July 4, 1933. C. D. BARR ET AL 1,916,296

CENTRIFUGAL CASTING MACHINE

Filed Sept. 23, 1931 2 Sheets-Sheet 1

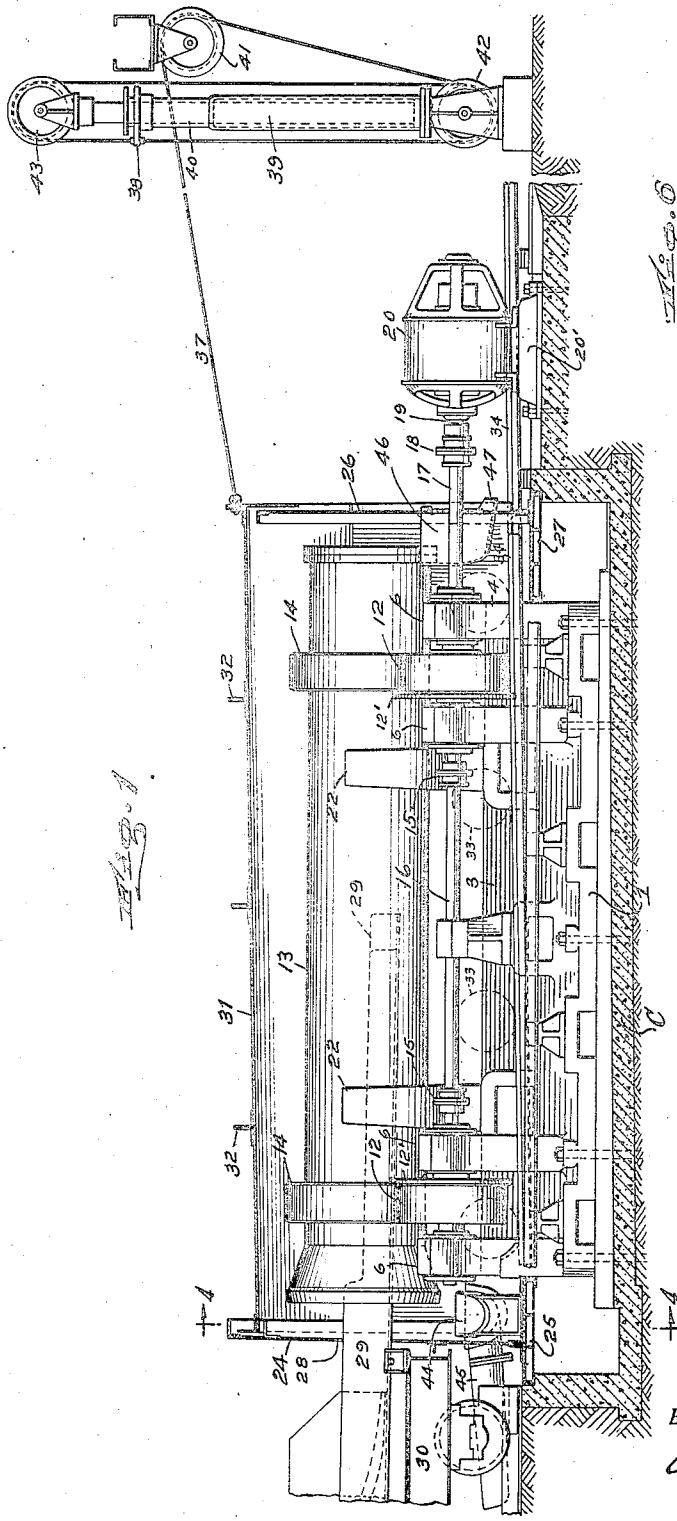


Fig. 1.

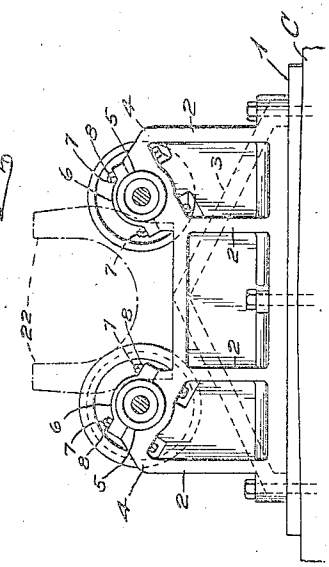


Fig. 6.

