June 16, 1925. 1,541,902

H. R. COLLINS

DRIER

Filed April 26, 1922 5 Sheets-Sheet 1

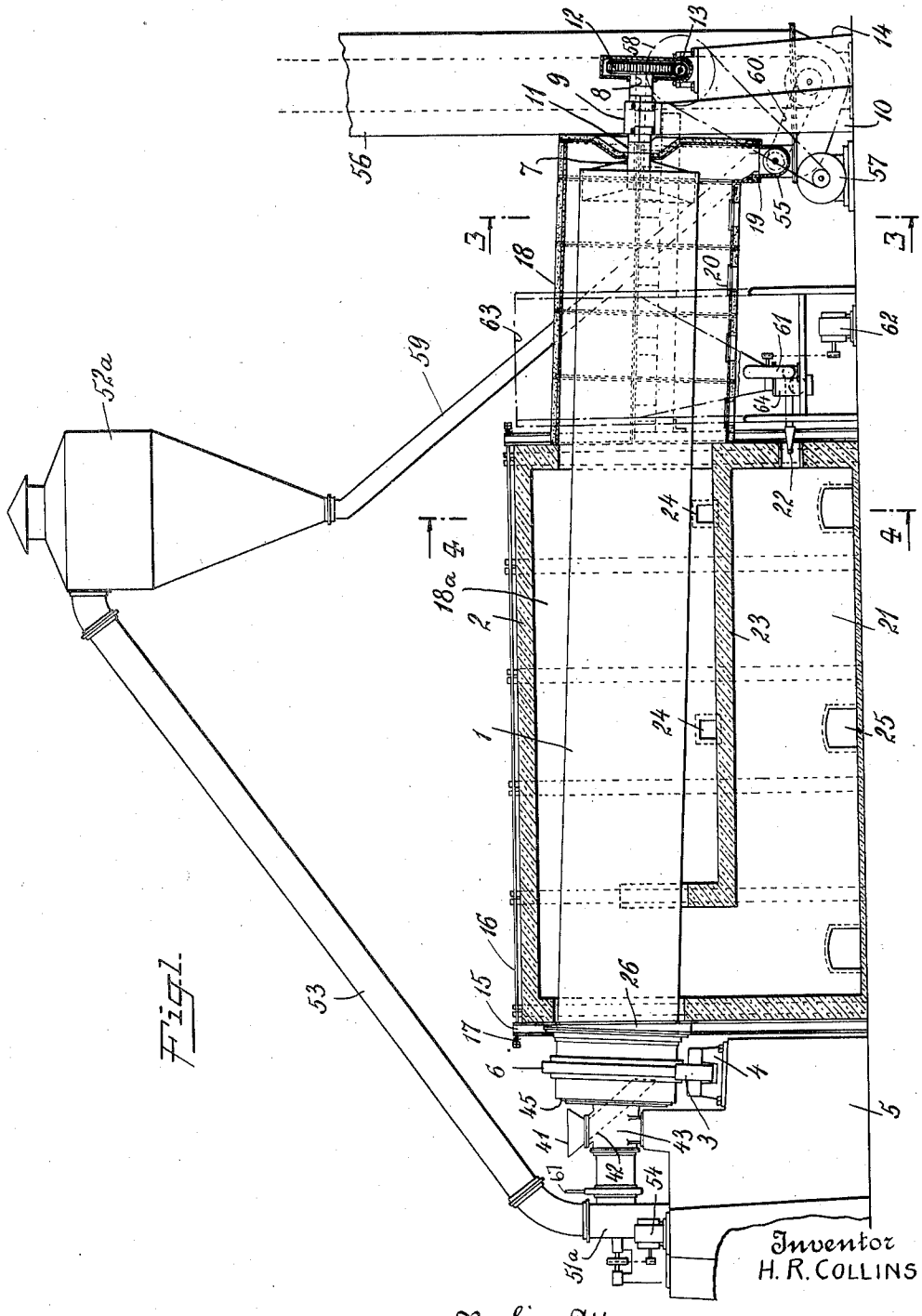


Fig. 1.

Inventor
H. R. COLLINS

By his Attorneys
Penniman Davis Marvin & Edmonds

June 16, 1925. 1,541,902

H. R. COLLINS

DRIER

Filed April 26, 1922 5 Sheets-Sheet 2

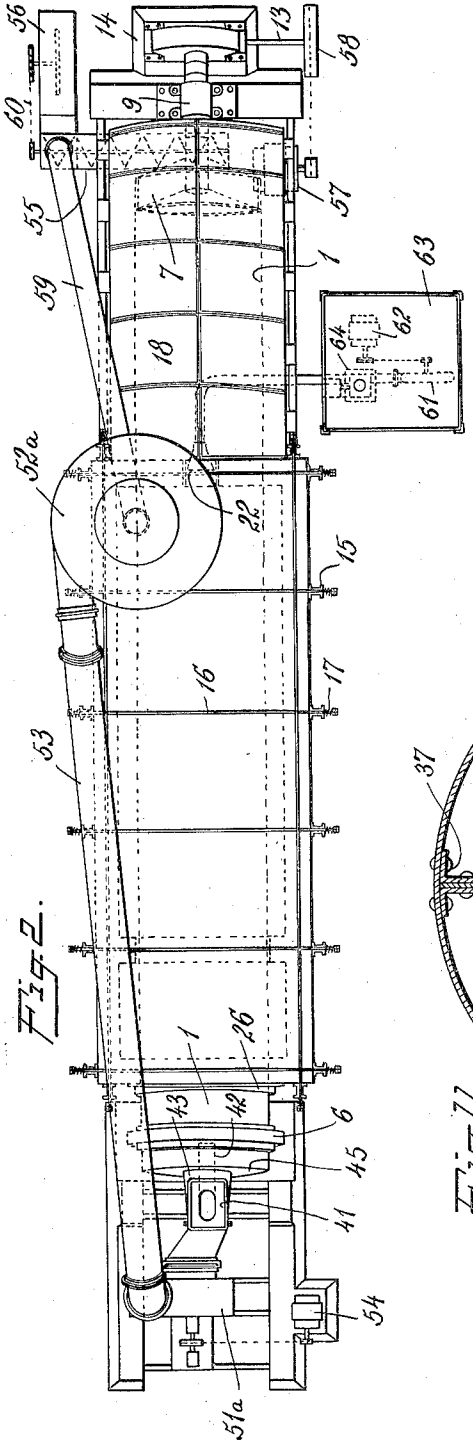


Fig. 2.

