May 27, 1941. C. F. RAMSEYER 2,243,122

MEANS FOR SPINNING MINERAL WOOL

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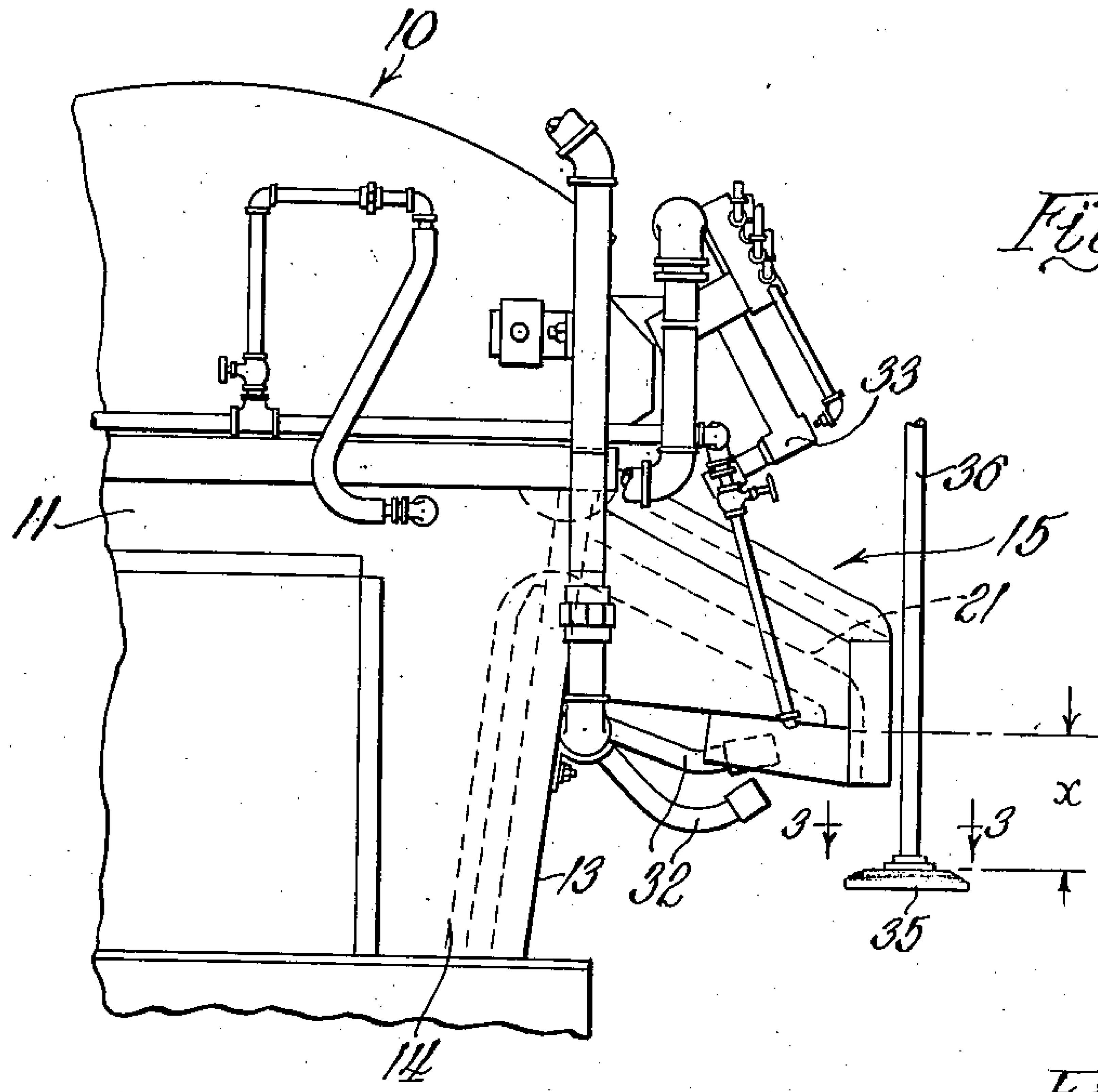

Fig. 1.

