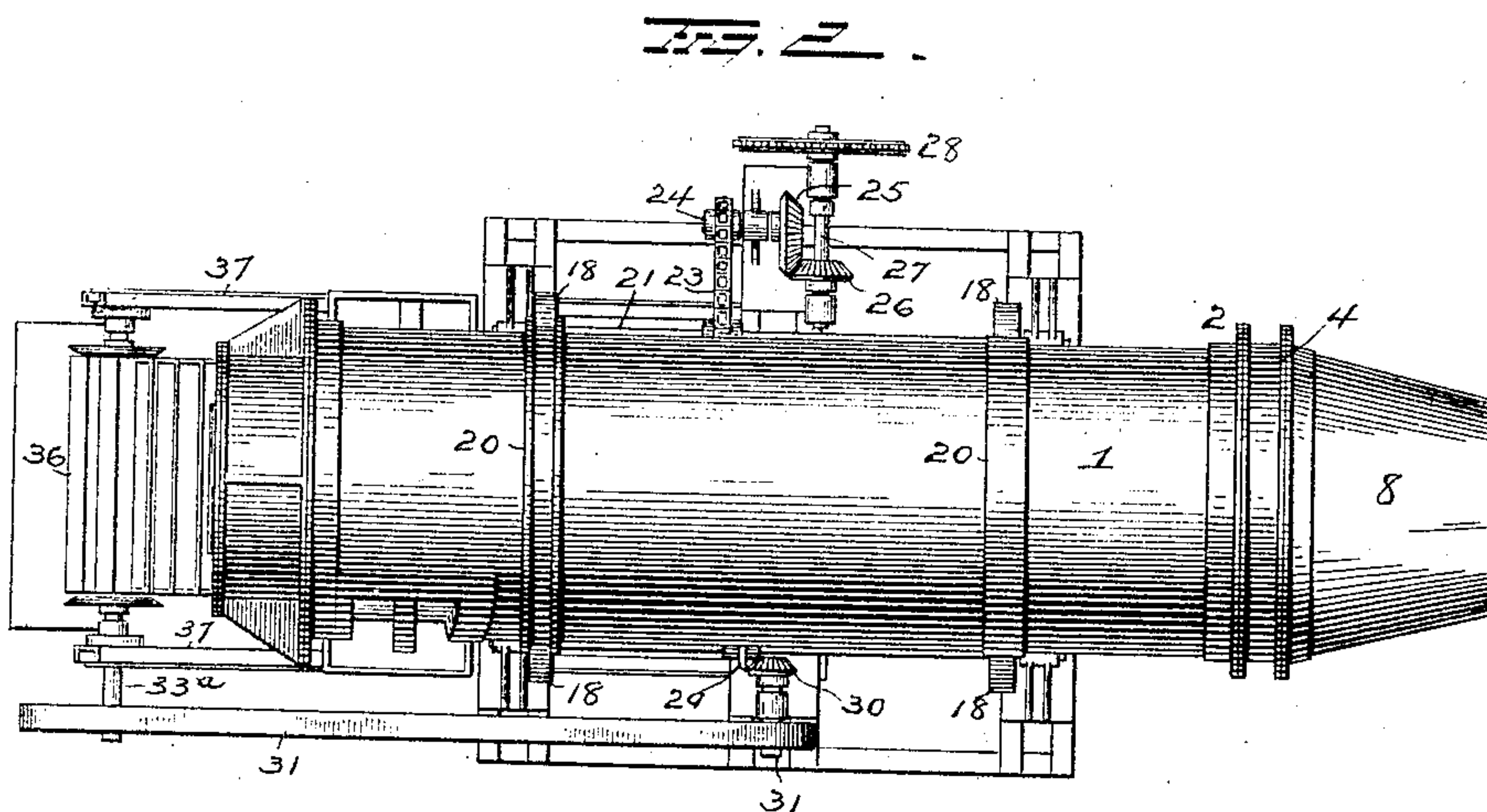