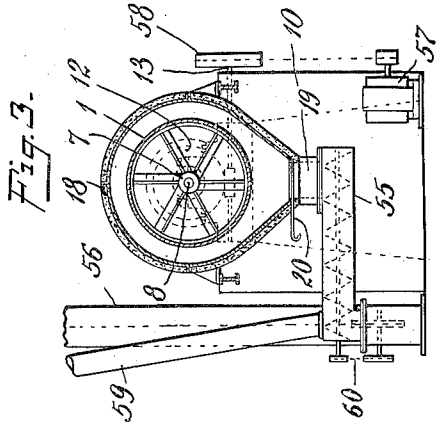


Fig. 3.

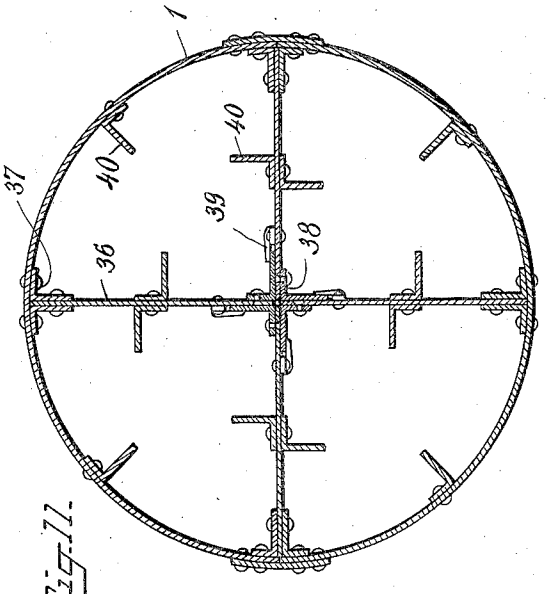


Fig. 11.

Inventor
H. R. COLLINS

By his Attorneys
Pennie Davis Marvin & Edmonds

June 16, 1925. 1,541,902

H. R. COLLINS

DRIER

Filed April 26, 1922 5 Sheets-Sheet 3

Fig. 4.

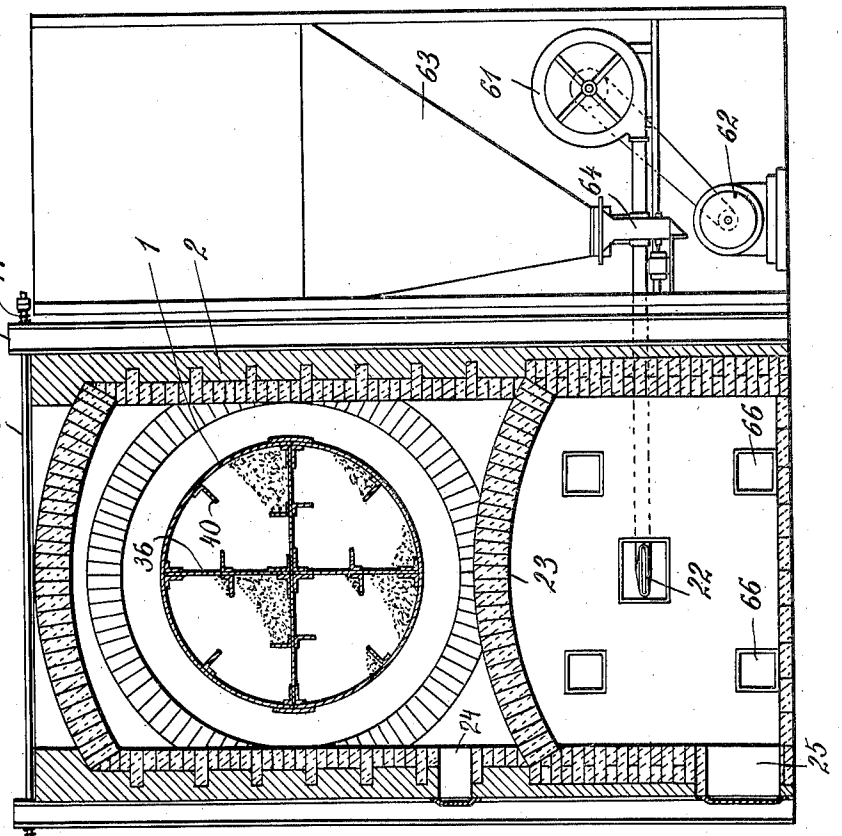
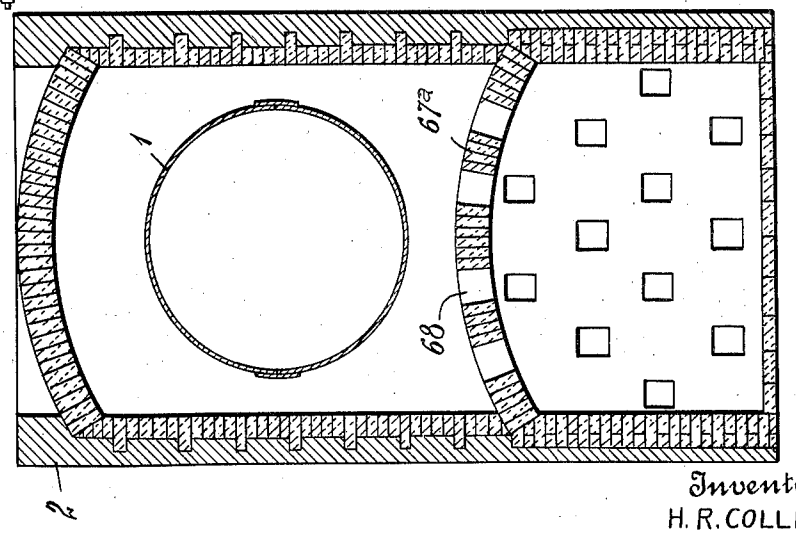


Fig. 12.



