

F. L. O. WADSWORTH.
METHOD OF TREATING METAL.
APPLICATION FILED AUG. 20, 1908.

936,389.

Patented Oct. 12, 1909.

2 SHEETS—SHEET 1.

FIG. 1.

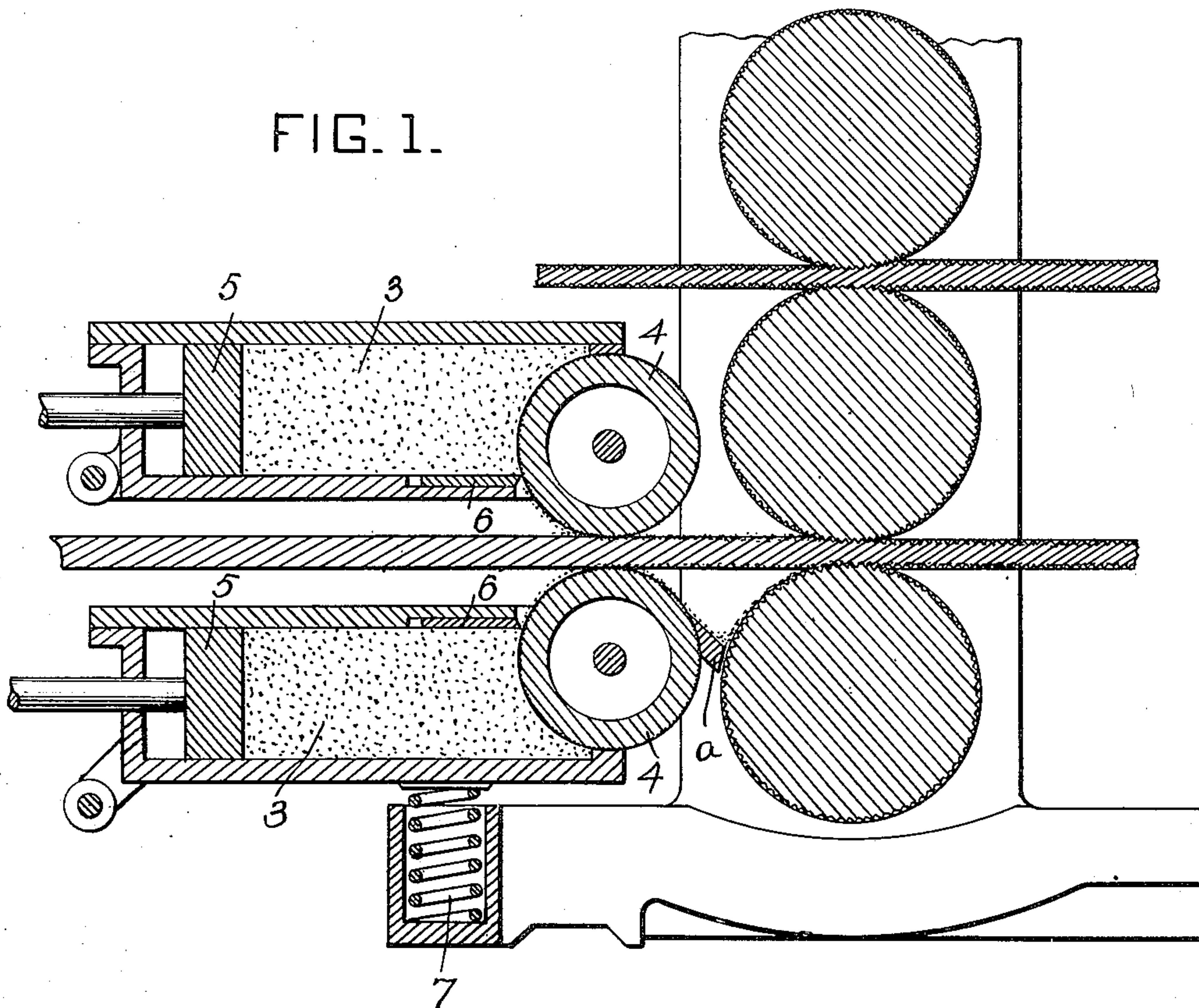
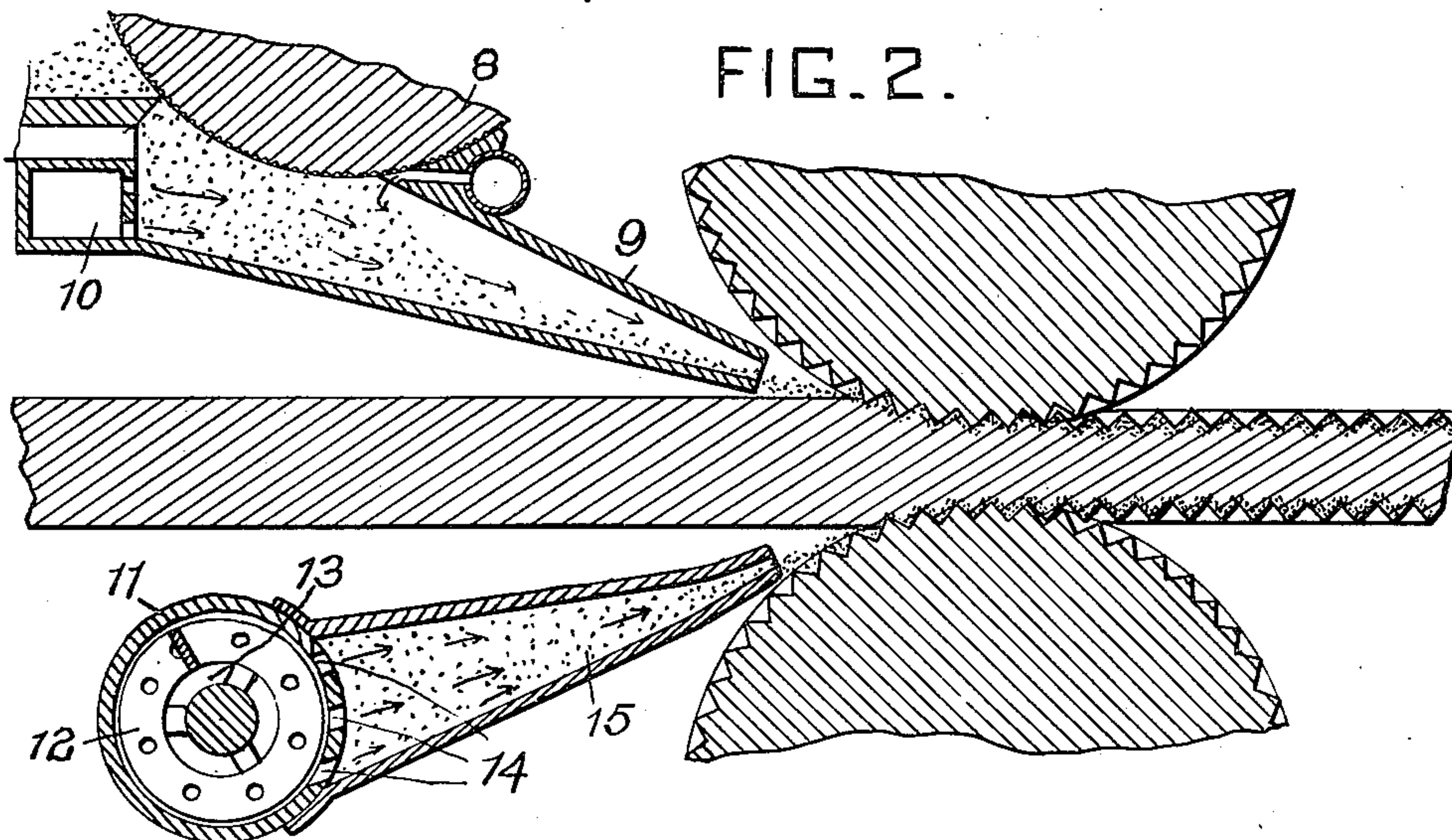


