

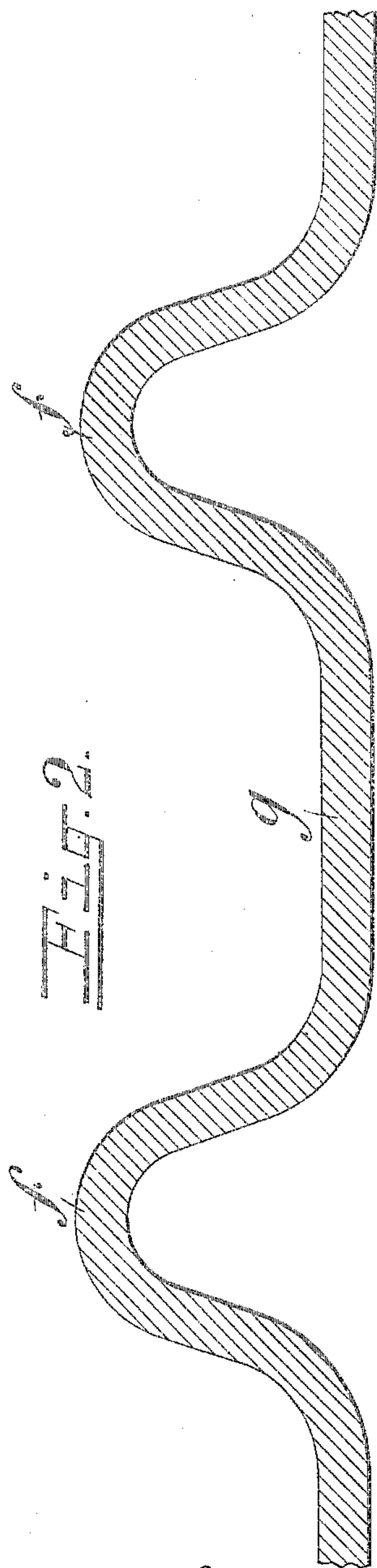
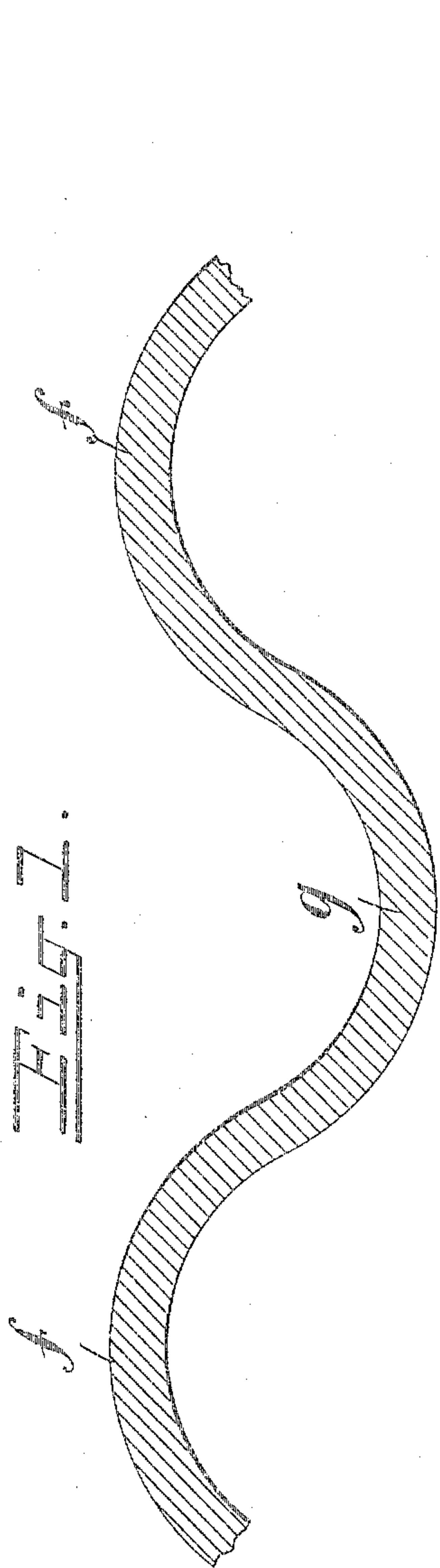
No. 794,088.