Inventor
H. R. COLLINS

By his Attorneys
Pennie Davis Marvin & Edmonds

June 16, 1925. 1,541,902

H. R. COLLINS

DRIER

Filed April 26, 1922 5 Sheets-Sheet 4

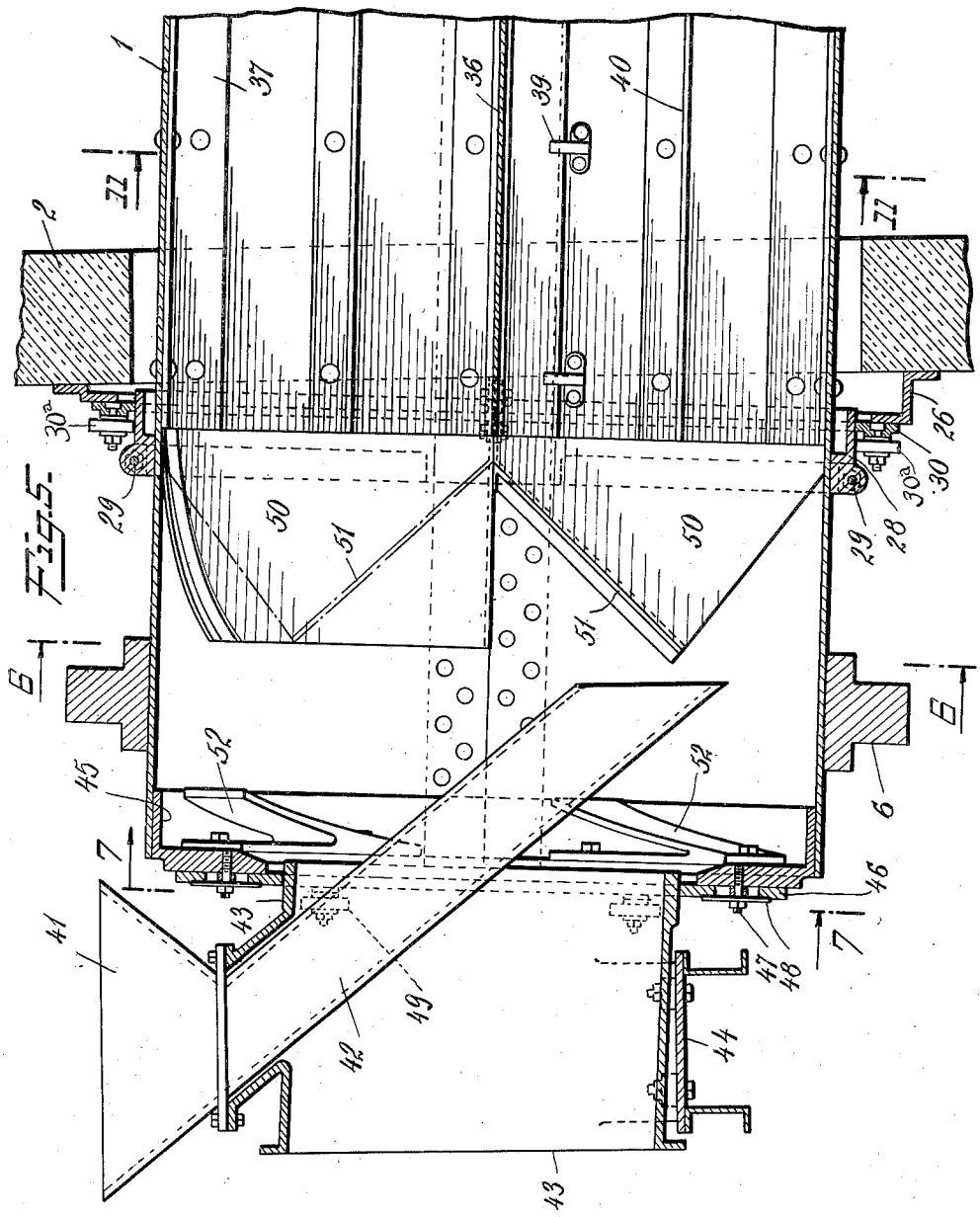


Fig. 5.

Inventor
H. R. COLLINS

By his Attorneys,
Pennie Davis Marvin & Edmonds

June 16, 1925. 1,541,902

H. R. COLLINS

DRIER

Filed April 26, 1922 5 Sheets-Sheet 5

Fig. 6.

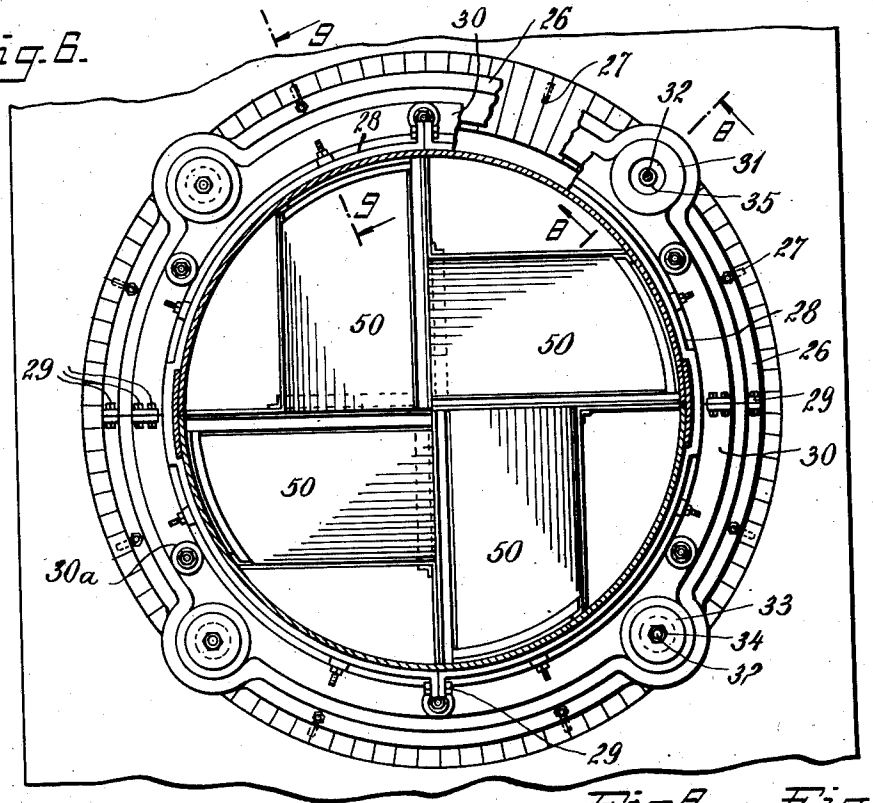


Fig. 7.