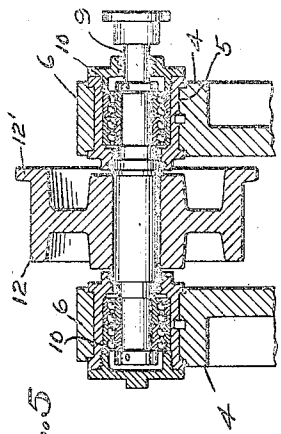


Fig. 5.

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CENTRIFUGAL CASTING MACHINE

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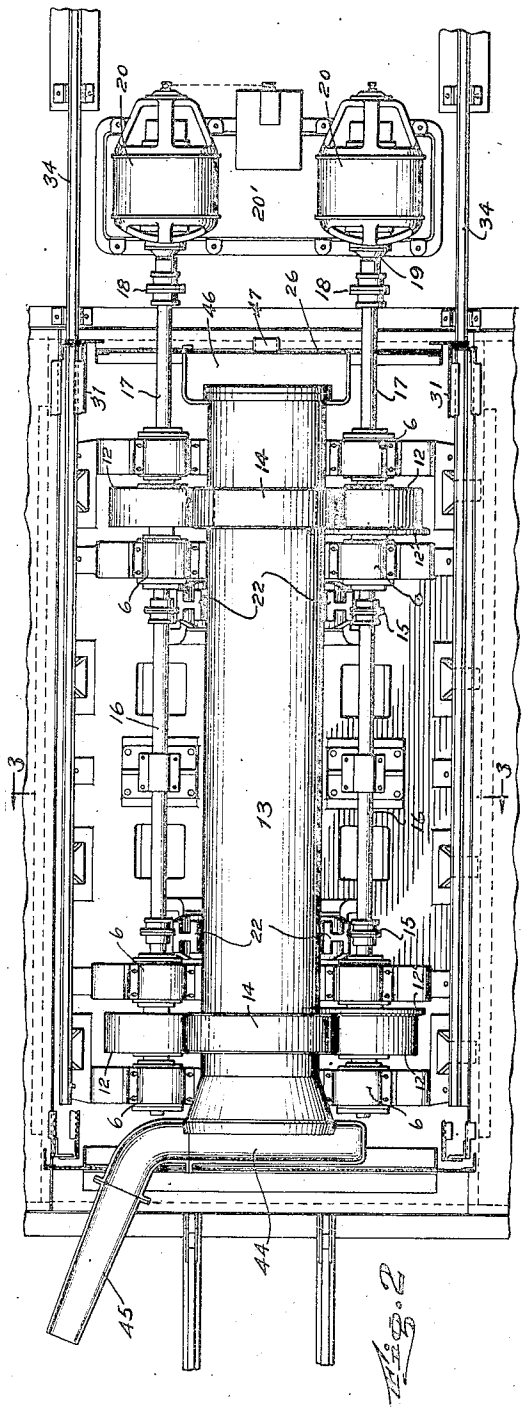