Fig. 2.

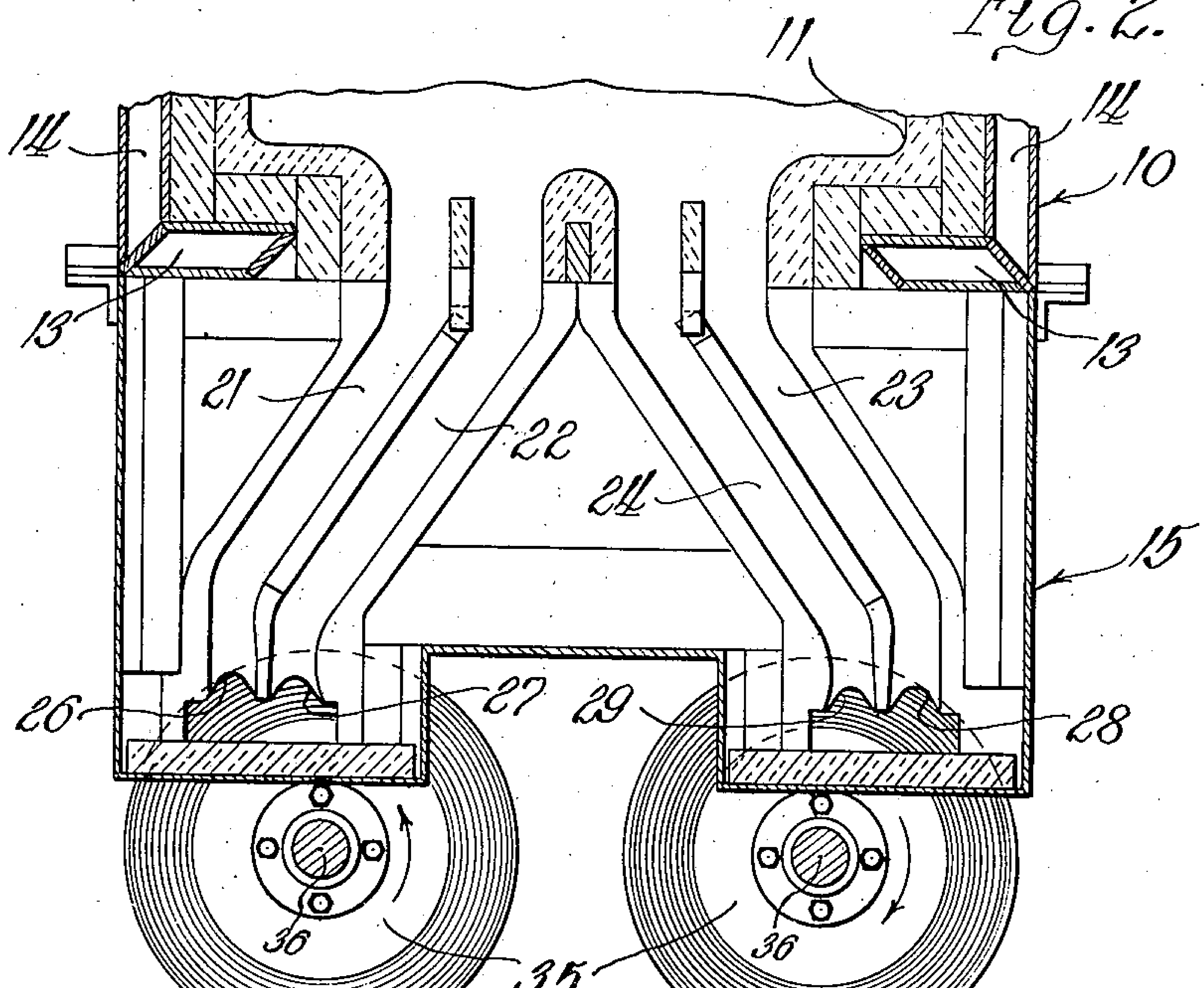

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Fig. 3.