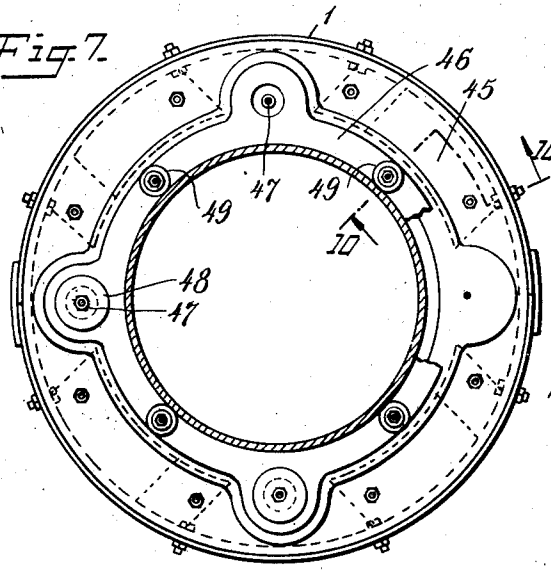


Fig. 8.

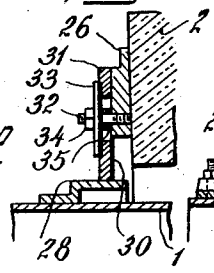


Fig. 9.

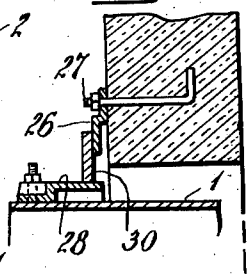
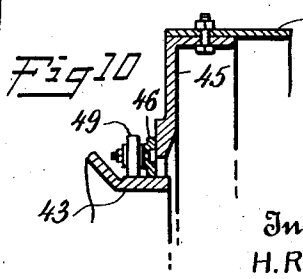


Fig 10



Inventor
H. R. COLLINS

By his Attorneys
Pennie Davis Marvin & Edmonds

Patented June 16, 1925. 1,541,902

UNITED STATES PATENT OFFICE.

HARRY RAYMOND COLLINS, OF ALLENTOWN, PENNSYLVANIA, ASSIGNOR TO FULLER-LEHIGH COMPANY, A CORPORATION OF PENNSYLVANIA.

DRIER.

Application filed April 26, 1922. Serial No. 556,679.

To all whom it may concern:

Be it known that I, HARRY R. COLLINS, a citizen of the United States, residing at Allentown, in the county of Lehigh, State of Pennsylvania, have invented certain new and useful Improvements in Driers; 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.

This invention relates to driers and involves more particularly the provision of an improved form of rotary drier such as is employed in preparing fuel for firing in pulverized form. In order that fuel may be successfully burned when pulverized, the moisture content should ordinarily be reduced to one per cent or less except in the case of lignite coal. Installations for preparing, introducing and burning pulverized fuel therefore include, among the various apparatus for crushing, pulverizing, conveying and burning of the fuel, a drier for reducing the moisture content so that the fuel will be adapted for use in firing it in pulverized form. Such driers are commonly of the rotary type.

In construction rotary driers of this character, it has been common to provide a cylindrical casing or shell mounted to rotate about an inclined longitudinal axis and extending through a furnace for supplying heat to the material in the casing to be dried, both ends of the casing extending outside the furnace walls. The casing is mounted to rotate by means of bands or tires encircling the casing near each end which are supported on rollers, and the casing has gear connections with driving means for rotating it to agitate the material fed to the casing which then passes downwardly through the casing by gravity to the discharge end thereof. The material is heated in its downward passage to the casing by means of the gases of combustion from the furnace which are caused to circulate about that portion of the casing within the furnace, about the discharge end of the casing and through the latter in direct contact with the material. The heating gases are carried from the furnace for circulation about the discharge end of the casing, thence through the casing by means of a hood or heating jacket surrounding the discharge end of the casing and connected to the furnace by means of a breeching affording a comparatively shallow passage, separate from the casing, through which the gases pass from the furnace to the hood. Between the furnace and the hood the casing is exposed to the air and this portion of the casing is utilized for the supporting means or rotatable mounting for the discharge end of the casing and the drive connections. The external heating effect of the gases of combustion is therefore limited to the portion of the casing within the furnace and its discharge end. The casing, moreover, in apparatus of this construction heretofore employed in practice, has been fitted on its interior surface with longitudinally extending buckets or shelves for agitating the material, the shelves being arranged circumferentially around the inner surface and leaving an open central space throughout the casing for the passage of the heating gases therethrough in direct contact with the material within the casing.

The drier constituting the present invention is of the rotary type consisting of a cylindrical casing or shell which is mounted to rotate about a longitudinal axis, preferably in an inclined position from the inlet or feed end of the casing to the discharge end thereof, and having appropriate means for supplying heat to the casing to dry the material fed therethrough. The heating means for the casing are constructed and arranged in such manner that heat is applied to the exterior surface of the casing from its inlet end throughout to its discharge end. Thus the material in the casing is subjected to heat substantially throughout its entire length both exteriorly and interiorly as distinguished from driers heretofore constructed having a considerable length of casing, the exterior surface of which is not reached by the heating gases, and which, as a matter of fact, is exposed to the atmosphere that acts to cool the casing along this portion and thus counteract the effect of the heating gases passing through the casing from the discharge to the inlet end thereof.