FIG. 2.



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2 SHEETS—SHEET 2.

FIG. 3.

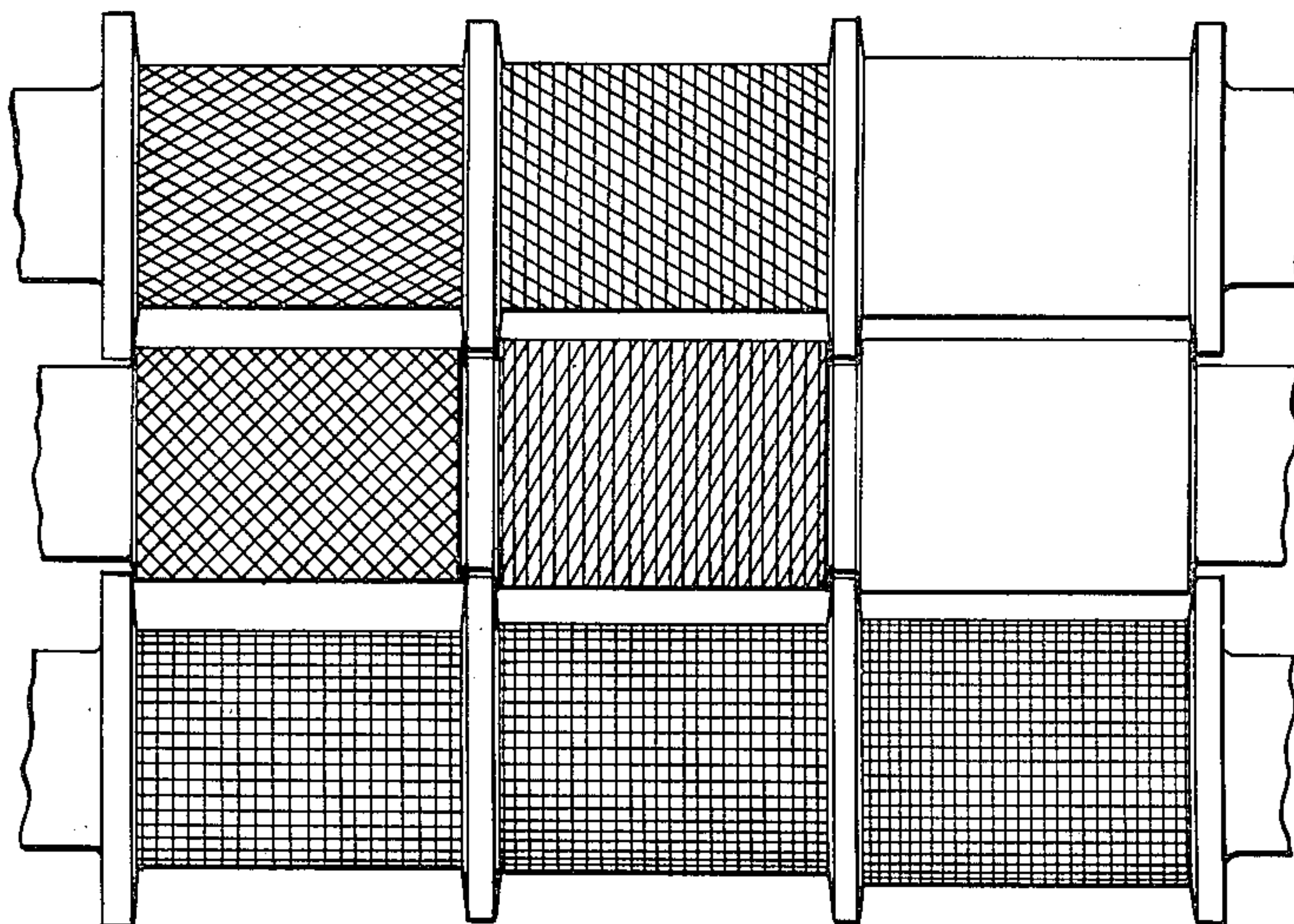


FIG. 5.