PATENTED JULY 4, 1905.

E. GEARING & W. RAINFORTH.
APPARATUS FOR TRANSVERSELY CORRUGATING TUBES.

APPLICATION FILED AUG. 18, 1903.

4 SHEETS—SHEET 1.



Witnesses
E. R. Beck
W. H. Reid.

Inventors
Earnest Gearing and
William Rainforth
by A. J. Patterson.
Atty.

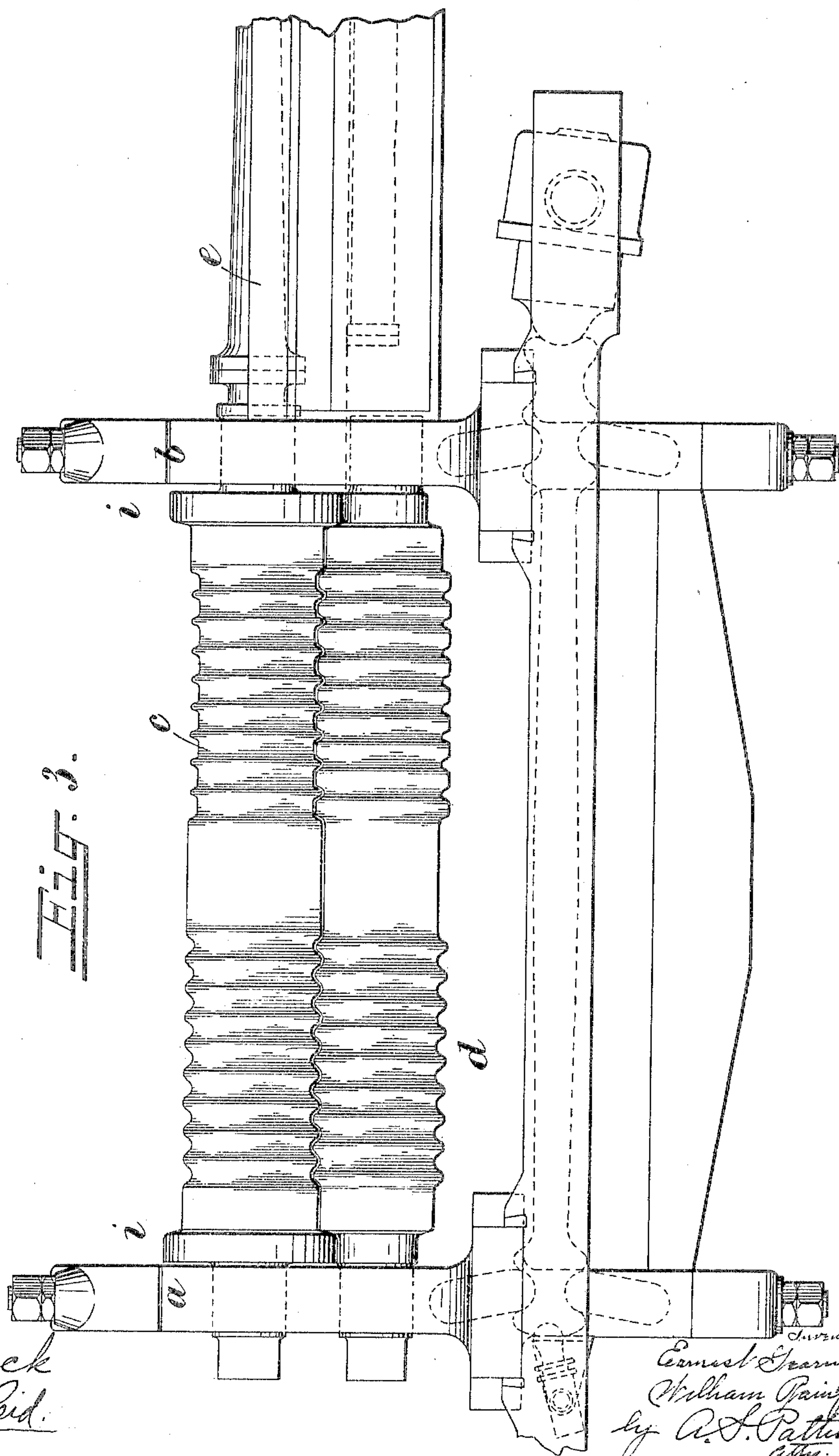
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Witnesses
E. R. Peck
W. H. Reid.

