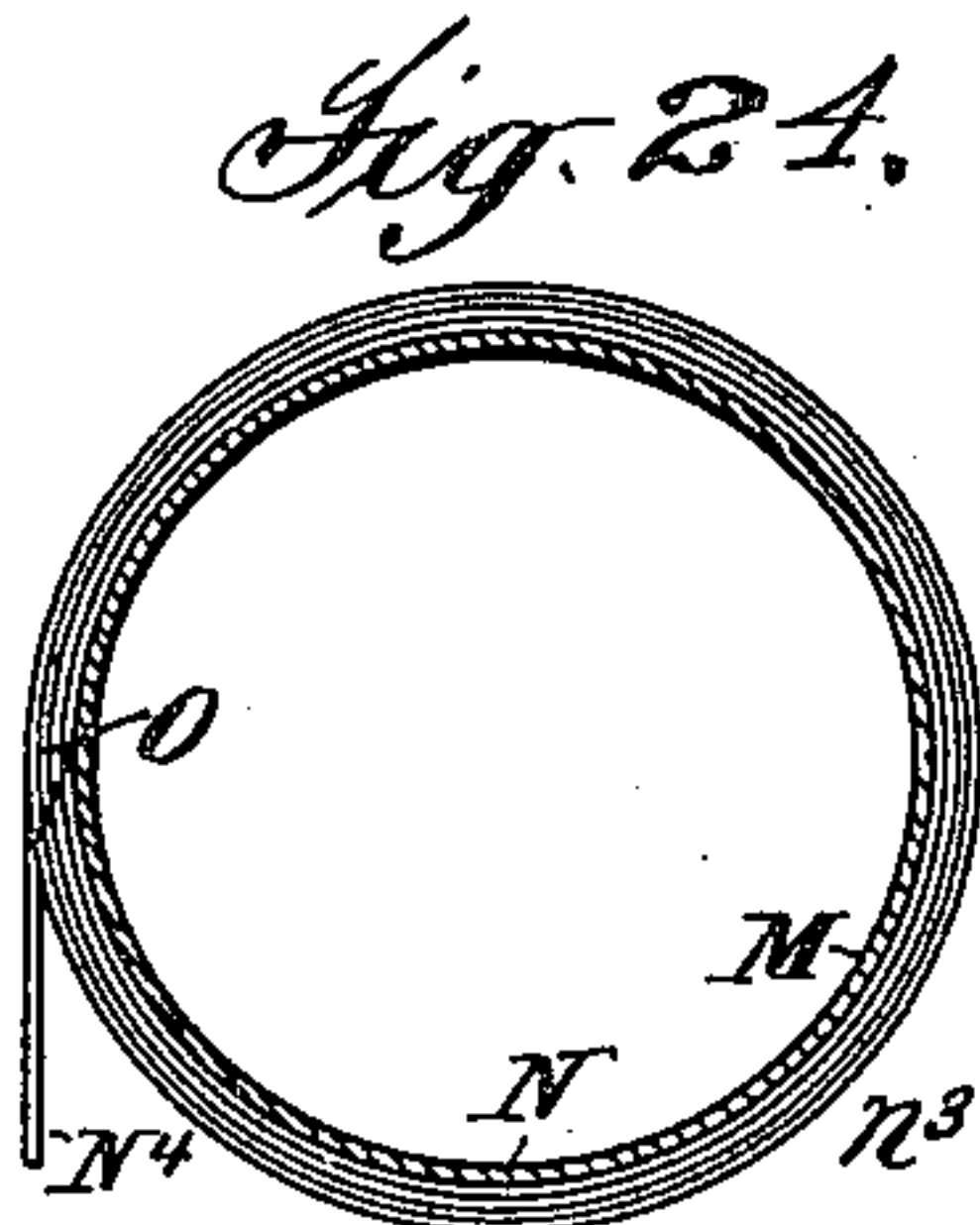
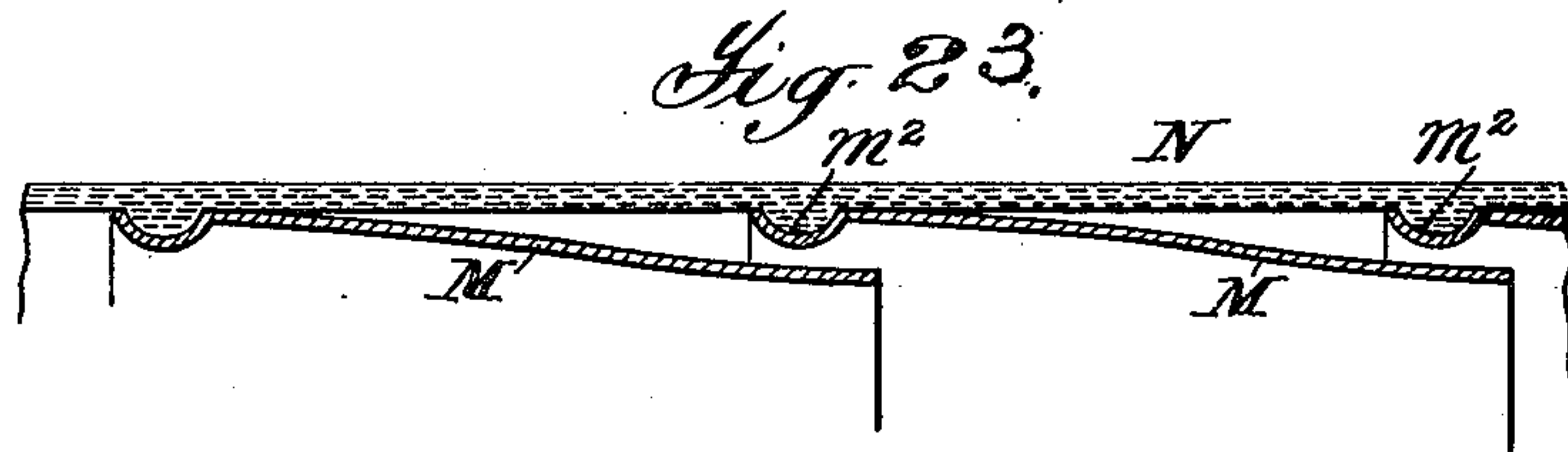
J. & F. H. HAVILAND & J. FARMER.

