Oct. 4, 1949. C. W. NICHOLS 2,483,591

PIPE JOINT

Filed March 2, 1946

Fig. 1

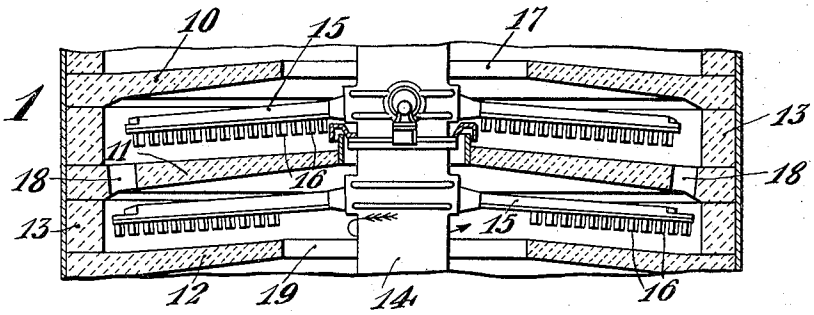


Fig. 2

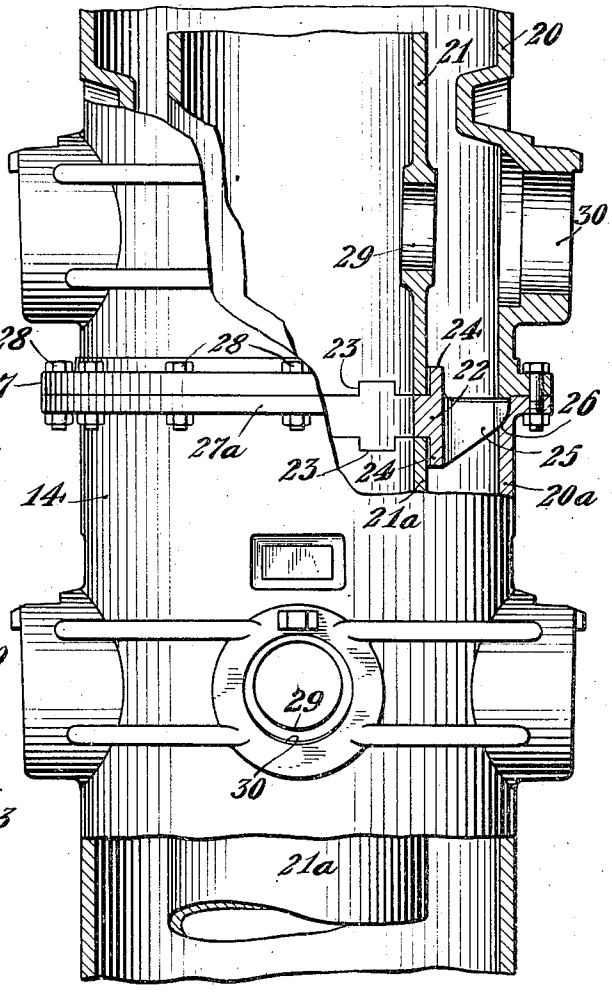


Fig. 3

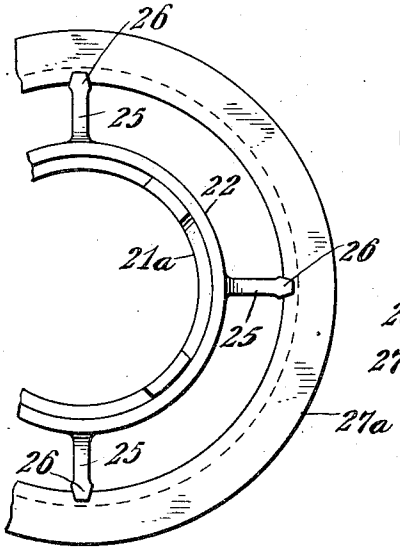
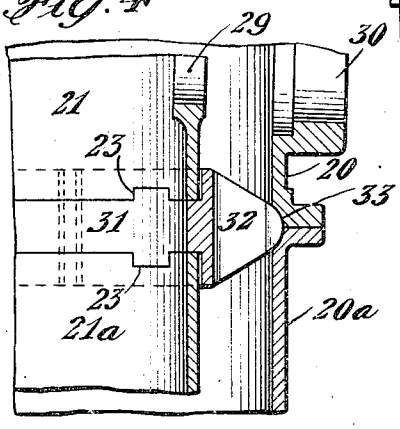


Fig. 4



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2,483,591

PIPE JOINT

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6 Claims. (Cl. 285—22)

1

This invention relates to roasting furnaces and more particularly to the construction of rotatable hollow shafts used in such furnaces.