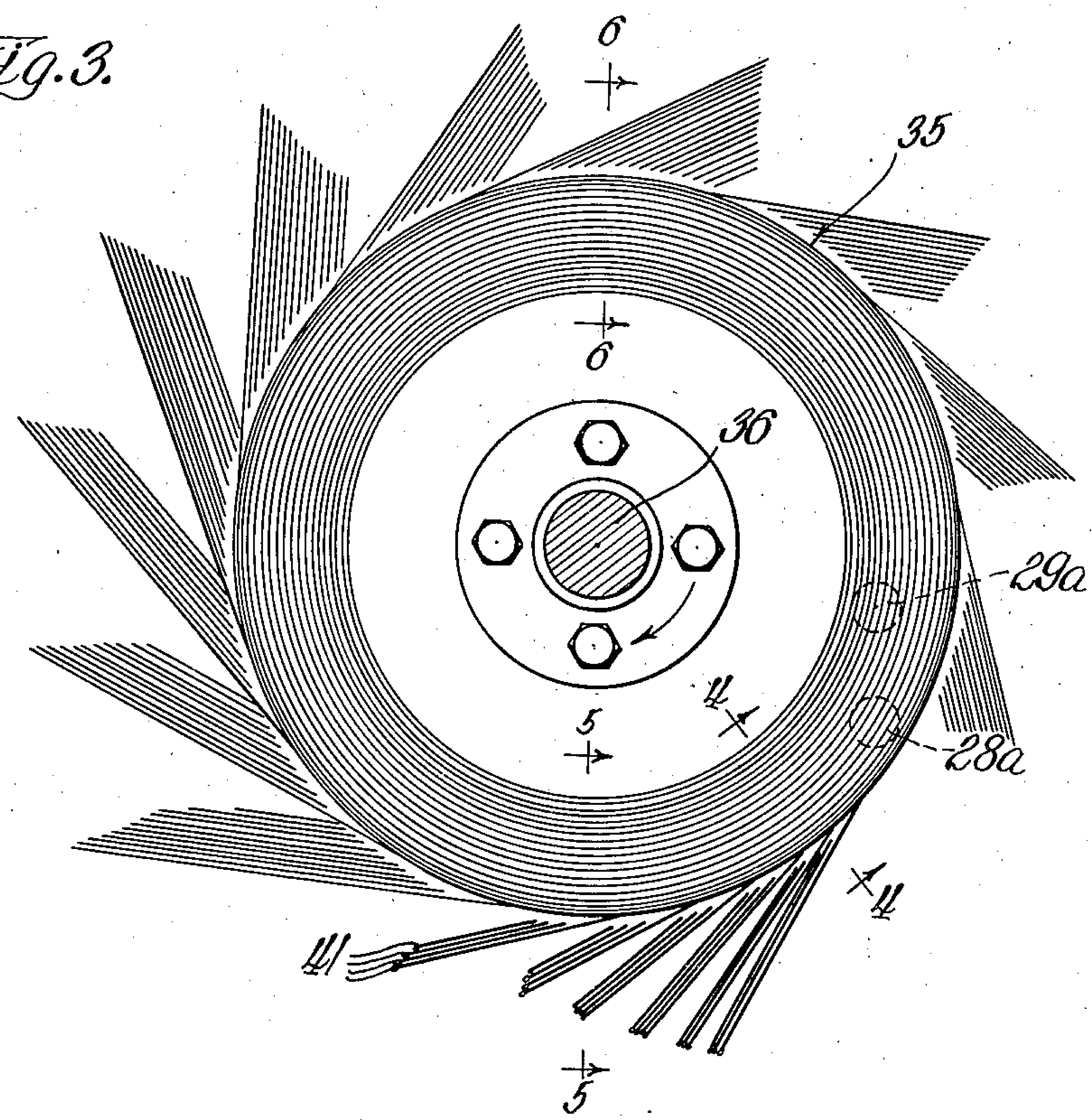


Fig. 5.