The heating means conveniently employed

in the drying apparatus of the present invention is a furnace through which the casing or shell extends, the furnace preferably being one employing pulverized fuel and having a combustion chamber and a passage or flue for the gases of combustion through which the portion of the casing within the furnace extends. In order that a maximum of the exterior surface of the casing may be subjected to the heating effect of the gases of combustion as indicated, means are provided for constraining the passage of the gases about the casing from the inlet or feed end thereof to the discharge end. In one form of construction, as described hereinafter, this is accomplished by providing the furnace with a horizontal wall or arch which divides it into a combustion chamber and a passage for the gases of combustion or flue situated above the combustion chamber and communicating with it, and connected to the furnace in communication with the flue therein is a jacket or hood which surrounds or envelops the discharge end of the casing. The gases of combustion are constrained by the arch and the heating jacket to circulate about the casing from its inlet end to its discharge end, thence through the casing to its inlet end in direct contact with the material in the casing. Circulation of the gases in this manner is produced preferably by an exhauster located in the inlet end of the casing which serves also to produce an inward suction at the joints and cracks of the casing and associated parts at its inlet end to prevent the escape of pulverized material to the atmosphere.

The casing is rotated by suitable driving means and is advantageously divided into a plurality of compartments by a series of longitudinally extending radial partitions which are preferably two in number, positioned at right angles to each other and dividing the casing into four similar compartments. These partitions are spaced from the inlet end of the casing to provide a feed chamber into which the pulverized material is introduced by feed devices consisting of a hopper, spout and a feed sleeve. Each compartment is provided with a scoop, and these scoops operate by rotation of the casing to pick up the material in the feed chamber and introduce it into the respective compartments. The material received in the feed chamber from the hopper and spout and feed sleeve is pushed forwardly in the feed chamber in the path of the compartment scoops by means of deflector blades secured at the extreme inlet end of the casing. Situated in each of the casing compartments is a plurality of blades or buckets extending longitudinally of the casing and secured to the casing wall and to the radial partitions. The material scooped into each of the compartments is divided into a plurality of separate streams which slowly pass along the casing as the latter is rotated due to its inclination from the inlet to the discharge end thereof. The material in each of these separate streams is kept in a constant state of agitation through being picked up, both by the partitions and the longitudinal buckets, and thrown to different positions at each point of rotation of the casing from the inner wall thereof to its axis and back again. Thus each particle of the separate streams of material is subjected to the heat radiated through the casing wall and the direct drying action of the gases passing through the casing in contact with the material. The thorough distribution of the material in this way, combined with the more effective heat distribution in the manner described, not only accomplishes a more thorough drying of the material with a less expenditure of heat, but the distribution of the material in the casing, during the drying action, in the manner described, results in the further advantage that there is a balancing of the load to the extent that considerably less power is required to rotate the casing than that which is necessary where the agitating devices or buckets are distributed circumferentially on the inner wall of the casing with a central open space through the latter as in prior devices.

Further features of the invention consist of the provision of seals of improved construction for sealing the opening between the casing and the furnace wall at the point near the inlet end of the casing where the latter projects through the wall, and a seal between the extreme end of the casing and the feed sleeve. These and other features of the invention will be brought out in the description hereinafter, in connection with the drawings, of the preferred form of drier construction.

The form of the invention at present preferred is illustrated in the accompanying drawings, in which—

Fig. 1 is a longitudinal section of the drier.

Fig. 2 is a top plan view,

Figs. 3 and 4 are sections on the lines 3—3 and 4—4 respectively, of Fig. 1,

Fig. 5 is an enlarged detail section at the intermediate end of the drier casing,

Figs. 6, 7 and 11 are sections on the lines 6—6, 7—7 and 11—11 respectively, of Fig. 5,

Figs. 8 and 9 are sections on the lines 8—8 and 9—9 respectively, of Fig. 6,

Fig. 10 is a section on the lines 10—10 of Fig. 7, and

Fig. 12 is a transverse vertical section showing a modified construction of drier.

The drier consists essentially of a tubular casing or shell 1 which is mounted to rotate on its longitudinal axis within a furnace 2, the casing extending through the furnace and projecting beyond the end walls thereof

at both its ends. The casing is supported in a position inclined downwardly from the front or inlet end for material to the rear or discharge end thereof as shown in Fig. 1, so that the material fed into the casing at the inlet end will travel through the casing to the discharge end as the casing is rotated.

The casing is supported at its front or inlet end by means of a bearing permitting rotation of the casing which consists of rollers 3, journaled in brackets 4 on a support or pedestal 5 and a tire ring 6 with which this end of the casing is fitted, the tire rim engaging the rollers 4. The rear or discharge end of the casing is rotatably supported by means of a spider 7 secured within this end of the casing, and a shaft 8 held within the spider, the shaft being journaled in a sectional bearing 9 on a pedestal 10. A thrust collar 11 is arranged on the shaft between the bearing and the spider, and the shaft is driven by a worm wheel 12 mounted thereon which meshes with a worm on the worm shaft 13, driven in a manner to be presently described, and journaled on a suitable support or pedestal 14. When, therefore, power is applied to the worm shaft 13, this will be transmitted to the casing to cause its rotation through the worm wheel 12 and the shaft 11, the inlet end of the casing riding on the rollers 3, and the discharge end being supported in the bearing 9.

The furnace 2 for supplying the heat to the casing is built of any suitable refractory material as, for instance, brick, and it is supported externally by buck stays 15 arranged at opposite sides of the furnace and connected above the top of the furnace by tie rods 16. The tie rods pass through the buckstays at their ends, and are engaged by nuts outside the buckstays, and between the latter and the nuts are coil springs 17 which are arranged to exercise a yielding pressure on the buckstays toward the furnace walls. The discharge end of the casing is enclosed by a heating jacket or hood 18 which surrounds or encloses the rear end of the casing in spaced relation therewith, and is connected to the furnace in communication with the passage for the gases of combustion or flue 18^a situated above the combustion chamber 21 of the furnace. The jacket or hood 18 has a discharge tube 19 at its extreme outer end through which the material passing through the casing is discharged therefrom. Clean out openings are provided in the lower part of the jacket below the casing which are normally closed by sliding doors 20.

The furnace may be arranged to utilize any character of fuel, in the present instance being designed to burn pulverized fuel as, for example, pulverized coal which is blown into the combustion chamber 21 through the rear wall of the furnace with the proper admixture of air by means of a burner 22 preferably of the induction type, as is usual. A wall or arch 23 separates the combustion chamber 21 of the furnace from the upper portion thereof, the arch being spaced from the front wall of the furnace to provide a passageway for the gases of combustion which are constrained to pass upwardly over the arch 23 through the passageway or flue 18^a circulating about the casing 1, thence into the jacket or hood 18^a circulating about the rear portion of the casing, and then through the casing to the front end thereof, this circulation of the gases being produced in a manner to be presently described. The furnace is provided with bottom doors 25 opening into the bottom of the combustion chamber by which atmospheric air may be admitted to form a cooling zone of air beneath the fuel and flame stream through which the ash particles settle and are cooled below slag forming temperature, in accordance with approved practice, the ash depositing in a granular or dust-like condition on the bottom of the combustion chamber from which it may be removed by raking or hoeing out of the bottom doors.