In furnaces of this type, it is customary to provide a rotatable hollow shaft having hollow rabble arms attached radially thereto. The shaft has an inner passage through which cooling air is circulated to inner passages in the rabble arms, returning through outer passages in the rabble arms to an outer passage of the shaft. Shafts as used heretofore in such constructions have been made in sections, each of which comprised a single casting including integrally the inner and outer tubular members of the shaft, these members being usually united through a plurality of integral webs. That integral construction has various disadvantages as will be pointed out more fully hereinafter. In accordance with the present invention, however, a construction is provided having a hollow rotatable shaft which has separate inner and outer tubular members, which if desired may be formed of dissimilar metals.

Various other objects, features and advantages of my invention will be apparent from a reading of the following detailed description in connection with the accompanying drawing, in which:

Figure 1 is a sectional front elevation of a typical portion of a roasting furnace of a type in which my invention may be used, the section being taken substantially along the vertical axis;

Fig. 2 is an enlarged view, partly in section, of a shaft portion embodying my invention;

Fig. 3 is a horizontal sectional view of the shaft of Fig. 2; and

Fig. 4 is a vertical sectional view of an alternative form of construction.

In the furnace as shown in Fig. 1 a plurality of vertically spaced and substantially circular hearths are provided as at 10, 11 and 12. These hearths are surrounded and supported in the conventional manner by a substantially cylindrical furnace wall 13. A rotatable shaft 14 is mounted vertically at the center of the hearths. To the shaft are attached a plurality of rabble arms 15 having attached thereto teeth 16 so mounted as gradually to move the charge along as the rabble arms slowly rotate.

The charge to be roasted is introduced into the furnace at its top, passing successively downward under the impetus of gravity and the pushing of

2

the teeth 16 on the rabble arms, through central opening 17 to hearth 11, thence through peripheral openings 18 to hearth 12 and out central opening 19 to discharge or to similar lower hearths.

The structure and operation thus far described above are old in the art, being shown, for example, in the patent to Dudley Baird No. 1,669,925, issued May 15, 1928.

It has been found in practical operation that under the high temperature conditions of these furnaces the central shafts sometimes become fractured. The furnace space about the outer periphery of the shaft reaches high temperatures and the outer part of the shaft expands. The inner part of the shaft, on the other hand, is cooled more than the outer part by the circulating air and does not reach as high temperatures as does the outer part, therefore does not expand to the same extent. The result of this differential in amount of expansion is to put the integral connecting ribs under stress, sometimes to such an extent as to cause a fracture of the metal in the ribs. Replacement of the shafts in prior constructions has entailed considerable inconvenience and loss due to shutting down of the furnace and due to the fact that whole shaft sections might have to be replaced, an item of substantial cost, whenever a rib becomes fractured.

Moreover, shafts of integral construction as previously made are difficult to cast, requiring intricate and expensive patterns.

Turning now to the novel features of my invention, an inspection of Fig. 2 will show that I have constructed the shaft 14 of separate parts, outer tubular sections as at 20 and 20*a*, inner tubular sections as at 21 and 21*a*, and a keyed, supporting ring-shaped connective member 22. The latter member locks members 21 and 21*a* so that they can not rotate with respect to each other, such locking being accomplished by means of cooperating lugs and notches 23 on member 22 and at the end edges of tubular members 21 and 21*a*. Member 22 also has shoulders 24 extending upwardly and downwardly on the outside of tubular members 21 and 21*a*. Shoulders 24 hold members 21 and 21*a* in coaxial relationship. The ring-shaped member 22 is supported in the outer tubular member 20*a* and is locked to pre-

vent rotation relative thereto by means of keys or lugs 25 preferably located substantially symmetrically about the circumference of member 22, and integral therewith, and cooperating with similarly spaced notches 26 in outer tubular section 20*a*. The outer tubular sections 20 and 20*a* may be united circumferentially along flanges 27 and 27*a* by means of bolts 28. It will be noted that the lower edge of section 20 overlies lugs 25, thus retaining the ring member 22 securely in position.

Air for the purpose of cooling the rabble arms and shaft is introduced into the shaft through central tubular members 21, 21*a*, etc. to the central tubes of rabble arms 15 secured in sockets, as at 29, in a manner shown in the Baird patent referred to above. The air passes through the central tubes of the rabble arms and back through the outer tubes of said arms to cool them, then passes into the annular space between outer tubular sections 20 and 20*a* and inner tubular sections 21 and 21*a*, the rabble arms being secured to the outer tubular sections at sockets 30.