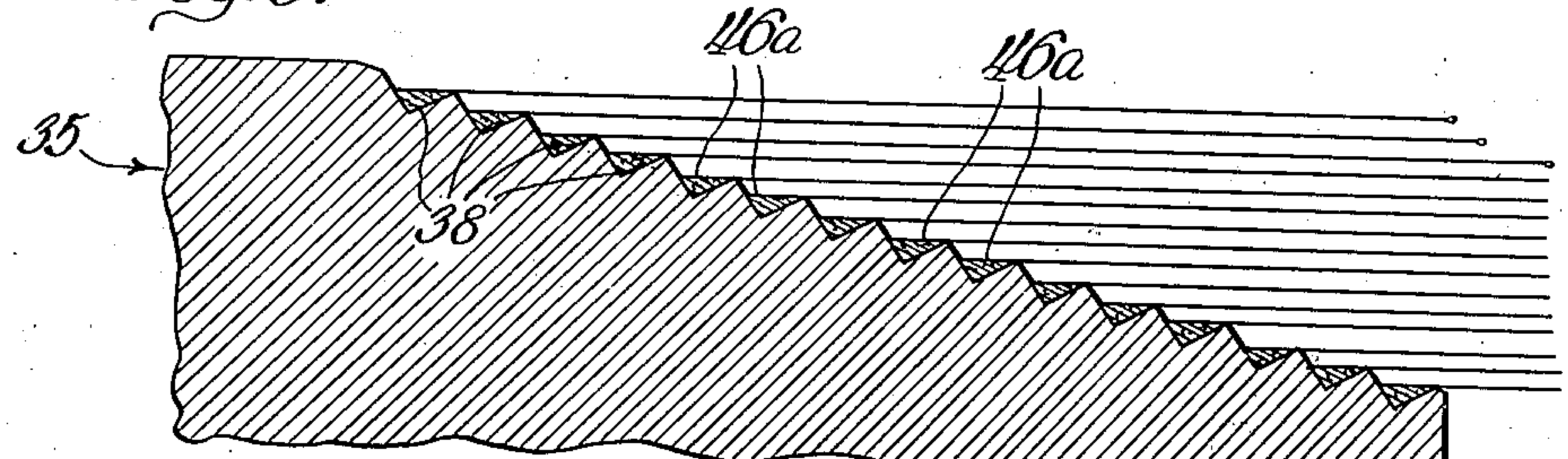
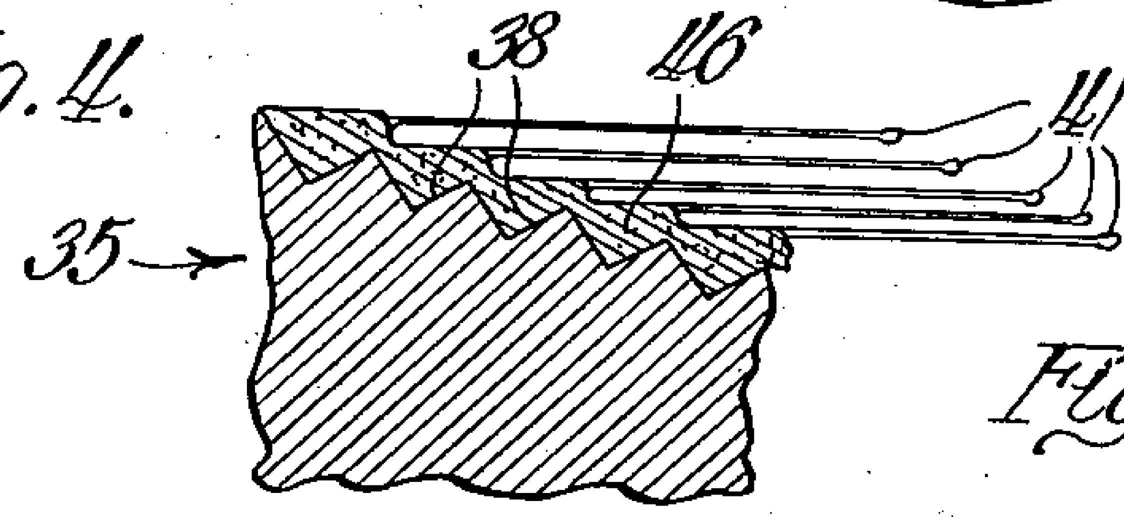


Fig. 4.