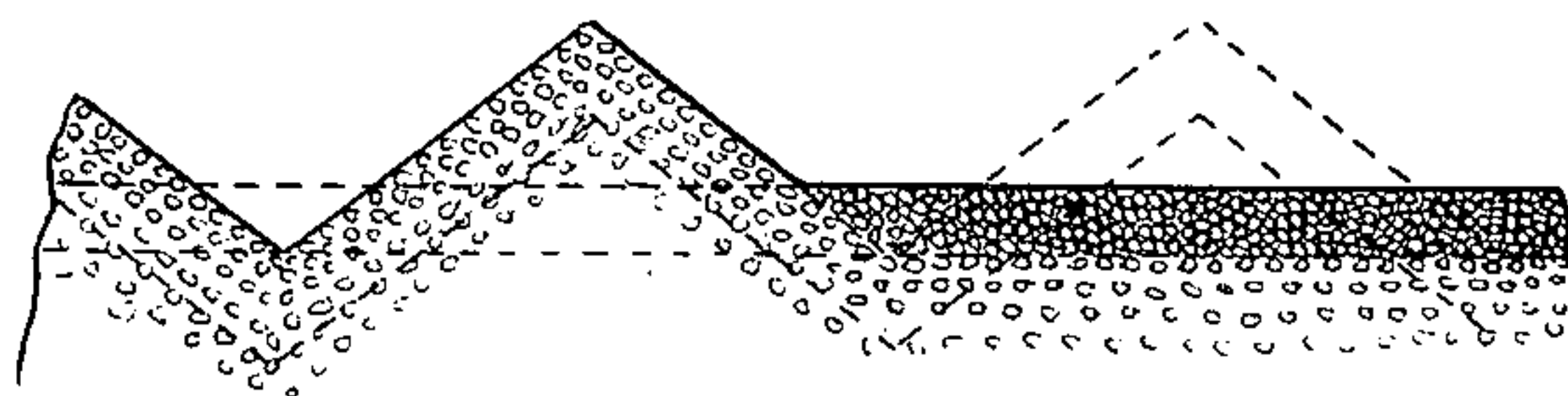
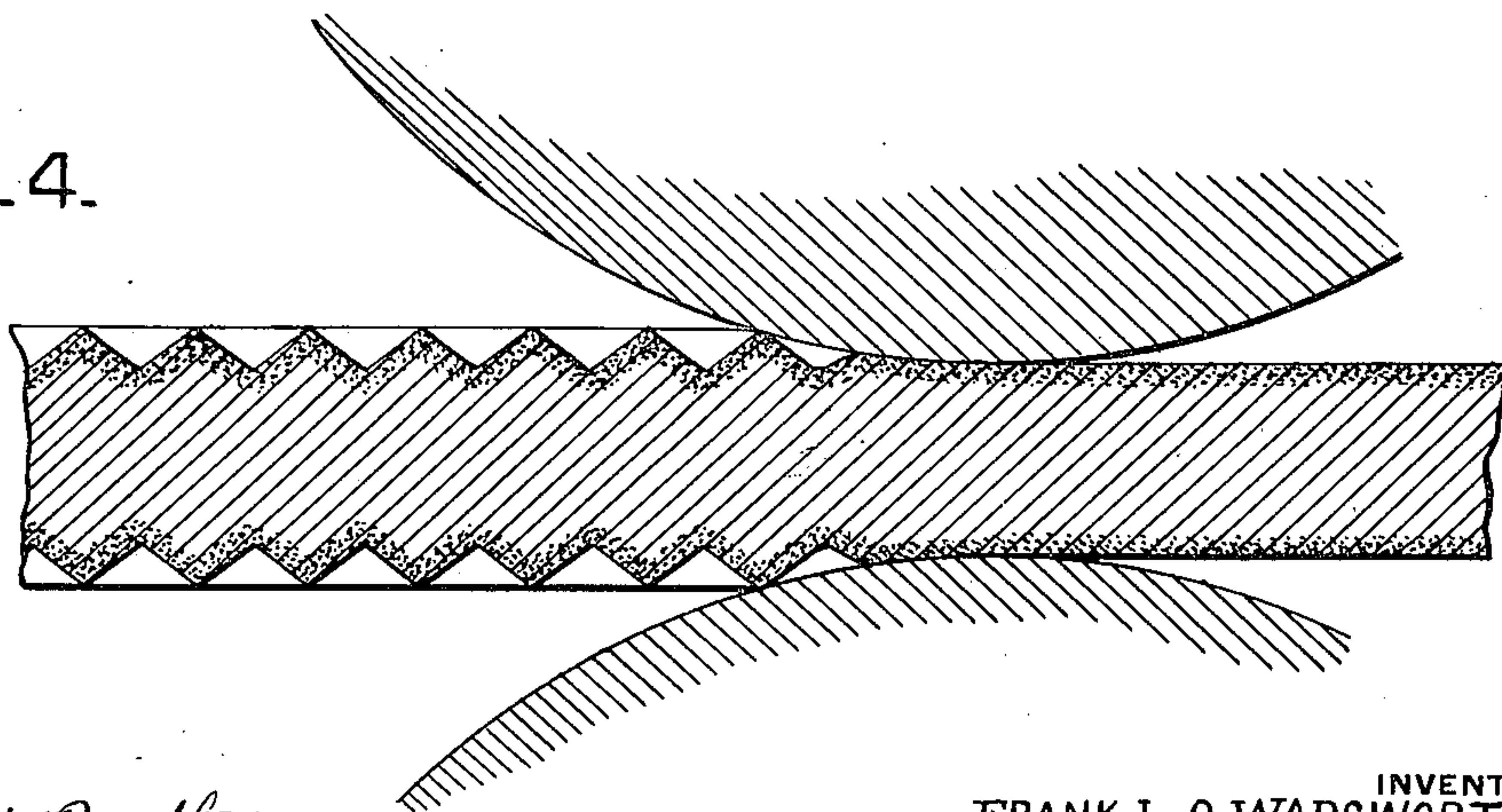