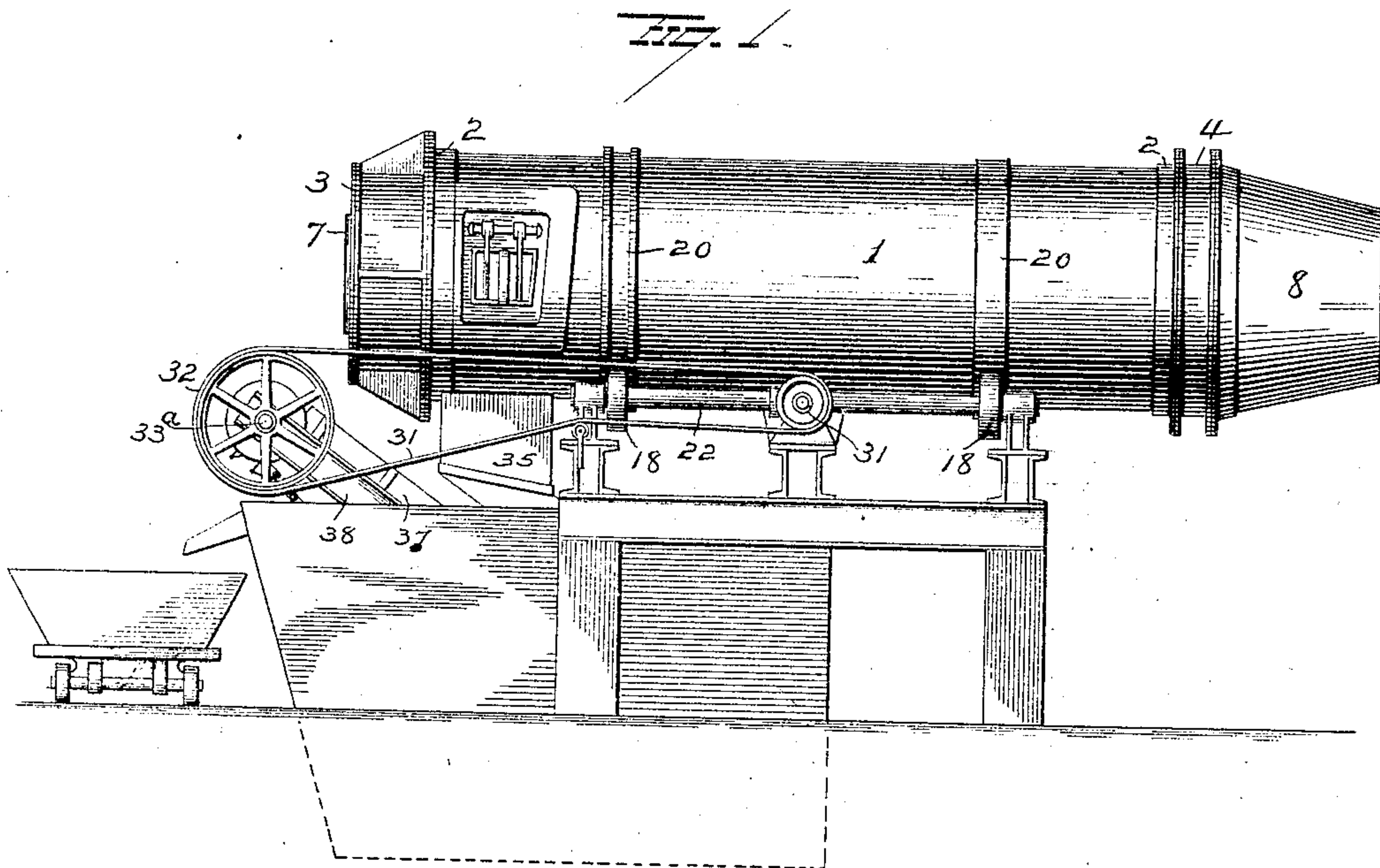