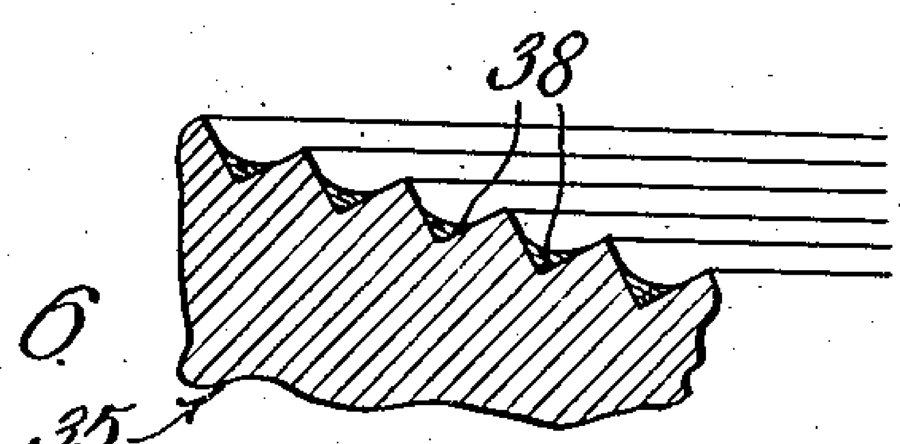


Fig. 6

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Patented May 27, 1941

2,243,122

UNITED STATES PATENT OFFICE

2,243,122

MEANS FOR SPINNING MINERAL WOOL

Charles F. Ramseyer, Chicago, Ill.

Application August 13, 1938, Serial No. 224,830

1 Claim. (Cl. 49—1)

This invention relates generally to the art of forming mineral wool and more particularly to the art of producing mineral fiber from molten material by spinning or drawing out the latter through the use of rapidly rotating surfaces onto which the material in molten form is caused to flow and from which it is thrown by centrifugal force. Heretofore, the method of forming mineral wool most generally in use involved the use of a jet of steam or air under pressure which was caused to impinge on a falling stream of molten material, and recently mineral wool has been formed by depositing molten material in a fine stream onto the outwardly and downwardly inclined periphery of a rapidly rotating disc.

The object and general nature of this invention is the provision of a method of producing mineral wool from such material as coal ash slag.

It has been found that the viscosity of the molten material at the time the spinning or blowing takes place is one of the most important factors determining the quantity and quality of the wool. Usually the better grades of wool are made up of relatively small but long fibers. The molten materials from which commercial forms of rock and glass wools have been made have a relatively long viscosity range; that is, such materials remain viscous over a long temperature range, and hence little difficulty is experienced in forming the relatively small but long fibers desired.

This invention, however, is particularly concerned with the formation of mineral wool from molten coal ash slag, such as is available as a by-product in the operation of the so-called wet bottom or slag tap boiler furnaces in which the ash collects in molten form in the bottom of the furnace and can be drawn off at will. Molten coal ash slags, especially those including relatively high iron oxide content, produce a very fine soft grade of mineral wool, but the formation of the wool from such material by conventional means and methods has been attended by certain difficulties, due to the fact that molten coal ash slag has a viscosity range that is quite short and hence in certain instances the fibers, while fine and soft, tended to be short.

In order to form mineral wool in a commercially successful fashion from molten coal ashes other factors must also be considered, especially when using spinning discs, cylinders and the like. For example, the molten slag must be maintained in a molten state in which the material is of sufficient fluidity that it can be easily handled and controlled, yet the material must be at the right viscosity when it comes into contact with the wool forming means in order to retain for as long as possible the viscosity at which the most wool is formed.

An important feature of this invention is the provision of a method of spinning mineral wool and the like from a molten material having a relatively short viscosity range which comprises flowing the molten slag onto the spinning disc in a pair of short streams so that in its fall the streams of slag are cooled from fluid stage down to the temperature at which the most mineral wool is formed.