Ernest Gearing & Wm Rainforth
by A. S. Patterson
attys.

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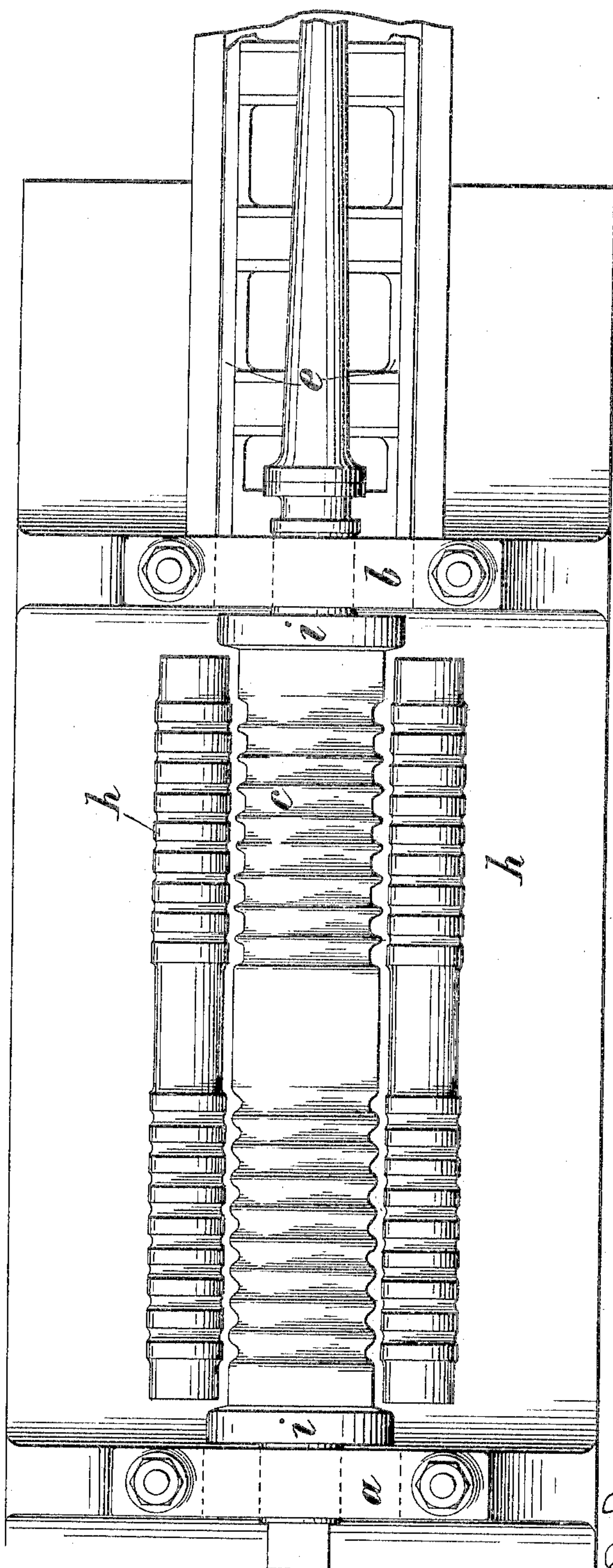
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Fig. 4.



Witness
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W. H. Reid.

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Fig. 5.