In order to prevent the escape of heating gases from the furnace to the atmosphere between the front wall of the furnace and the inlet end of the casing projecting therethrough, there is provided means for sealing the space between the furnace wall and the casing which comprises a ring 26, secured to the furnace wall by means of anchor bolts 27, a ring 28 mounted on the casing 1, and a floating or sealing ring 30 carrying rollers 30^a riding on the ring 28 (Fig. 5). The ring 26 consists of portions offset with respect to each other and connected by an integral web, one of the portions being secured to the furnace wall by means of the anchor bolts and the other portion extending toward the casing or shell 1, but spaced therefrom at the inner edge of the ring. The ring 28, mounted on the casing, is secured thereto in any convenient manner, and this ring extends alongside the shell spaced therefrom along a portion of its width. The floating or sealing ring 30 is connected to the ring 26 and coacts with this ring and the ring 28 in sealing or closing the space between these rings. The ring 30 has radial perforated projections 31 through which pass screw bolts 32 from the ring 26. The screw bolts are axial to the openings and engage the ring 26. A plate or disc 33 is held over each perforation by the bolt 32, and a nut 34 and a washer 35 are arranged between each plate and the ring 26. The rollers 30^a on the ring 30 ride upon the ring 28 to reduce the friction between these parts. The inner edge of the ring 30 fits closely against the outer

face of the ring 28, as shown in Figs. 8 and 9. Each of the rings 26, 28 and 30 is composed of similar semi-circular sections, and the sections of the rings are connected by bolts and nuts 29.

The shell 1 is divided into a plurality of similar compartments by means of longitudinal radial partitions 36, four partitions being provided in the present instance which divide the shell into four like compartments. The compartments of the casing are each supplied with material from the feed chamber at the forward or front end of the casing by means of scoops 50, in a manner presently to be described, and the material therefore passes through the casing in a plurality of streams, each of which, due to the rotation of the shell, is subjected to precisely the same conditions of drying as all the others. By making the partitions radial, the greatest possible radial movement is obtained and hence a maximum of agitation. The partitions extend from a point near the spider 7 to a point just beyond the furnace wall at the front end of the shell as shown in Fig. 5, and the partitions are slidably connected at the center of the shell to permit of their expansion and contraction. Referring particularly to Fig. 11, it will be noticed that each partition is connected to the shell by means of angle plates 37, and the inner edge of each partition has riveted thereto an angle plate 38. Each of these angle plates has a portion which engages the partition extending at right angles to the partition on which the angle plate is riveted and this portion is slidably connected to the partition by means of clips 39, the clips loosely engaging the portion of the angle plate so that the partition may slide relative to the plate to which it is clipped. Secured to the partitions and to the interior of the shell are stirring plates or buckets 40 and, as shown in Fig. 11, these plates or buckets are situated midway between the ends of the partitions, each partition being provided with two buckets extending in opposite directions. This arrangement of radial partitions and buckets not only insures a thorough stirring or agitation of the material as it passes through the casing by which the material is more effectively and completely subjected to the heat within the casing and the drying cases passing therethrough, but by this means a more even distribution of the material within the casing is obtained with the result that less power is required to rotate the casing.

The forward ends of the partitions are spaced apart from the inlet end of the shell 1, as shown in Fig. 5, to provide a feed chamber, and the material to be dried is fed into this chamber from a hopper 41 through an inclined chute 42 extending from the hopper into the feed chamber. The hopper with its chute is supported upon a feed sleeve 43 situated at the inlet end of the shell 1, the sleeve being mounted upon a bracket 44 on the pedestal 5, as before stated. The feed sleeve 43 projects into an opening in the end of the casing or shell 1, which opening is made somewhat larger than the feed sleeve in order to allow for lateral movement of the casing relative to the sleeve. For closing the opening between the casing and sleeve while permitting a certain amount of lateral movement of the casing in its rotation, a seal is provided which consists of an angle ring 45 secured within the feed end of the shell, and a sealing ring 46 which is connected with the angle ring by means of screw bolts 47 that pass through openings in projections or lugs on the sealing ring. Cover plates 48 are held by the screws 47 over the openings in the lugs, the screw bolts being engaged by nuts to clamp the cover plates in place, and spacing washers are arranged between the cover plates and the angle rings. The inner edge of the sealing ring fits closely about the feed sleeve 43 and the ring carries rollers 49 which engage the outer surface of the feed sleeve to assist in supporting the shell.

For feeding the material to the several compartments of the shell, there is provided a scoop 50 for each compartment, the scoops being secured to the partitions and to the wall of the casing. These scoops, as the casing rotates, scoop up the material fed into the casing from the chute 42, and as the casing continues to rotate, the material slides down the inclined bottom 51 of the scoop into the compartment through which it is fed by gravity and by the rotation of the casing. In order that the material thus let into the feeding chamber may be pushed along the feed chamber to the path of the scoops 50, a plurality of deflectors 52 are provided, each of which is in the form of an angle plate consisting of two portions extending at an acute angle with respect to each other. One of these portions is secured to the ring 45, while the other inclines outwardly away from the ring into the feed chamber. The deflectors constitute in effect a spiral conveyor which acts to push the material rearwardly of the casing and feed it to the scoops 50. The arrangement of the deflectors will depend upon the rotation of the shell 1 and the apices of the deflectors will preferably be pointed in the direction in which the shell is arranged to rotate.

In order to induce circulation of the heating gases through the system and to provide an effective seal for preventing the escape of the finely pulverized material during the operation of the drier, means are provided for setting up a circulation of gases which at the same time serve to reduce

the pressure in the casing at the inlet end thereof to carry out any dust held in suspension at this end of the casing and to provide an inward pressure at the joints and cracks. Such means is in the form of a blower or exhauster 51ª which is connected to the outer end of the sleeve 43, the blower delivering to a separator 52ª to which it is connected by means of a pipe 53. The exhauster or blower is driven by a suitable motor 54 connected to the shaft of the exhauster by a belt as indicated in Figs. 1 and 2.