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APPLICATION FILED DEC. 4, 1908.

940,280.

Patented Nov. 16, 1909.

3 SHEETS—SHEET 1.



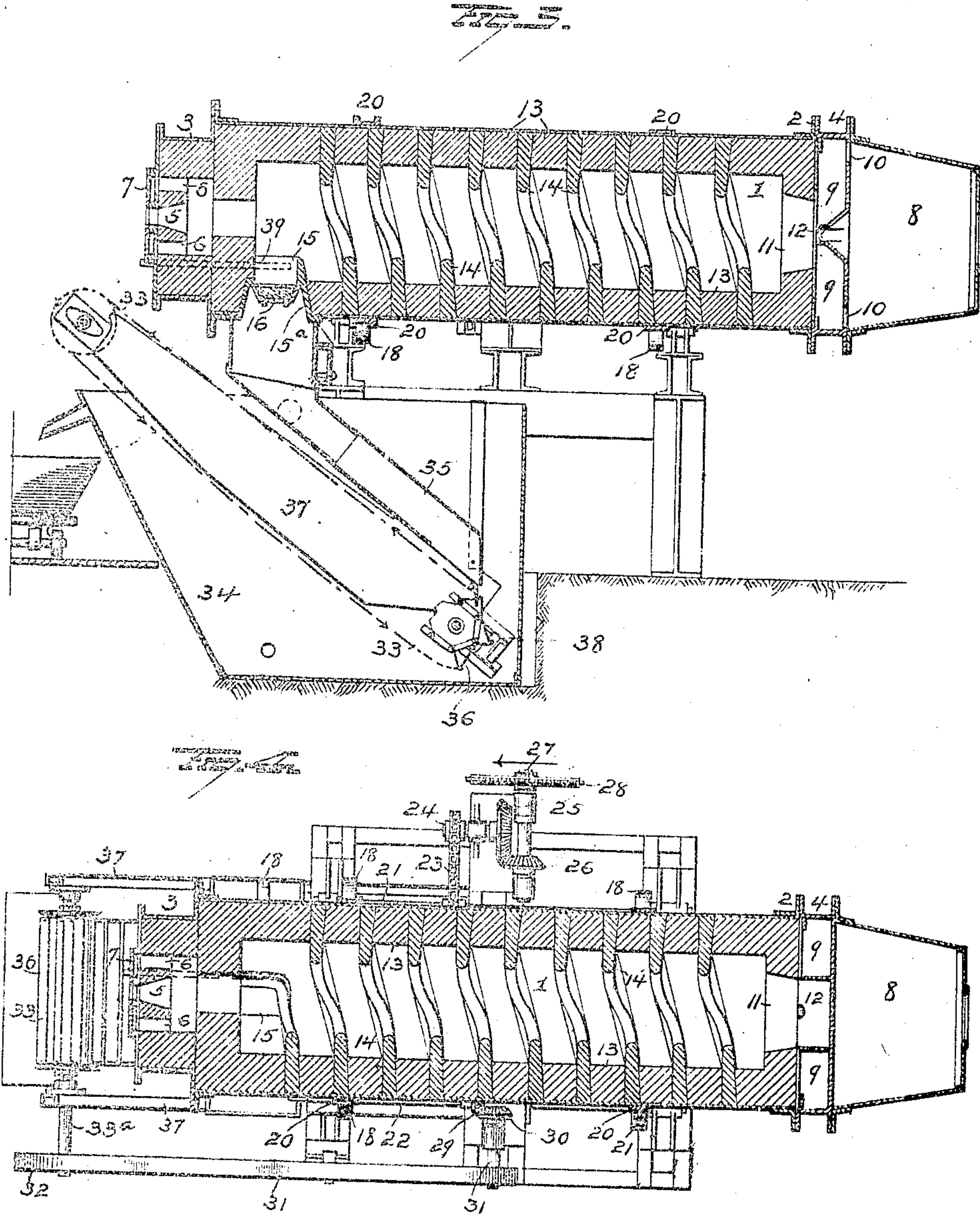