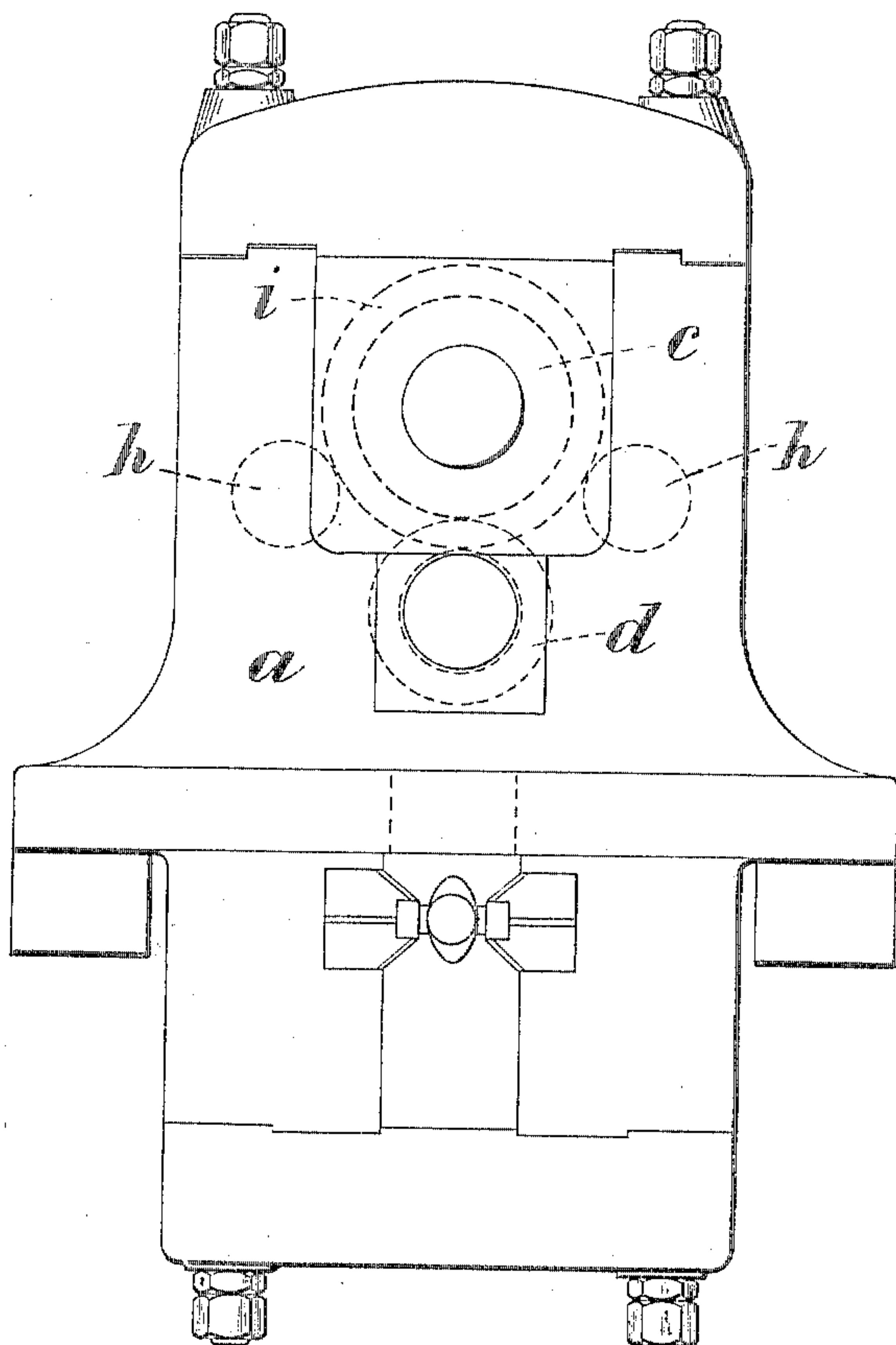


Fig. 7.