Fig. 2

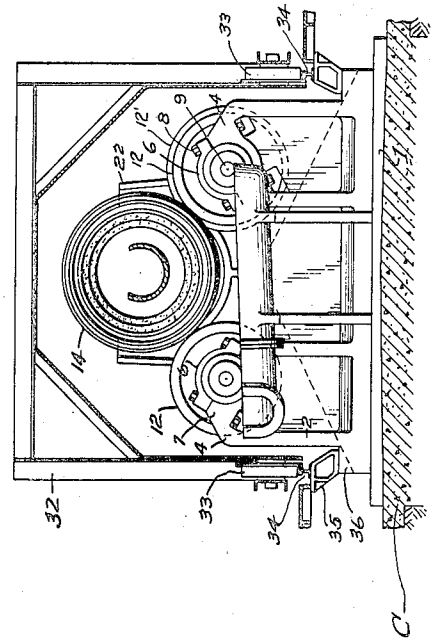


Fig. 4

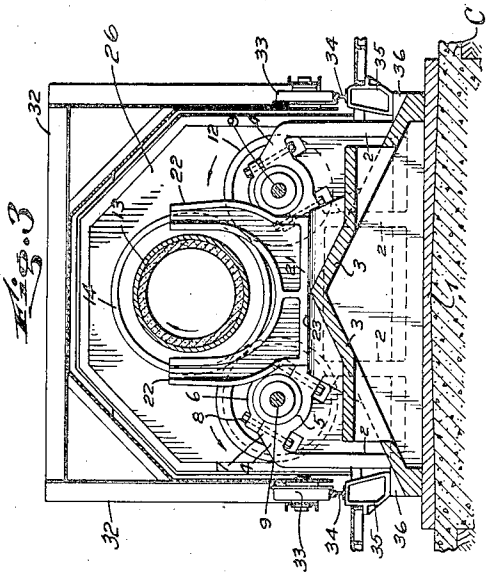


Fig. 3

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UNITED STATES PATENT OFFICE

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CENTRIFUGAL CASTING MACHINE

Application filed September 23, 1931. Serial No. 564,691.

Our present invention relates to certain new and useful improvements in centrifugal casting machines, and more particularly to that type of machine wherein each cast is made in a removably supported rotatable flask having a refractory lining, such as a lining of prepared sand or sand mixtures appropriately rammed or compacted in the flask.

The machine of the present application has been especially designed for the manufacture of cast iron bell and spigot pipes of relatively large diameters, as, for instance, pipes having a diameter of 14 inches and larger and lengths of 12 feet and longer, although it is to be understood that the invention is not limited to the manufacture of pipes of any particular size.

We have discovered from extensive experience in the art of centrifugal casting, that one of the greatest enemies to success in this method of casting, is excessive vibration of the casting machine and its flask during the casting operation,—excessive vibration being due in part to the speed of rotation and the weight of the flask and its casting, and in part to the construction of the machine, and one of the prime purposes of the present invention is to provide a centrifugal casting machine, wherein the possibility of vibrations is reduced to a minimum.

In machines of the type to which the present invention belongs, the flasks are made of metal, and when prepared for casting, have a lining of refractory material, such as sand, and where the flask is of a size to cast pipes of, say, 14 inches or larger in diameter, and from 12 to 16 feet or longer in length, the weight of the flask and its lining plus the weight of the pipe cast therein, runs into a matter of tons, and where flasks of such weight are employed the likelihood of excessive vibrations of the machine during the casting operation is much more pronounced.

An important object of the present invention is to provide a centrifugal casting machine wherein the likelihood of machine vibrations during the casting operation is reduced to a minimum, this being due largely to the machine construction and the manner of rotating the flasks.

A further object of the invention is to provide a centrifugal casting machine wherein the flask is driven or rotated through power derived directly from the rollers which support the flask.

A still further object of the invention is to provide a centrifugal casting machine with a simple safety means for preventing the flask from being thrown out of the machine during the casting operation in the event of breakage of the supporting rollers or other parts of the machine.

A still further object of the invention is to provide means associated with the machine for collecting and conducting away from the machine, such excess molten metal as may be thrown from or out of the flask during the casting operation.

A still further object of the invention is to provide a centrifugal casting machine with a longitudinally movable hood which normally surrounds the machine during the casting operation to protect the operators from flying particles of molten iron, which may be thrown from the machine during the casting operation.

To this and other ends the invention comprises the features of construction and combinations and arrangement of parts hereinafter described in detail and then more particularly pointed out in the appended claims.

In order to enable others skilled in the art to make and use our said invention we will now proceed to describe the same in detail in connection with the accompanying drawings, wherein,—

Fig. 1 is a side elevation of a centrifugal casting machine constructed in accordance with the invention;

Fig. 2 is a top plan view of the machine;

Fig. 3 is a transverse section on the line 3—3 of Fig. 2;

Fig. 4 is a transverse section on the line 4—4 of Fig. 1;

Fig. 5 is a longitudinal section of one of the flask-supporting rollers and its bearings; and

Fig. 6 is an end view of the cast metal bed-

frame of the machine showing a portion of two of the oppositely-arranged bearings for the shafts of the flask-supporting rollers.

Referring more particularly to Figs. 1, 2 and 6, the bed of the machine consists of a heavy metal casting comprising a base 1, and an integral supporting structure consisting of a pair of spaced vertical walls 2 arranged at opposite ends of the base and integral upwardly and inwardly-extending inclined walls 3 located between the walls 2, the adjacent ends of said inclined walls terminate in an inverted V-shaped ridge arranged substantially centrally of the base-frame. The base frame is suitably bolted to a heavy concrete foundation C, as more clearly shown in Fig. 1.