FIG. 4.



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METHOD OF TREATING METAL.

936,389.

Specification of Letters Patent.

Patented Oct. 12, 1909.

Application filed August 20, 1908. Serial No. 449,531.

To all whom it may concern:

Be it known that I, FRANK L. O. WADSWORTH, residing at Sewickley, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in Methods of Treating Metal, of which improvement the following is a specification.

10 The invention described herein relates to certain improvements in the art of forming a dense protective coating or skin of substantial thickness on the surface of metal articles. This skin or coating is produced by increasing the superficial area of the metal by forming projections on or depressions in the surfaces of the metal preferably during the shaping of the metal, chilling the surfaces of the projections or depressions and finally forcing the chilled walls of the projections or depressions into a common plane, or in other words decreasing the superficial area of the article. The skin thus produced is due, it is thought to a structural or physical change in the molecules and not in any material degree to any chemical change.

15 This invention has for its object the production of both a physical and a chemical change in the character of the metal forming the skin, by combining or alloying with such metal, a material or materials, which will so change or modify the metal composing the skin as to impart improved resistant qualities to the surface without detrimentally affecting the physical change produced by the mechanical treatment of the metal.

20 The invention is hereinafter more fully described and claimed.

25 In the accompanying drawings forming a part of this specification Figure 1 is a sectional elevation of a form of apparatus adapted to the practice of my invention; Fig. 2 is a similar view illustrating a modification of the apparatus; Fig. 3 is an elevation of the rolls shown in Fig. 1, and illustrating a construction of the roll-surfaces for the mechanical treatment of the metal; Fig. 4 is a diagrammatic view illustrating a step in my improved method, and Fig. 5 is a similar view illustrating the rolling down of the kneaded projecting portions of the metal

to a uniform plane, and the action resulting therefrom.

30 In the practice of my invention the surfaces of the article to be treated are subjected, preferably during the reduction of the metal to the desired shape, to the action of projection or depression forming surfaces, and during such operation, the material such as carbon, vanadium, nickel, zinc, etc., which is to be incorporated or alloyed with the surface metal, is applied to the surface or surfaces of the article in a finely divided or pulverulent condition. As the metal is quite soft and plastic at this time the finely divided material will be forced into and thoroughly mixed with the metal and being in a finely divided condition will quickly and readily combine or alloy therewith.

35 The invention described herein can be conveniently carried out, while reducing the metal by rolling between rolls having passes shaped to produce the article desired. It will be understood that although the invention is shown and described as carried out in a three high mill having the passes shaped to form sheet bars or skelps that other forms or construction of mills may be employed and the passes shaped to produce the article desired. As shown the reducing surfaces which when in contact with the metal move in the same direction as the metal, are constructed to form projections on or depressions in the surface of the metal. It is preferred that the metal should be subjected to the projection or depression forming surfaces in a plurality of passes, both for the reason that sufficient chilling of the surfaces of the projections and depressions can be effected by the roll-surfaces and for the reason that a more effectual and thorough incorporation of the combining or alloying material can be effected, when a plurality of the passes having marked or patterned surfaces are employed, it is preferred that the marks or patterns on successively operating roll surfaces should be varied so that the material to be combined or alloyed can be more thoroughly kneaded into the metal.