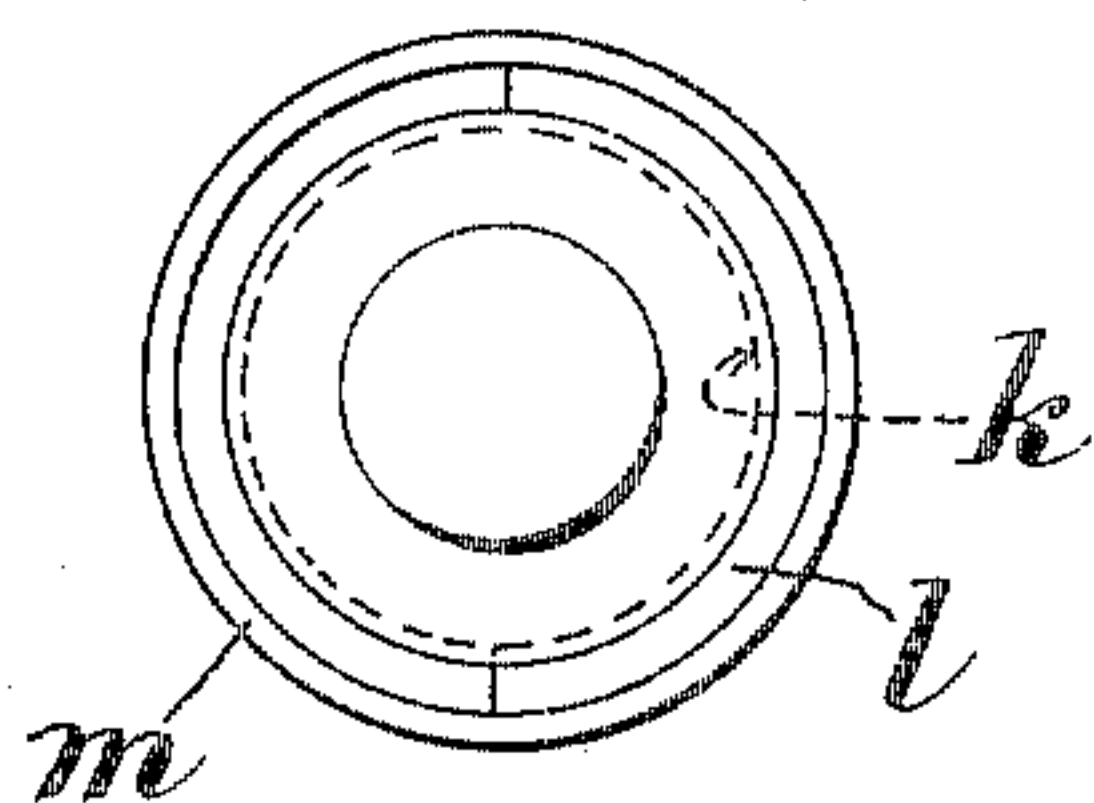
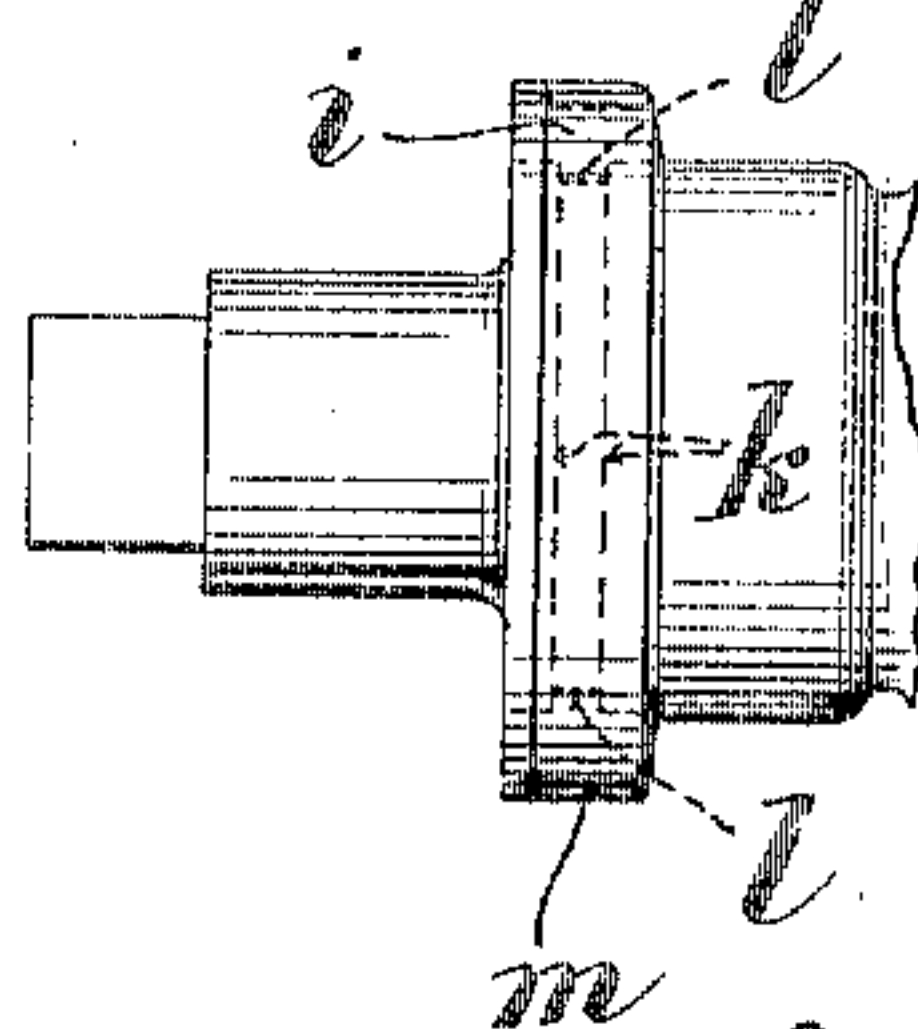