WITNESSES  
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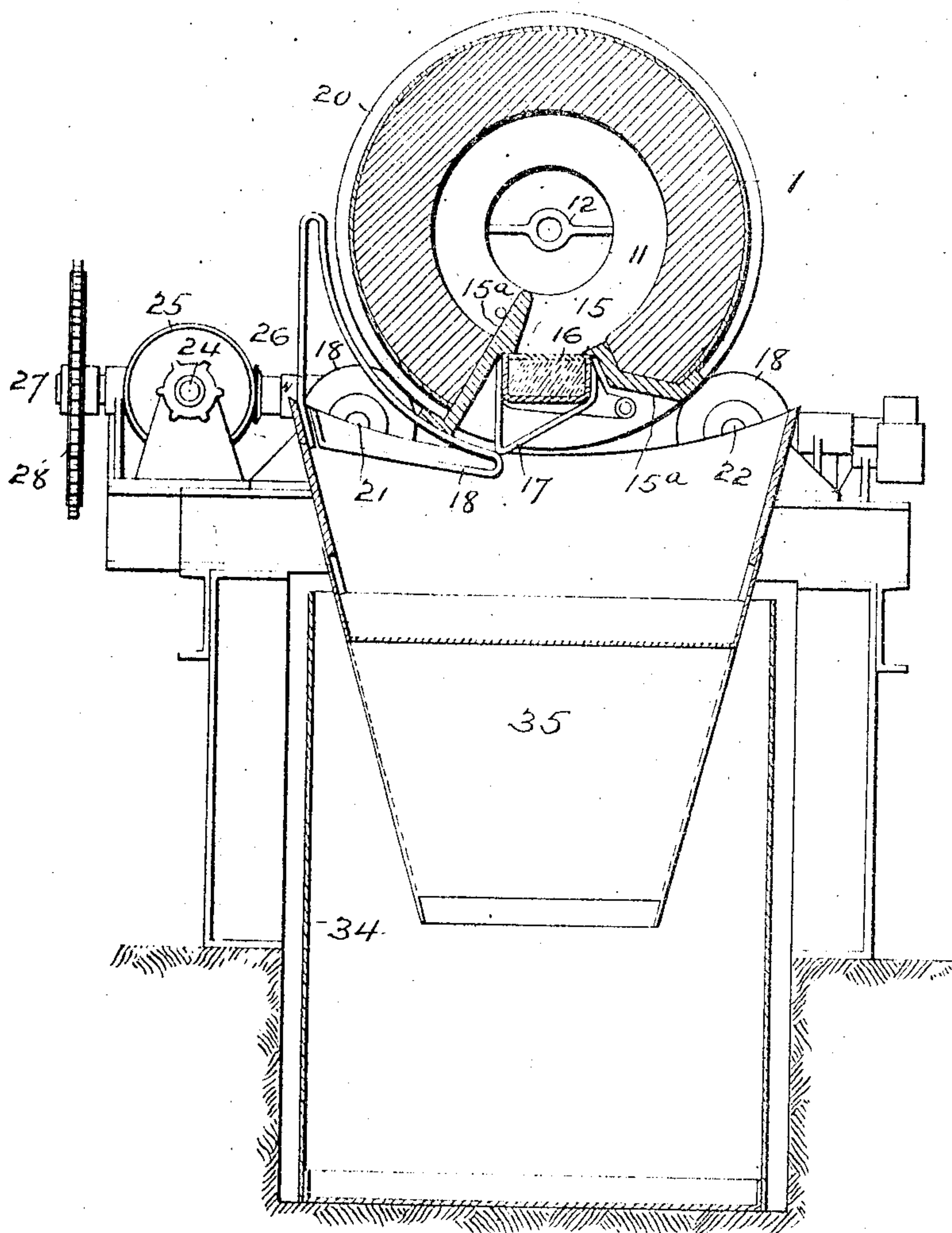
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Fig. 5.