Each pair of spaced vertical walls 2 at opposite sides of the central line of the base casting terminate in upstanding cradle bearings 4, of which there are four in number, located in alinement at each side of the base casting. Each cradle has its upper end inclined downwardly and inwardly to provide a flat face in which a semi-cylindrical bearing seat 5 is formed, and each of said inclined faces is covered by a bearing cap 6 removably secured thereto by bolts 7 and their nuts 8. Each cap 6, has a semi-cylindrical bearing seat which cooperates with the complemental seat 5, of its associated cradle to provide a cylindrical bore for a bearing presently to be described. As will be seen by referring to Figs. 1 and 2, the cradles 4 at opposite sides of the central line of the base are arranged in pairs, the cradles and the bearings of each pair being spaced apart, and the pairs being positioned near the opposite ends of the machine.

A stub shaft 9 is supported for rotation in each pair of cradles, and each stub shaft is mounted for rotation in roller bearings 10, removably supported in the bearing seats 5, as more clearly shown in Fig. 5. Each stub shaft 9 carries a flask supporting roller 12, and each roller has a flange 12′ formed integral therewith at one side. As more clearly shown in Figs. 1, 2 and 4, the flanges serve to hold the flask 13, against endwise movement when resting upon supporting rollers 12. Because the shafts 9 as shown in Fig. 3 are located in bearings formed in the inwardly inclined faces at the top of the pedestals the weight and thrust of the flask 13 during rotation is directed radially on downwardly and outwardly inclined lines, and it has been found that this arrangement serves to provide a more sturdy construction with a minimum of vibration.

The flask 13 is provided near each end with an annular band 14, which form circular tracks upon which the rollers travel and thru the medium of which the flask is rotated as will hereinafter appear. Each pair of stub shafts 9, at the opposite sides of the machine, is connected by flexible couplings 15 to a power-transmitting shaft 16, and each of the stub shafts toward the rear end of the machine as shown at the right-hand side of Fig. 2, is connected to a driving shaft 17, connected by a flexible coupling 18 to the motor shaft 19 of an electric motor 20. The two motors 20 are mounted upon a base casting 20′ which is separate from the machine base so that vibrations set up by the motors will not be transmitted to the machine frame.

As will be seen by reference to Fig. 2, there is a separate motor 20, for each of the train of shafts 9, 16 and 17, or for each pair of flask-supporting rollers 12. The motors are synchronized for speed so as to drive all of the flask-supporting rollers at a uniform speed, and when rotating in the direction of the arrows shown in Fig. 3, the flask 13 will be rotated in the direction of the arrow shown in said Figure, and the molten metal when introduced into one end of the flask will be applied to the inner face of the refractory lining in the flask, according to the laws of centrifugal force, which are well understood in the art.

In order to prevent a flask from being accidentally thrown out of the machine during rotation thereof in the casting operation, in the event one or more of the supporting rollers should break or become out of alinement or otherwise, we have provided the machine with safety members consisting in the instance shown of two upstanding U-shaped bracket castings 21, the upstanding legs of which are disposed upon opposite sides of the flask 13, but sufficiently spaced therefrom to give the proper amount of clearance without flask interference during the casting operation. These U-shaped bracket castings 21 are bolted, or otherwise secured, to flat seats 23 formed upon a horizontal top wall of the two innermost vertical walls 2 of the bed-frame, as more clearly shown in Fig. 3. As will be seen, the legs of the U-shaped casting are spaced apart at their upper ends in order that the flasks may be lowered therebetween from above and onto the supporting rollers 14 and may also be lifted out of the machine in the same direction.

The length of each leg 22 of the U-shaped casting is such that when the flask 13 is in position upon its supporting rollers 12, a portion of the face of the flask will extend slightly above the free ends of the legs, as more clearly shown in Fig. 3.

The flasks 13 are placed in position in the machine and removed therefrom by means of an overhead crane or grapple (not shown) as is common in foundry practice.