The chute 19 at the end of the hood or jacket 18 delivers the material discharged from the end of the casing to a screw conveyor indicated generally at 55, and this screw conveys the material from the chute to an elevator indicated generally at 56 by which it is carried to suitable receptacles for storage or distribution.

The separator 52ª is connected by a pipe 59 with the casing of the screw conveyor 55 so that the pulverized fuel which has been carried in suspension to the separator passes into the screw conveyor after it has been separated from the air in which it was held in suspension. The elevator 56 is driven in any suitable manner and it is connected to the screw conveyor to drive the latter by the pulley and by the mechanism indicated at 60.

The shell or casing 1 is driven by a motor 57 connected to a pulley 58 on the shaft 13, preferably by means of a silent chain sprocket.

As before noted, the furnace for supplying heat to the casing in the present instance is arranged for the burning of pulverized fuel, and this fuel, with the proper admixture of air, is delivered to the combustion chamber of the furnace by the burner 22. The fuel is injected into the combustion chamber through the burner by means of a blower 61 connected to the burner and driven by a motor 62 through the belt and pulley connection indicated. Fuel is supplied to the burner from a hopper or receptacle 63 by means of a feeder indicated at 64. Suitable cleanout doors 24 are provided above the partition wall or arch 23, and additional air inlet openings 66 are provided in the rear wall of the combustion chamber as shown in Fig. 4. Situated between the exhauster 51ª and the casing is a blast cap or damper 67 by which the draft or circulation of gases through the system is regulated.

In Fig. 12 there is shown an alternative construction, wherein the partition wall 67ª between the combustion chamber and the drier casing, and corresponding to the partition 23 of Fig. 1, is provided with openings 68. Through these openings heated gases pass into the chamber in which the drier casing is arranged, and around the shell of the drier to the jacket. The area of these openings is determined by the amount of fuel burned per unit of time in each size drier, and the openings are arranged in the arched roof of the combustion chamber, so that the direct action of the hot gases will not be immediately upon the shell of the drier at its lowest point, but diverted to each side and around the shell, preventing direct impingement and possible damage to the shell at is lowest point. It will be understood that the shape of the furnace will be modified to suit the fuel burned, but, however constructed, the arrangement will be such that the hot gases follow the surface of the shell to its discharge end, thence within the shell to the feed end thereof. The hot gases heat the material indirectly during the first part of their travel and afterwards directly thereby to provide a safeguard against ignition of the material.

The combustion chamber in Fig. 12 has its inner walls entirely constructed of firebrick, forming an enclosed chamber. One of the objects of this construction is to obtain the action of the radiant heat from the firebrick after the walls have become thoroughly heated. The action of the radiant heat will ignite all of the volatile gases that may arise from the fuel in its process of combustion in the chamber before passing through the openings in the arch and end wall, thereby overcoming heat losses and passage of smoke into the main body of furnace and to the chamber. This action will tend to reduce the quantity of fuel necessary for the drier operation, after the walls have become thoroughly heated, promoting consequent economy. Sufficient air must be admitted to the bottom of this chamber through proper clean out doors and air inlets to furnish the oxygen necessary for complete combustion.

I claim:

1. A drier including a tubular casing or shell which is rotatably mounted and is constructed and arranged to receive material to be dried at one end thereof and to carry it to the other end of the casing for discharge, and a furnace for supplying heat to dry the material in the casing as it passes therethrough, the furnace having a combustion chamber and a passage for the gases of combustion, and the shell being mounted to extend through said passage and to project outside the furnace at both ends thereof, an extension casing connected to the furnace and communicating with said passage by which the discharge end of the shell is housed, the passage and extension casing being constructed and arranged to constrain circulation of the gases of combustion about the exterior surface of the shell from its feed end throughout to its discharge end,

around the latter, thence through the shell to the feed end thereof, and means for causing circulation of the heating gases, substantially as described.

2. A drier including a tubular casing or shell which is rotatably mounted and is constructed and arranged to receive material to be dried at one end thereof and to carry it to the other end of the casing for discharge, and a furnace for supplying heat to the material in the casing as it passes therethrough, the furnace having a combustion chamber, a gas flue, and a hood connected thereto at one end and communicating with the flue, and the casing being mounted to extend through the flue projecting outside the furnace at both ends thereof and into the hood at its discharge end, the flue and hood being constructed and arranged to constrain circulation of the gases of combustion about the exterior surface of the casing from its inlet end throughout to its discharge end, around the latter, thence through the casing toward the feed end thereof, and means for causing circulation of the hot gases, substantially as described.

3. A drier including a tubular casing or shell, devices for feeding material into the casing at the inlet end thereof and for receiving the material discharged from its outlet end, a furnace for supplying heat to the exterior surface of the casing, the casing extending through and projecting outside the furnace at both its ends, a rotatable mounting for the casing at its inlet end, and a mounting for the casing at its outlet end comprising a shaft mounted in a bearing, means at this end of the casing by which the latter is centrally supported upon the shaft, and an extension housing communicating with the furnace and surrounding the outer end of the casing, substantially as described.

4. A drier including a tubular casing or shell, and a furnace for supplying heat to the casing, the furnace having a combustion chamber and a passage for the gases of combustion, and the casing being mounted to extend through the said passage and to project outside the furnace at both ends thereof, devices for feeding material to be dried to one end of the casing and for receiving the dried material discharged from the other end thereof, a rotatable mounting for the casing at its feed end, a shaft mounted in a bearing for supporting the casing at its discharge end, and an extension housing surrounding the discharge end of the casing which is connected to the furnace and communicates with the passage for the gases of combustion therein, substantially as described.

5. A drier including a tubular casing or shell, a furnace for supplying heat to the casing, the furnace having a combustion chamber and a passage for the gases of combustion, the casing being mounted to extend through the passage and to project outside the furnace at both ends thereof, and devices for feeding material to be dried to the casing at one end thereof and for receiving the dried material discharged at its other end, the casing having at its discharge end a spider, a shaft upon which the discharge end of the casing is mounted by means of said spider, a tire at the feed end of the casing and rollers upon which said tire is supported, and means for rotating the casing, substantially as described.