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# UNITED STATES PATENT OFFICE.

WALTER S. ROCKWELL, OF NEW YORK, N. Y., ASSIGNOR TO W. S. ROCKWELL COMPANY,  
OF NEW YORK, N. Y.

ANNEALING AND HARDENING FURNACE.

943,380

Specification of Letters Patent.

Patented Nov. 16, 1909.

Application filed December 4, 1908. Serial No. 466,007.

*To all whom it may concern:*

Be it known that I, WALTER S. ROCKWELL, of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Annealing and Hardening Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in annealing and hardening furnaces, the object of the invention being to insure a uniformly heated and clean product. To secure such results, I employ an internally fired cylindrical furnace, with a spiral lining, the furnace being rotated at a certain speed and charged and discharged automatically, a pyrometer indicating the actual temperature at the point of discharge. The only manual part of the operation is that of firing, but as the fuel is constant, and the temperature is indicated by the pyrometer, it is only necessary to get the speed of the furnace and the temperature correct before starting, after which the entire operation is automatic.

In the accompanying drawings, Figure 1 is a view in side elevation of my improved apparatus. Fig. 2 is a plan view of same. Fig. 3 is a view in vertical longitudinal section. Fig. 4 is a view in horizontal section, and Fig. 5 is a view in vertical transverse section.

1 represents the furnace consisting of a cylindrical steel shell, preferably having one longitudinal riveted seam, and provided with solid steel flanges 2 at each end, to which are bolted the flanged cast iron tail and head pieces 3 and 4.

The tail piece or casting has an opening 5 through the axis for the passage of the fuel from the burner, and openings 6 for the admission of air for combustion, the air openings being regulated by a damper 7.

The head casting 4 is flanged for the attachment of the sheet steel feed hopper or drum 8, and is provided with two throats or passages 9, which communicate with the drum 8 through the openings 10.

The head casting is hollow as shown and is provided with a centrally located opening 11, through which the articles to be annealed pass into the furnace, the two throats or

passages 9 being separated by the V-shaped partition 12 which passes centrally across opening 11 thus dividing the latter into two openings, one opening communicating with each throat.

The articles to be annealed, hardened or tempered, are small pieces of like dimensions of brass, copper, steel or other metals, such as cartridge shells, eyelets, ferrules, buttons, caps, cups, coin blanks, steel balls, saw teeth, tacks, screws, rivets, springs, nuts etc. These pieces are deposited in the feed drum 8, and as the furnace revolves they gravitate through the lower opening 10 into the communicating throat 9. The continued revolution of the furnace carries the throat with the articles therein up to a plane above the partition 12, thus permitting the articles therein to fall through opening 11 into the furnace. As the upper throat is discharging its contents into the furnace the lower throat is taking in its supply, hence the pieces are fed automatically and regularly, twice at each revolution, to the furnace.

The furnace is lined with hard smooth fire tile 13 arranged in spiral form, and intermediate blocks 14 also of fire tile, also in spiral form, and projecting inwardly into the furnace beyond blocks 13, thus forming one complete spiral way or conveyer from the front to the rear of the furnace, hence as the furnace revolves, the articles deposited on the blocks 13 are deflected by the spirally arranged blocks 14 to the discharge opening 15 formed in the casting 15<sup>a</sup> at the rear end of the furnace. This opening is formed in a metal frame bolted or otherwise secured to the casing 1, and is located at the rear end of the spiral way or conveyer, hence every piece deposited in the furnace will be gradually and regularly moved rearwardly to the opening 15. This opening is normally closed by the door 16 shown clearly in Fig. 5. This door is hinged at one edge to the casting 15<sup>a</sup>, and opens and closes by gravity. It is provided on its outer face with the bracket 17, which engages the fixed guide 18<sup>a</sup> concentric with the axis of the furnace, and thus holds the door in its closed position as the latter passes the horizontal center in its downward movement, and until the door reaches its lowest point of travel. When this point is reached, the bracket leaves the guide, thus permitting the door to swing to its open position, and permitting

the articles at the discharge end of the spiral way to escape from the furnace. As the furnace continues to revolve the door automatically closes and remains so until it has  
5 made another revolution.