These and other objects and advantages of this invention will be apparent to those skilled in the art after a consideration of the following detailed description taken in conjunction with the accompanying drawings, in which:

Figure 1 is an end view of a conditioning furnace in which the slag is retained and held in its molten state until it is desired to form mineral wool;

Figure 2 is a horizontal sectional view of the installation shown in Figure 1, showing the two spinning discs associated with each conditioning furnace and each disposed so as to receive the molten slag from two separate channels of the spout of the conditioning furnace;

Figure 3 is an enlarged view, taken on the line 3—3 of Figure 1, showing one of the spinning discs and the manner in which the mineral wool fibers are formed; and

Figures 4, 5 and 6 illustrate somewhat diagrammatically the distribution of the molten material on the spinning disc.

Referring now to the drawings more particularly to Figures 1 and 2, the conditioning furnace is indicated in its entirety by the reference numeral 10 and includes a refractory container 11 having suitable water jacketed side and end walls 13 and 14 and a pouring spout construction indicated in its entirety by the reference numeral 15. As is more fully disclosed in my copending application Serial No. 217,397, filed July 5, 1938, the conditioning furnace 10 is a relatively small unit which is ordinarily disposed adjacent or underneath the boiler furnace and in a position to receive molten slag therefrom through a suitable runner or other means. The function of the conditioning furnace 10 is to receive the molten material from the boiler furnace and, through suitable controls, retain the molten material at or bring the same to the desired viscosity state by raising or lowering the temperature, as by passing a controlled amount of electric current through the molten mass of slag. The present invention is not concerned with the details of the conditioning furnace since that is fully disclosed and claimed in my copending application mentioned above. It is therefore sufficient here to point out that the pouring spout 15 of the conditioning furnace 10 is so arranged that when the furnace is tilted, the molten slag is divided into four streams by the channels 21, 22, 23 and 24, such channels being arranged in pairs and diverging as best shown in Figure 2. The exit lips of the channels 21 to 24 are indicated at 26 to 29. The channels 21 to 24 are formed by suitable refractory material so as to be capable of withstanding the heat of the molten slag. The temperature of the slag flowing out of the runners 21 to 24 is maintained at the desired point by gas burners 32 and 33, as best shown in Figure 1.

As best indicated in Figure 2, a pair of spinning discs 35 is provided in spaced apart relation, one disc for each of each set of channels 21—22 and 23—24. There may be, of course, a greater or smaller number of discs and channels, and the number of channels for each disc may vary, as desired. Each spinning disc 35 is supported at the lower end of a vertical shaft 36, and rotation of the shafts 36 may be effected by any suitable means. As best shown in Figure 4, each disc is provided with a generally conical margin which is peripherally grooved, as at 38.

In operation, each of the discs 35 receives two slag streams, the disc being positioned below the pouring spout 15 associated therewith in such relation that one slag stream hits the disc adjacent the margin thereof while the other slag stream hits the disc at a point behind and slightly upwardly and inwardly thereof, thereby substantially covering the entire grooved portion of the disc at this point. For example, looking at Figure 3, which illustrates the right hand disc 35 of Figure 2, the point where the slag stream from the lip 29 hits the disc is indicated at 29*a* in Figure 3, and the point where the slag stream from the lip 28 hits the disc is indicated at 28*a*. In coming into contact with the disc, the slag streams fall freely through a distance indicated at X in Figure 1.