In Fig. 4 may be seen a modification of the structure made according to my invention in which the ring-shaped member 31 replaces member 22. Member 31 has formed integrally therewith keys or lugs 32 spaced preferably substantially symmetrically about its circumference and cooperating with grooves 33 in the outer tubular sections 20 and 20*a*. The keys 32 are approximately triangular in form, as shown in Fig. 4 and, as indicated above, are assembled in locking and supporting relationship not only with both inner tubular sections 21 and 21*a*, but also with both outer tubular sections 20 and 20*a*. In other respects ring member 31 performs the same function in the same way as does ring member 22.

It will be seen that I have provided a simple, reliable construction for a hollow rotatable shaft for use in a roasting furnace, which is more economical in upkeep than prior devices. In the first place, differences in the rate of heating between inner and outer parts of the shaft do not put its parts in under stress as the parts are separate rather than integral. Thus, the tendency of such parts to fracture as a result of strains due to uneven rates of heating is minimized. In the second place, if such a part should become fractured, it can be replaced with considerably less delay and expense because each unit is simple in construction and can readily be added to or removed from the assembled structure. Replacement of one part can be done without requiring replacement of the whole assembly, as in prior devices. In the third place, hollow shafts of the unitary, integral inner and outer wall structure heretofore used require expensive, intricate patterns and are very difficult to cast without causing flaws. Such patterns as are required for the parts of my assembled shaft are of much simpler construction and satisfactory casting of such designs is easier.

An additional advantage of my invention is that it makes possible the use of different metals and alloys for parts which are in use exposed to different temperatures. For example, it is possible to construct the outer part of the shaft, which is exposed to higher temperatures, of an alloy which will withstand such temperatures. At the same time, the inner parts of the shaft, which are cooled more by the circulating air and hence do not reach such temperatures, may be formed of a less expensive metal, for example

cast iron, which need not be able to withstand a high temperature.

What is claimed as new and desired to be secured by Letters Patent of the United States, is:

1. In a roasting furnace, a rotatable hollow shaft comprising successive inner tubular sections, successive outer tubular sections, and rings for supporting said inner tubular sections in non-rotatable and coaxial relationship to each other and to said outer tubular sections, each ring comprising a member for embracing adjacent ends of two inner tubular sections and being formed with portions for keying engagement with said outer tubular sections.

2. In a rotatable hollow shaft for a roasting furnace, the combination of inner tubular sections, outer tubular sections, and means for supporting and locking said inner tubular members in non-rotatable and coaxial relationship to each other and to said outer tubular sections.

3. A device for securing together successive tubular sections of an inner rotatable shaft and for securing same in position with respect to an outer surrounding hollow rabble supporting shaft of a furnace, comprising a ring-like member adapted to embrace adjacent ends of two inner shaft sections, the inside of said ring-like member being formed with portions adapted to have lug and notch locking engagement with said section ends to prevent relative rotation thereof, and the outer surface of said ring-like member being formed with a plurality of protruding integrally formed lugs adapted for keying engagement with the outer shaft.

4. A combination of parts for use in a furnace of a type having rabble arms carried by a central shaft, comprising an inner shaft formed of tubular sections, the adjacent ends of two succeeding sections being formed with cut-out portions, a ring-like member for embracing said ends and formed with portions adapted to engage said cut-out portions to prevent relative rotation of said shaft sections, an outer surrounding shaft formed of tubular sections having their inner wall surfaces spaced from the inner shaft sections, and means for detachably securing two successive sections of the outer shaft together, said ring-like member being formed with spaced lugs protruding therefrom, the inner wall surface of the outer shaft at the line of juncture of successive sections being formed with cavities in which the outer ends of said lugs are removably received, whereby said ring-like member acts to prevent relative rotation of the inner and outer shaft sections and serves to position the inner sections in predetermined spaced relation to the inside walls of the outer sections.

5. A device for holding in coaxial relatively non-rotatable relationship an inner rotatable tubular section and a surrounding hollow outer tubular section, comprising a pair of ring-like members each embracing an end of said inner section, the outer surface of each of said ring-like members having a plurality of fingers for keying engagement with said outer section, the inner surface of each of said members being formed with portions adapted for longitudinally slidable lug and notch engagement with said inner section to prevent relative rotation thereof and to permit a lengthening of the outer shaft relative to the inner shaft.

6. A device for holding in coaxial relatively non-rotatable relationship successive tubular sections of an inner rotatable shaft and for securing same in position with respect to an outer

surrounding rotatable hollow shaft of a furnace, comprising a ring-like member adapted to embrace adjacent ends of two inner shaft sections, the outer surface of said ring-like member having a plurality of protruding fingers for keying engagement with said outer shaft, the inside of said ring-like member being formed with portions adapted for keying engagement with said two inner sections to prevent relative rotation thereof but to permit a lengthening of said outer shaft relative to said inner shaft.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
819,986	Ellis	May 8, 1906