The furnace body rests on four rollers 18 secured to shafts journaled in the fixed frame 19, and bearing against two heavy steel bands 20 riveted to the cylinder. The  
10 rollers, two to a side are mounted on the shafts 21 and 22. The shaft 21 is provided with a sprocket wheel around which chain 23 passes to a sprocket wheel on counter-shaft 24, carrying bevel pinion 25 meshing  
15 with bevel pinion 26 on driving shaft 27, the latter being driven by a chain engaging sprocket wheel 28, or by a belt and pulley, in lieu of the chain and sprocket. The movement of the furnace turns shaft 22, and  
20 the bevel pinion 29 on the latter meshes with bevel pinion 30 on shaft 31 and rotates the latter. This shaft is provided with a pulley carrying the belt 31 which passes around the pulley 32 on the conveyer shaft 33<sup>a</sup> and  
25 imparts movement to the conveyer 33.

If the furnace is to be used for hardening, a quenching tank 34 is located below the discharge spout 35, the lower end of the spout terminating well down below the level of the  
30 bath, and above and near the lower end of the conveyer 33. This conveyer is provided with buckets 36 into which the articles fall, and the buckets are so constructed as to permit the liquid therein to drain out, the articles in the buckets being carried up above  
35 the tank and deposited in a wheel barrow or other receptacle located in a position to receive same.

The conveyer frame 37 rests on the fixed  
40 channel irons 38, and is held thereon by two bolts, by removing which the conveyer 33 may be removed intact, and as it rests on a fixed frame, it is impossible to replace same except in its correct position to receive  
45 the articles discharged into spout 35.

Either oil or gas may be used as a fuel, and if oil be used it can be atomized with compressed air or with steam at boiler pressure.

50 With my improved furnace the maximum temperature is attained at the discharge end of the furnace, and it is at this point that the pyrometer 39 is located, hence the necessary and exact temperature of the articles  
55 as they leave the furnace may be regulated to a certainty.

The good or ill effects of annealing or hardening extend to all future operations upon the metal, and to the very life of the  
60 material itself. If the pieces are brass, for instance, and must be punched or drawn or spun, the machine which handles them will run easier and faster without risk if the pieces are clean and uniform in malleability.  
65 If they are to be stamped or pressed they

will appear clear and distinct and if they are to be buffed they will be of one color when finished. If the pieces are steel and must be hardened they will be uniformly hardened, and be as hard as the particular  
70 kind of steel under treatment will admit of.

Experiments have demonstrated that articles can be more uniformly heated in this furnace than is possible in the tumbling barrel, or peanut roaster type of furnace, or  
75 in the horizontal bucket or chain conveyer type, because the material is not only brought up to the desired temperature from its cold condition, in a gradual manner so as to afford time for the heat to penetrate its  
80 mass without overheating its surface parts, but each individual piece is constantly exposed to the open heat of the chamber and to the everchanging surface of its evenly heated convolutions of the spiral conveyer,  
85 and is discharged at exactly the time it reaches its maximum or desired temperature. This is of the utmost importance in hardening steel and it prevents or reduces oxidation to a great extent.  
90

By providing the furnace with a revolving hopper discharging into two throats, the material is fed to the furnace twice at each revolution. The throats 9 also serve as  
95 vents for the exit of spent gases, and as the ingoing material absorbs most of the heat, there is but little if any destructive action of the heat on the front end of the furnace.