Fig. 6.



Witnesses
E. R. Peck
W. H. Reid.

Inventors
Earnest Gearing
and
William Rainforth
by A. J. Patterson
Atty

UNITED STATES PATENT OFFICE.

ERNEST GEARING, OF HARROGATE, AND WILLIAM RAINFORTH, OF
LEEDS, ENGLAND.

APPARATUS FOR TRANSVERSELY CORRUGATING TUBES.

SPECIFICATION forming part of Letters Patent No. 794,088, dated July 4, 1905.

Application filed August 18, 1903. Serial No. 169,890.

To all whom it may concern:

Be it known that we, ERNEST GEARING, residing at Harrogate, and WILLIAM RAINFORTH, residing at Upper Armley, Leeds, in the county of York, England, subjects of the King of Great Britain and Ireland, have invented Improvements in Apparatus for Transversely Corrugating Tubes, of which the following is a specification.

10 This invention has reference to improvements in machinery or apparatus for use in the manufacture of steam-boiler furnaces or flues of the kinds that have corrugations or hollow strengthening ribs or ridges formed in their walls, more especially those having deep steep-sided ribs or ridges, our improvements being hereinafter described and illustrated in the accompanying drawings and claimed in the claiming clauses hereof.

20 Our machinery or apparatus is adapted to produce such steep corrugations, ribs, or ridges (hereinafter referred to as "ridges") in a plate or tube by two or more corrugating operations, the effect of each successive operation being to maintain the pitch of the ridges and to cause the plate or the wall of the tube to assume a form, as seen in longitudinal section, more nearly approaching the intended final form, the pressure being so applied in successive operations as to gradually change the sectional form of the plate or tube without unduly distressing or thinning the metal. The corrugating machinery or apparatus may be provided with rotating or non-rotating cor-
35 rugating means.

Referring to the accompanying drawings, Figures 1 and 2 illustrate sections through a plate or tube wall after the preliminary and final corrugating operations, respectively. Figs. 3, 4, and 5 illustrate in side elevation, plan, and end elevation a mill constructed according to this invention and adapted to manufacture steam-boiler flues from tubes. The roll-driving arrangement and other parts are well understood, being similar to those of an ordinary corrugating-mill, and are omitted. Figs. 6 and 7 illustrate in side and end view one end of a roll having a collar detachably secured thereto.

a b are the mill-housings in which corrugating-rolls *c* and *d* are mounted. The top roll *c* is coupled to the carriage *e* and is capable of being withdrawn therewith to permit of the tube being introduced and removed from the mill, and the lower roll *d* is carried in vertically-movable bearings hydraulically actuated through toggles, as well understood. The rolls *c* and *d* are extra long and are formed with two sets of corrugations or ribs. The corrugations or ribs at the left-hand end of the rolls are of such contours as will stretch the metal of the plate or tube wall more or less equally throughout and form deep and wide but not steep-sided ridges *f*, Fig. 1, of a given pitch, the intermediate valleys *g* being of about the same curvature. The corrugations or ribs at the right-hand end of the rolls are so formed as, during the rolling of the tube at this part of the rolls, to apply pressure chiefly to the sides of the ridges *f*, Fig. 1, so as to steepen their sides without altering their pitch practically by altering the position of the material without further stretching it, and so as to cause the ridges and the intermediate valleys to assume the forms shown at *f* and *g*, Fig. 2.

h h are the guide-rolls, which are also extra long and formed with two sets of grooves to receive the ridges *f*, Figs. 1 and 2.