40 The material to be combined or alloyed with the metal may be applied to the sur-

faces in any suitable manner. As for example the finely divided material may be placed in a box 3, suitably supported above or both above and below the position of the article when moving into a pass in the rolls. The forward ends of the box is closed by a roller 4 suitably mounted so as to be rotated in any manner as by contact with the article being rolled. The surface of the roller is slightly roughened so as to carry the material from the box onto the article. The material is pushed forward into contact with the roller by a piston 5 or any other suitable means and the amount of material carried out by the rollers is regulated by gates 6. When applying the material to the under surfaces of an article the roller should press with some considerable force against the article so as to embed the material in the surface of the article or cause it to adhere thereto until worked in by the rolls. This requisite pressure can be obtained by a spring 7 or other suitable means. In this case it is also desirable to provide a bridge or feed block *a* interposed between the feed roll and the lower roll which serves to catch any material not adhering to the under surface and return it to said under surface through the action of the corrugated or marked face of the lower roll.

In Fig. 2 the pulverulent material is carried by a roller 8 into a nozzle 9 where it is caught by a stream of fluid flowing from the pipe 10 (which is connected to a suitable source of fluid under pressure,) and forced through the end of the nozzle and between the roll and the article. Another form of apparatus consists of a drum 11 into which the material is forced from one end by a screw 12 on the shaft 13. As the screw shaft is rotated the material is drawn in and distributed along the drum in front of openings 14 connecting with the nozzle 15. As the material reaches these openings, it is forced through into the nozzle by fluid introduced under pressure into the drum through the hollow shaft 13. In this form of application is secured not only a uniform feed of the material to the initial surfaces simultaneously with the entrance of the same into the roll pass but there is also secured a cooling action of the surfaces by the action of the fluid. If sufficient material to produce the desired effect can not be applied in the first marking or patterning pass, successive applications of the same or of different materials can be applied in any or all of the passes as desired. As will be readily understood the kneading of the metal due to the successive actions of the marking or patterning surfaces, especially if the marks or patterns on such successive surfaces are varied, will effectually work the

material into the metal. After such working or kneading a thorough incorporation of the material with the metal, the plate bar or other shape is sent through one or more smoothing passes, and in these passes the projections or depressions formed by the marked or patterned rolls are compressed to a smooth surface. In these final passes the area of the patterned or marked surface is reduced as shown in Figs. 4 and 5, and by reason of this reduction the composite material of the surface skin is subjected to compression, resulting in a very substantial densification of the particles of this skin, with a consequent increase in its resistance to corrosion and abrasion. By reason of the described treatment, a very complete and effective amalgamation or alloying of the original surface metal and of the powdered or finely divided material applied thereto is obtained, and an article is produced having an exterior surface possessing new and valuable characteristics, due in part to the nature of the new combination of materials, and in part to the mechanical treatment to which said surface has been subjected during such combination.

I claim herein as my invention:

1. The method of treating metal, which consists in applying a combining or alloying material in a finely divided condition to the surface of highly heated metal, and incorporating such material with the metal by forming projections on or depressions in the metal after the application of the metal and eliminating the projections or depressions so formed by pressure applied in a direction substantially normal to such surface.

2. The method of treating metal, which consists in applying a combining or alloying material in a finely divided condition to the surface of highly heated metal, and incorporating such material with the metal by forming projections on or depressions in the metal after the application of the metal, chilling the surfaces of the projections or depressions and restoring the surface of the metal to a uniform plane by pressure applied in a direction substantially normal to such surface.

3. The method herein described which consists in applying a combining or alloying material in a finely divided state to the surface of highly heated metal and then incorporating such material with the metal by the successive formation of differently shaped projections or depressions whereby the material and the surface metal are kneaded together and restoring the surface of the metal to a uniform plane by pressure applied in a direction substantially normal to such surface.

4. The method herein described which

consists in applying a combining or alloy-
ing material in a finely divided state to the
surface of highly heated metal and then in-
corporating such material with the metal by
5 the successive formation of differently
shaped projections or depressions whereby
the material and the surface metal are
kneaded together and rolling down said de-
pressions and projections to form a surface

of less area, thereby subjecting the material 10
on the surface to compression in a direction
substantially parallel with said surface.

In testimony whereof, I have hereunto
set my hand.

FRANK L. O. WADSWORTH.

Witnesses:

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