It is evident that many slight changes might be resorted to in the relative arrangement of parts shown and described without departing from the spirit and scope of my invention hence I would have it understood  
100 that I do not wish to confine myself to the exact construction shown and described, but,  
105

Having fully described my invention what I claim as new and desire to secure by Letters-Patent, is:—

1. In an annealing furnace having a feed opening at one end and a block and tile lining, of means for revolving the furnace, and  
110 a discharging door adjacent the rear end of the furnace, adapted to automatically open and close once at each revolution of the furnace.  
115

2. In an annealing furnace, the combination with a cylinder having a fire block or tile lining, of a hopper at one end of said furnace, an automatically opening door at the discharge end thereof and means for rotating the furnace.  
120

3. In an annealing furnace, the combination with a cylinder and a lining composed of a series of fire tile blocks arranged in spiral form and intermediate blocks also in  
125 spiral form and projecting beyond said first mentioned blocks, and means for revolving the furnace.

4. In an annealing furnace, the combination with a cylinder having a feed opening  
130

at one end, and a lining having a spiral conveyer formation, of means for revolving the furnace, and an automatically opening and closing door for discharging the articles at the rear end of the spiral conveyer at each revolution of the furnace.

5. In an annealing furnace, the combination with a cylinder having a feed opening at one end, and provided with a lining, of a feed hopper carried by and rotating with the cylinder and having an automatically opening and closing door for feeding the material into the furnace, means for automatically discharging the material near the opposite end and means for rotating the furnace.

6. In an annealing furnace, the combination with a cylinder having a spiral conveyer therein, of a hopper carried by the cylinder and means for automatically feeding the material from the hopper into the furnace, and means for rotating the furnace.

7. In an annealing furnace, the combination with a cylinder having a fire brick lining, of an automatically opening and closing door for discharging a portion of the contents of the furnace at each revolution thereof, and means for rotating the furnace.

8. In an annealing furnace, the combination with a cylinder having a spiral conveyer therein, of a hinged door located adjacent to one end of said spiral conveyer and adapted to open and close by gravity and means for holding the door in its closed position until it reaches its lowest position.

9. In an annealing furnace, the combination with a cylinder having a spiral conveyer therein, of a feed drum secured to one end of said cylinder, throats leading from said drum to the feed opening in the cylinder and a partition separating said throats.

10. In an annealing furnace, the combination with a cylinder and a spiral conveyer therein, of means carried by and rotating with the cylinder for automatically feeding the material into the furnace near one end, means for automatically discharging it near its opposite end and a burner discharging into the furnace adjacent to the discharge end of the latter.

11. In an annealing furnace the combination with a cylinder having a discharge opening near one end, of a hinged door located adjacent the discharge end of said cylinder and adapted to open and close by gravity and means for holding the door closed until it reaches its lowest position.

12. In an annealing and hardening apparatus, the combination with a cylinder, a feed opening at one end and an automatically operating closure for the discharge opening in said cylinder, of means for rotating the cylinder, a quenching tank below said discharge opening and a conveyer partly submerged in the quenching tank and adapted to receive the articles discharged into the liquid from the furnace.

13. In an annealing and hardening apparatus, the combination with a cylinder provided with a feed opening in one end and a discharge opening near its other end, of means for automatically feeding the articles to the cylinder, means for rotating the cylinder, a quenching tank, a conveyer therein and means for transmitting motion from the cylinder to the conveyer.

14. In an annealing and hardening apparatus, the combination with a cylinder, means for automatically feeding the articles into said cylinder, and automatically operated means for discharging the articles from the cylinder, of a quenching tank into which the heated articles are discharged, a conveyer in said tank, and means for rotating the cylinder and actuating the conveyer.

15. In an annealing furnace, the combination with a cylinder, of means for automatically feeding the material into the cylinder at one end, automatically operated means near its opposite end for discharging a part of said material at each revolution, and a burner discharging into the cylinder adjacent to the discharge end of the latter.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

WALTER S. ROCKWELL.

Witnesses:

THOMAS G. TURNER,

FRANK ALFRED CALHOUN.