FLEXIBLE PIPING.

(Application filed Nov. 20, 1899.)

(No Model.)

4 Sheets—Sheet 4.



Witnesses
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UNITED STATES PATENT OFFICE.

JOHN HAVILAND, OF NORTHAMPTON, AND FREDERICK HENRY HAVILAND,
OF BOURNEMOUTH, ENGLAND, AND JOHN FARMER, OF GLASGOW, SCOT-
LAND.

FLEXIBLE PIPING.

SPECIFICATION forming part of Letters Patent No. 663,570, dated December 11, 1900.

Original application filed April 25, 1899, Serial No. 714,412. Divided and this application filed November 20, 1899. Serial No. 737,642. (No model.)

To all whom it may concern:

Be it known that we, JOHN HAVILAND, solicitor, of Northampton, and FREDERICK HENRY HAVILAND, solicitor, of Bournemouth, Eng-
land, and JOHN FARMER, engineer, of Glasgow, Scotland, all subjects of the Queen of Great Britain and Ireland, have invented certain new and useful Improvements in and Relat-
ing to Flexible Piping for Conveying Granu-
lar, Liquid, and other Material, of which the
following is a specification.

According to our invention we make an im-
proved india-rubber and canvas combined
metal-lined flexible pipe for use in elevators
and the like, suitable for grain-suction pipes,
to be placed between the barges or lighters,
or other suitable places where a vacuum or
pressure has to be maintained, and is specially
applicable for granular material passing
through.

We will describe our invention as applied
to grain-elevators, though applicable to other
purposes.

In order that others skilled in the art to
which our invention relates may understand
how same may be carried into practice, we
have hereunto appended explanatory draw-
ings.

Figures 1 to 26 are sectional views showing
the different arrangements of pipes and their
fittings as used under our invention.

When bends are formed on these pipes suit-
able to the varying positions and conditions
necessary in grain-discharging, the internal
liners at the bent parts rapidly wear out; and
our objects are, as well as making a flexible
pipe, to make one so that ready access can be
had to it internally for the purpose of repair of
the metallic lining and also to fix the liners in
the pipe in such a manner that there shall be
no obstruction of the bolt or rivet heads in-
side to cause damage to the grain on its pas-
sage through; to maintain the relative posi-
tions of the liners to each other, so that upon
the pipe being bent an overlap between the
liners will always be maintained, and thus
prevent an opening where the grain could
rush through and injure the pipe outside, and,
further, to fix the liners in such a manner that
each will be allowed to be turned on its own