In order to protect the operators and others standing about the machine, from flying particles of iron which may be thrown from the machine during the casting operation, we

provide the machine with a sheet metal enclosure consisting of a fixed upstanding front wall 24 secured in any suitable way at its lower end to a metal grating 25, and a fixed upstanding rear wall 26 likewise secured at its lower end to the grating 27. The front wall 24, has an opening 28, to permit the insertion and removal of the charging trough 29, for the molten metal, which trough is mounted upon a wheeled carriage 30, carrying a tilting ladle, not shown. Any suitable charging mechanism may be employed to charge molten metal into the machine, such for instance as that disclosed in pending application, Serial Number 564,690, filed September 23rd, 1931.

The machine proper is enclosed by a longitudinally movable hood 31, made of sheet steel which is suitably attached to a metal frame, which frame may be made up of angle irons 32, as clearly shown in Figs. 3 and 4. The hood is supported for movement upon flanged rollers 33, which travel upon tracks 34, secured to track-supports 35, which rest upon flanges 36 at opposite sides of the machine base casting 1, all as more clearly shown in Figs. 3 and 4. The tracks 34 extend rearwardly from the rear end of the machine and are of such length that the hood 31 may be shifted longitudinally a sufficient distance to completely uncover the machine, and thus permit a flask to be inserted therein or removed therefrom.

The tracks 24 are inclined downwardly from the rear end of the machine toward the front end so that the hood 31 will normally tend to move by gravity in a direction to completely cover the machine. The hood may be moved on its tracks to uncover the machine by any suitable means. In the present instance we have shown this means as consisting of a cable 37 attached at one end to the rear end of the hood, and at its other end to a flange 38 at the top of a vertically-arranged hydraulic cylinder 39, in which a plunger 40 is mounted for movement. Intermediate portions of the cable 37 pass over a fixed sheave 41, at one side of the cylinder 39, thence over a fixed sheave 42, located beneath the cylinder 39 and over a sheave 43, mounted at the upper end of the plunger 40, the arrangement being such that when fluid is admitted to the cylinder 39, by a suitable controller valve (not shown) the plunger 40 will be forced upwardly causing a pull on the cable 37 in a direction to draw the hood from over the casting machine. When the fluid in the cylinder 39 is permitted to escape, the plunger 40 will descend by gravity, thus permitting the hood to travel longitudinally on its tracks 34 to a position to completely cover the machine.

In order to convey away from the machine any molten iron that may be thrown or overflow from the ends of the flask during the casting operation, we mount an inclined trough 44 adjacent the upstanding front wall 24, and directly beneath the open end of the flask 13, said trough 44 having a downward extension 45 projecting thru an opening in the lower part of the wall 24, to conduct away such molten iron as may be discharged therein during the casting operation. Likewise a trough 46 with an outlet 47 is supported by the rear upstanding wall 26 of the machine enclosure with its open end located beneath the rear end of the flask.

The operation of the machine may be briefly described as follows:—

The flask with its refractory lining having been placed in the machine upon its supporting rollers 12, with the flanges 12′ of the rollers engaging the adjacent inner sides of the annular tracks 14 to prevent longitudinal movement of the flask during rotation, the two motors are then put in operation simultaneously to cause the flask to rotate at the required speed for the particular size pipe to be cast. The car 30 with its pouring spout 29 is then brought forward until the end of the spout reaches a position within the flask about midway thereof. The car 30 with its trough is then caused to move outward to slowly withdraw the trough at the same time the molten metal, through the operation of the tilting ladle, (not shown) is caused to flow thru the trough and into the flask, thus delivering the metal from the end of the trough where centrifugal force will distribute it evenly throughout the flask, distribution of the metal being effected while the trough is being withdrawn. The casting speed is maintained until the pipe is sufficiently cooled to allow the machine to be shut down, whereupon the current to the motors is cut off and the flask gradually comes to rest. The hood is then shifted longitudinally to expose the flask and the entire machine. An overhead crane with its grapple (not shown) is then attached to the flask and the latter is lifted from the machine and carried to a cooling pit (not shown) where the casting is allowed to cool. A fresh flask is then placed in the machine, the hood brought in position to cover the machine, and the described operations are repeated for each cast.

We consider the heavy cast-metal bed-frame with its upstanding cradle bearings and flask-supporting rollers constructed as described, as being an important feature of the invention, the said heavy bed-frame and the cradle bearings being so arranged that the shocks and strains resulting from the rapid rotation of the heavy flask will be uniformly distributed and absorbed in such a manner as to substantially eliminate vibrations, which is a desideratum of prime importance in centrifugal casting machines.