6. A drier including a tubular casing or shell, and a furnace for heating the casing having a combustion chamber and a flue for the gases of combustion, devices for feeding material to the casing at one end thereof and for receiving the dried material discharged from the other end thereof, the casing being inclined downwardly from the feed to the discharge end thereof and extending through the furnace flue projecting outside the furnace at both ends thereof, a rotatable mounting for the casing comprising a tire supported on rollers at the feed end thereof, a shaft at the discharge end thereof mounted in a bearing, a spider at this end of the casing upon which the latter is supported on the shaft, and a hood connected with the furnace, communicating with the flue and surrounding the discharge end of the casing, substantially as described.

7. In a drier, a tubular casing or shell, means for rotating the casing about its longitudinal axis, radial partitions dividing the casing into similar compartments extending longitudinally of the casing, and a slidable connection between the partitions at the center of the casing to permit expansion and contraction of the partitions, substantially as described.

8. In a drier, a tubular casing or shell, means for rotating the casing about its longitudinal axis, radial partitions dividing the casing into similar compartments extending longitudinally of the casing, a slidable connection between the partitions at the center of the casing to permit expansion and contraction of the partitions, and means operative by rotation of the casing for feeding material to be dried to the several compartments, substantially as described.

9. In a drier, a tubular casing mounted to rotate about its longitudinal axis, radial partitions extending longitudinally of the casing and throughout its length and dividing it into a plurality of sector-shaped compartments extending uninterruptedly substantially from the inlet to the outlet of the casing, and means at the inlet end of each compartment for scooping material into such compartment, substantially as described.

10. In a drier, a tubular casing mounted

to rotate about its longitudinal axis, partitions mounted radially in the casing and forming sector-like compartments extending uninterruptedly substantially from the inlet to the outlet of the casing, the partitions terminating short of the inlet end of the casing to provide a feed chamber with which all the compartments communicate, means for feeding material into the chamber, and means at the several compartments for feeding material from the chamber into these compartments.

11. In a drier, a tubular casing mounted to rotate about its longitudinal axis, partitions mounted radially in the casing and forming sector-like compartments extending uninterruptedly substantially from the inlet to the outlet of the casing, the partitions terminating short of the inlet end of the casing to provide a feed chamber with which all the compartments communicate, means for feeding material to the chamber, means at the several compartments for feeding material from the chamber to the compartments, and means operative by rotation of the casing for advancing the material along the feed chamber and toward the compartments.

12. In a drier, a tubular casing mounted to rotate about its longitudinal axis, partitions mounted radially in the casing and forming sector-like compartments extending uninterruptedly substantially from the inlet to the outlet of the casing, the partitions terminating short of the inlet end of the casing to provide a feed chamber with which all the compartments communicate, means for feeding material to the chamber, means at the several compartments for feeding material from the chamber to the compartments, and deflector blades situated at the end of the casing for pushing the material forwardly toward the compartments.

13. In a drier, a tubular casing, a furnace in which the casing is mounted to rotate, the casing extending beyond the furnace at both ends, means for feeding material to be dried to one end of the casing, means for receiving the material at the other end, means for constraining the heated gases from the furnace to circulate about the casing from the inlet end thereof throughout to the discharge end, thence through the casing, the latter being divided into a plurality of longitudinal compartments extending uninterruptedly substantially from the inlet to the outlet of the casing a plurality of longitudinally extending buckets therein, and means at the inlet end of each compartment for feeding material to be dried thereto and for causing circulation of the hot gases, substantially as described.

14. In a drier including a tubular casing mounted to rotate about its longitudinal axis and through which the material to be dried is passed, means for heating the casing, a plurality of radial partitions extending longitudinally of the casing, and dividing the casing substantially throughout its length into compartments which extend uninterruptedly substantially from the inlet to the outlet of the casing, means for feeding material to each compartment, and a plurality of buckets situated in each of the compartments, substantially as described.

15. In a drier including a tubular casing mounted to rotate about its longitudinal axis and through which the material to be dried is passed, means for heating the casing, a plurality of radial partitions extending longitudinally of the casing substantially throughout its length and dividing the casing into compartments extending uninterruptedly substantially from the inlet to the outlet of the casing, means for feeding material to each compartment, and a plurality of buckets in each of the compartments extending longitudinally of the casing and secured to the casing wall and on the partitions, substantially as described.

16. In a drier, a tubular casing or shell and a furnace for supplying heat to the casing having a combustion chamber and a flue for gases of combustion, the casing being mounted to rotate and extending through said flue and projecting outside the furnace at both its ends, devices for feeding material to the casing at the inlet end thereof for material to be dried, said devices including a sleeve opening into the inlet end of the casing, a seal between the furnace wall and the casing, and a seal between the end of the casing and the sleeve, a conduit connecting said sleeve with a separator, and a blower for drawing off dust in suspension at the inlet end of the drier and feeding it to said separator, a feed screw at the discharge end of the casing and a conduit connecting the separator outlet with said feed screw for conducting material separated from the air to the discharge end of the drier, substantially as described.

17. In a drier, a tubular casing or shell and a furnace for supplying heat to the casing having a combustion chamber and a flue for the gases of combustion, the casing being mounted to rotate and extending through said flue projecting outside the furnace at both its ends, and a seal between the furnace wall and the casing comprising a ring secured to the furnace wall and surrounding the casing, a ring secured to the casing adjacent the first mentioned ring, and a sealing ring co-acting with the casing and furnace rings to maintain a tight fit and prevent the escape of hot gases from the combustion chamber, said sealing ring

being mounted so as to be capable of movement relative to the furnace ring, substantially as described.

18. In a drier, a tubular casing or shell, and means for supplying heat thereto, devices for feeding material to the casing at the inlet end thereof for material to be dried, said devices including a sleeve opening into the inlet end of the casing, and a seal between this end of the casing and the sleeve, said seal comprising a sealing ring mounted at the end of the casing and coacting with the sleeve, a plurality of circumferential apertures in said ring, and fastening means passing through said apertures and into the end of the casing and having cover plates for closing the outer end of said apertures, substantially as described.

In testimony whereof I affix my signature.

HARRY RAYMOND COLLINS.