The roll *c* is formed at each end with an integral collar *i* and the ends of the roll *d* are reduced in diameter to permit of the collars *i* overlapping the tube and so preventing it moving endwise into contact with the end bearings. Instead of integral collars renewable collars may be secured to the roll ends, as illustrated in Figs. 6 and 7, where the roll ends are formed with annular grooves *k*, and each collar *i* is in two semi-annular portions formed with internal ribs *l*, that fit the groove, a ring *m* being passed over a reduced portion of the divided collar to secure it in place. The inner opposite edges of the collars are rounded and their faces somewhat beveled, as shown. A tube may be formed with deep steep-sided ridges and valleys of the required contour with a mill such as illustrated at one heat by first rolling between the left-hand end por-

tions of the rolls *c* and *d* and then between the right-hand end portions thereof, the shifting from one end to the other being effected when the rolls are separated by the lowering
5 of the roll *d*. A flat or curved plate may be rolled in a similar manner in a mill such as has been described for rolling a plate in the form of a tube.

Instead of the apparatus being in the form
10 of a rolling-mill it may be in the form of a press, the dies or the like being made with similar sets of corrugations or ribs.

What we claim is—

1. Corrugating apparatus comprising de-
15 vices for applying pressure to a plate between them, a plurality of sets of corrugations of different contours but equal pitch on the active faces of said devices and means for forcing the one device toward the other, as set
20 forth.

2. Corrugating apparatus comprising a pair of corrugating-rolls formed with a plurality of sets of corrugations, the pitch of all the corrugations being equal but the contour of each
25 set being different, as set forth.

3. Corrugating apparatus comprising a pair of corrugating-rolls formed with a plurality of sets of corrugations of equal pitch, one set of corrugations being adapted to form deep
30 and wide but not steep-sided hollow ridges and intermediate valleys, and successive sets being of different contours and adapted to cause a plate to assume a form more nearly approaching the intended final form, as set
35 forth.

4. Corrugating apparatus comprising a pair of corrugating-rolls formed with a plurality of sets of corrugations of equal pitch, one set of corrugations being adapted to form deep
40 and wide but not steep-sided hollow ridges and intermediate valleys, and successive sets being of different contours, adapted to apply externally pressure to the sides of the ridges chiefly, steepening them and widening the in-
45 termediate valleys, as set forth.

5. In a tube-corrugating mill, a pair of rolls of extra length and formed at different portions with sets of corrugations or ribs of different contours, but of equal pitch, one of

said rolls being adapted to act upon the in- 50
terior wall of a tube and the other on the exterior thereof, and each set of corrugations being adapted to corrugate practically the whole length of the tube, and means adapted to admit of the insertion and withdrawal of a 55
tube, as set forth.

6. In a corrugating-mill, a pair of rolls of extra length and formed at different portions with sets of corrugations or ribs of different contours but of equal pitch, one of said rolls 60
being adapted to act upon the interior of the wall of a tube and the other on the exterior thereof, as set forth.

7. In a corrugating-mill, a corrugating-roll having at each end an annular groove, a col- 65
lar formed in parts each having an internal rib adapted to fit said groove, and a ring adapted to fit over the parts and secure the collar on the roll, as set forth.

8. In a corrugating-mill, a pair of rolls of 70
extra length and formed at different portions with sets of corrugations or ribs of different contours, but of equal pitch, one of said rolls having a collar adapted to overlap the plate being rolled, as set forth. 75

9. In a corrugating-mill, a pair of rolls of extra length and formed at different portions with sets of corrugations or ribs of different contours, but of equal pitch, one of said rolls having a renewable collar adapted to overlap 80
the plate being rolled, as set forth.

10. In a corrugating-mill, a pair of rolls of extra length and formed at different portions with sets of corrugations or ribs of different contours, one of said rolls having at each end 85
an annular groove, a collar formed in parts each having an internal rib adapted to fit said groove, and a ring adapted to fit over the parts and secure the collar on the roll, as set forth. 90

Signed at Leeds, in the county of York, England, this 31st day of July, 1903.

ERNEST GEARING.
WILLIAM RAINFORTH.

Witnesses:

WM. JOHNSTON,
GEO. ARMITAGE.