While we have shown and described a preferred embodiment of our invention, we do

not wish to be unnecessarily limited to the specific details of construction and arrangement of parts shown except as we may be limited by a fair interpretation of the appended claims.

What we claim is:

1. A centrifugal casting machine comprising a heavy base casting, oppositely-disposed flask-supporting and driving rollers journaled in suitable bearings carried by the base casting, means for driving the said rollers, and a pair of U-shaped brackets carried by the base one near each end thereof, the legs of each U upstanding on opposite sides of the space in which the supported flask rotates, and spaced apart at their upper ends to permit flasks to be lowered therebetween.

2. A centrifugal casting machine comprising a heavy base casting, oppositely-disposed flask-supporting and driving rollers journaled in suitable bearings carried by the said casting, means for driving said rollers, and a pair of upstanding arms adjacent each end of the machine at opposite sides of the space in which a supported flask rotates, said arms being spaced apart at their upper ends to permit a flask to be lowered therebetween and serving to prevent accidental lateral displacement of the flask from the machine.

3. A centrifugal casting machine comprising a base having two pairs of flask-supporting and driving rollers journaled thereon, an upstanding wall at the front and at the rear of the machine, the front wall having an opening therein for the passage therethrough of a charging spout, and a hood cooperating with said walls and movable longitudinally of the machine to cover and uncover the same.

4. A centrifugal casting machine comprising a base having two pairs of flask-supporting and driving rollers journaled thereon, a fixed upstanding wall at the front and at the rear of the machine, the front wall having an opening therein for the passage therethrough of a charging spout, a hood cooperating with said walls and movable longitudinally of the machine to cover and uncover the same, and means for moving the hood longitudinally to uncover the machine.

5. A centrifugal casting machine comprising a base having two pairs of flask-supporting and driving rollers journaled thereon, a fixed upstanding wall at the front and at the rear of the machine, the front wall having an opening therein for the passage therethrough of a charging spout, a hood cooperating with said walls and movable longitudinally of the machine to cover and uncover the same, and power means for moving the hood longitudinally in one direction, said hood being movable by gravity in the reverse direction.

6. A centrifugal casting machine comprising a base casting having two pairs of flask supporting and driving rollers journaled thereon, tracks at opposite sides of the machine, said tracks extending beyond one end thereof, a longitudinally movable hood mounted upon wheels travelling on said tracks, said tracks being inclined to cause the hood to move by gravity in one direction and power means for moving the hood in a reverse direction.

7. A centrifugal casting machine comprising a base casting having two pairs of flask supporting and driving rollers journaled thereon, tracks at opposite sides of the machine, said tracks extending beyond one end thereof, a longitudinally movable hood mounted upon wheels travelling on said tracks, said tracks being inclined to cause the hood to move by gravity to closed position, a cable attached to one end of the hood, and means for exerting a pull on the cable to move the hood longitudinally to uncover the machine.

8. A centrifugal casting machine comprising a heavy base casting provided with an integral supporting structure including a pair of spaced transversely arranged vertical walls located at each end of the base and upwardly and inwardly inclined walls rising from opposite sides of the base and extending longitudinally between the vertical walls and formed integral therewith, each vertical wall provided at its upper end with a pair of integral bearing pedestals, a shaft journaled in each pair of pedestals, and a flask-supporting and driving roller carried by each shaft for rotation between each pair of pedestals.

9. A centrifugal casting machine comprising a heavy base casting provided with an integral upstanding supporting structure including a pair of spaced transversely arranged vertical walls located at each end of the base, and upwardly and inwardly inclined walls rising from opposite sides of the base and arranged between and formed integral with said vertical walls with the ridge at the point of juncture of said inclined walls extending longitudinally and substantially centrally of the base casting, each vertical wall provided at its upper end with a pair of opposed bearing pedestals, a stub shaft journaled in each pair of pedestals, and a flask-supporting and driving roller carried by each shaft for rotation between each pair of pedestals.

Signed at Birmingham, in the county of Jefferson and State of Alabama this 17th day of September A. D. 1931.

CLARENCE DALE BARR.
STEPHEN DEWEY MOXLEY.