axis independent of its neighbor for the pur-
pose when they get worn of exposing new sur-
faces to the scouring action of the grain at the
greatest circle of the bend. These metallic
ferrule liners M would be formed of cylindrical
shape with tapered ends M' to be embraced by
the ends adjacent to them, as shown in Figs.
1 and 2, and be fitted with wire rings m, brazed
or soldered or formed onto the same and gal-
vanized, if desired. The ferrules M would
be kept in connected position by their pro-
jections fitting into corresponding indenta-
tions in the rubberized canvas cover or pipe
N, which would be divided or split up longi-
tudinally to allow of the liners M being in-
serted or withdrawn. These liners M may
be formed of a straight shape and the ends
expanded out to a curved or bell-mouth shape
at m', which would abut against the canvas
covering and perform the function of the wire
m, as shown in Figs. 3, 7, and 8, or the liners
M may have parallel ends, the smaller diam-
eter run into the larger by a curve or straight,
as shown by Figs. 5 and 17, or they may be
in the form of cones, as Fig. 6, or of conoidal
shape, as shown by Fig. 4. As shown par-
ticularly in Figs. 10 to 16, these liners M
would be secured together by an outer cover
of rubberized canvas N, divided longitudi-
nally and having flaps N' formed with the
cover or laid over it for the purpose of lacing
the pipe N tightly around the liners by cords
n' passing through eyelet-holes n, and a
tongue-piece or strip or strips of rubberized
canvas n² (shown loose in Figs. 9 and 12)
would be folded together over the joint, as
shown in Figs. 10 to 13, to insure an efficient
joint, or, if desired, the strips would be ce-
mented or otherwise secured together, as well
as folded. A tongue-piece or strip of rubber-
ized canvas n³ may have its end n⁴ cemented
over the laced joint of cover, as shown in
Fig. 17, or the cover N may be surrounded
by a strip n³, having its tongue end n⁴ ce-
mented over the joint, as shown in Figs. 18
and 19, or alternatively flaps N' may form
part of the strip n³ and one of these flaps be
cemented over the joint and then laced to
the other flap fixed onto strip, as shown in
Fig. 20.

In order to make the longitudinal joint of cover N perfectly air-tight at ends should the laces n^2 not draw the cover close, as shown at X, Figs. 17 to 20, the strip n^3 is carried beyond the end of cover N and cemented from end to end and fitted tightly over a band N^3 , preferably of india-rubber, encircling the end socket connection M^2 , Fig. 17. The strip n^3 is tied tightly over the band N^3 with cord or wire N^5 or a light gland may be used.

Fig. 22 shows a method of making the ends of cover N air-tight by means of an overlapping india-rubber ring N^3 , fitting tightly over the end socket connections M^2 and drawn over the outer end of the cover N. Usual fixing-glands N^4 for holding the pipe N to the end socket connections are fitted preferably over the rings N^3 . The longitudinal joint is shown closed by a strip n^5 , cemented the length of the pipe N. The cover N may be drawn up tight over the liners M by means of tapes or bands N^2 .

Instead of wires m' ridges or projecting surfaces m^2 may be formed on the liners M to fit into corresponding recesses in the outer cover N, as shown in Figs. 17 and 18, or convexities m^2 may be made in the pipe-cover and corresponding concavities in the liners for holding them in place, as shown by Fig. 23.

To prevent the open joint of cover N, as at X, Fig. 19, we by another modification scarf the joint, as shown at O, Fig. 24, allowing a tongue-piece n^4 the length of the cover or pipe N to overlap, which we cement to it from end to end or we cement the joint O, as shown by Fig. 25, without tongue-piece.

In Fig. 26 separate rings of india-rubber, steel, or other material P are formed to encircle the beads m or other projections or concavities of the liners M, cut across and cemented, riveted, or fixed at their proper distances apart in any convenient manner to a strip of rubberized cloth N the length of the pipe, but of breadth sufficient to be wound around the diameter of the liners M, inserted within as many times as required to give sufficient strength. The end of the cloth is then cemented or otherwise fastened to the body from end to end and the whole fixed by usual glands N^4 to end coupling connections M^2 .

These improvements, it will be seen, are

equally applicable to blast as well as suction elevators.

We claim as our invention—

1. A flexible piping having cylindrical liners, the liners and piping having cooperating recesses and projections by which the piping holds each liner in position, independent of any other liner.

2. A flexible piping having liners, said piping being divided or slit longitudinally throughout its length thereby permitting the adjustment, removal or replacing of the liners, with means for securing the edges of the slit piping.

3. A flexible piping having liners, said piping being slit longitudinally, means for securing the edges of the slit piping, and cooperating projections and recesses on the interior of the piping and exterior of the liners, whereby the latter are independently removable and adjustable rotarily, as and for the purpose set forth.

4. Flexible piping for conveying granular, liquid and other material, comprising short metallic ferrules or liners with an outside covering of rubberized canvas, the latter and the liners having cooperating projections and recesses, by which the liners are held in position independently of each other, one end of each liner entering the next, but free from contact therewith, as and for the purpose set forth.

5. Flexible piping for elevating and discharging grain and the like, and consisting of laced rubberized canvas cover and joint-protecting flaps in combination with liners, substantially as set forth.

6. A flexible piping having internal liners and a flexible cover, open longitudinally, having scarfed edges at said longitudinal opening and means for securing the edges together.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JOHN HAVILAND.

FREDERICK HENRY HAVILAND.

JOHN FARMER.

Witnesses:

WM. MCKENZIE,

WM. RUTHERFORD.