The discs 35 revolve at a high speed in the direction of the arrows shown in Figures 2 and 3, the latter figure showing somewhat diagrammatically the distribution of the molten slag about the disc periphery when in normal operation. The movement of the two slag streams from the spout 15 onto the disc 35 at first fills substantially all of the grooves 38 to overflowing. This condition of overflowing the grooves 38 continues for about 60°. The excess slag at this point is thus largely in the form of globules of molten slag which rapidly solidify to form what is called "shot" indicated at 41. Figure 4 is a fragmentary cross section taken at a point where the slag, indicated at 46 overflows the grooves 38. Very little wool of acceptable grade is formed at this point on the disc. After the excess slag has been thrown off, each of the grooves 38 is almost full of slag, which is distributed fairly uniformly therein due partly to the fact that the slag from the spout runner strikes the edge at two spaced apart points. As the disc rotates portions of the slag are thrown out from each of the grooves in the form of small fibers which are fine and soft, and so long as there is any slag in the grooves 38, as indicated in Figure 6, the slag continues to be thrown off and fibers of the desired fineness and length are formed. Preferably, the slag streams for each disc are so adjusted that there is some excess for the first 60°, as described above. While a large portion of this excess is wasted in the form of "shot" it has been found that supplying a slight excess at this point insures sufficient slag so that there is some slag in each groove. No claim is made here to the use of a grooved spinning disc per se.

In employing spinning discs in this manner, there are a number of factors which have to be correlated in order to secure the best results and obtain a commercially satisfactory quantity of mineral wool from any given amount of molten slag. As mentioned above, this invention is particularly concerned with the formation of mineral wool from the molten coal ash slag which comes from a wet bottom furnace. In order to have sufficient fluidity to pour easily and to obviate any danger of the slag freezing and clogging one or more of the channels, it is desirable to maintain the molten slag at a temperature of about 2350° F. Molten coal ash slag at this temperature flows readily but is not sufficiently viscous to form mineral wool satisfactorily. Molten coal ash slag should be at a temperature of approximately 2250° F. if the mineral wool is to be in an acceptable form. It will therefore be seen, that the temperature of the molten slag must be reduced by about 100° F. between the time the slag streams leave the conditioning furnace and the time they strike the spinning discs. In flowing from the slag spout 15 (Figure 1) to the spinning discs 35, the slag cools a substantial amount, and the greater the distance of fall, the greater the cooling effect will be. However, it has been found that the terminal velocity of the falling slag as it strikes the spinning disc should not be too great, otherwise the slag stream will scatter and will not acquire the desired amount of peripheral velocity from the spinning disc. On the other hand, the velocity of the falling stream of slag should be sufficient to cause the slag to readily fill the grooves on the spinning disc. For coal ash slag, the terminal velocity of the falling stream must be kept down to such a minimum, in order to prevent scattering, yet it is necessary, to secure the necessary temperature reduction mentioned above in order to have the slag at the proper viscosity for spinning at the time it strikes the disc. I have found that where the slag falls in the ordinary manner in a single stream the distance of fall necessary to secure the desired temperature reduction becomes so great that spattering takes place when the slag strikes the spinning disc. On the other hand, if the amount of fall is reduced, the desired temperature reduction is not secured and the temperature at which spinning takes place is higher than is desirable. Hence, according to the principles of the present invention, the slag is delivered to each disc by a pair of channels. Given the same quantity of material, two streams of slag will lose approximately sixty percent more heat than the same quantity of slag if falling in a single stream. I have found that providing two streams of slag secures the desired temperature reduction between the point where the slag streams leave the pouring spout and the points where they strike the spinning disc, and that the terminal velocity of the falling streams, while sufficient to fill the grooves of the spinning discs, is not great enough to cause scattering of the slag.

As far as I am aware, I am the first to spin mineral wool successfully from molten material having a short viscosity range by so correlating the surface exposure and the distance of fall of the slag stream that the slag strikes the spinning discs at the proper temperature and terminal velocity.

What I claim and desire to secure by Letters Patent is:

In combination, a pair of rotary spinners mounted for rotation on vertical axes, each spinner having a conical spinning surface upon which are disposed a multiplicity of circumferential grooves for the spinning of fibers or threads, a container for a pool of molten material to be spun, a pair of ducts for each spinner leading from the container to a point above the spinner, said ducts terminating in spouts for depositing the material to be spun upon the grooves of the discs, the axes of the spinners being spaced a less distance than the pairs of spouts and the spinners having means for driving them in opposite directions, the spouts of each pair lying at different radial and angular positions relative to the cooperating spinner whereby the grooves are supplied with molten material of substantially equal consistency and substantially without spattering.

CHARLES F. RAMSEYER.