

[54] **MEANS FOR INTERNALLY COOLING
BRIQUETTING MACHINE ROLLS AND
SEGMENTS**

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Related U.S. Application Data

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[52] U.S. Cl. **425/471; 425/237; 425/335;
425/363**

[51] Int. Cl.² **B29C 3/02**

[58] Field of Search **425/237, 335, 363, 408,
425/471, 407; 100/155 R, 176**

[56] References Cited

UNITED STATES PATENTS

2,226,186 12/1940 Derhoef 425/471

3,142,866	8/1964	Pabo	425/471 X
3,635,637	1/1972	Bergendahl	425/363
3,662,821	5/1972	Saxon	425/363 X

FOREIGN PATENTS OR APPLICATIONS

213,035	2/1955	Australia	425/237
814,970	2/1956	United Kingdom	425/237

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[57]

ABSTRACT

Roll-type briquetting machines employed for high temperature operations such as in the compaction and briquette making of heated, reduced iron ore are cooled by the use of a flexible internal cooling system employing water. The flexibility of the machine requires that mold segments be removable from the rolls. This system provides means for circulating water through the roll segments from a common source and maintaining uniform temperature on the surface of each segment on the rolls.

10 Claims, 6 Drawing Figures

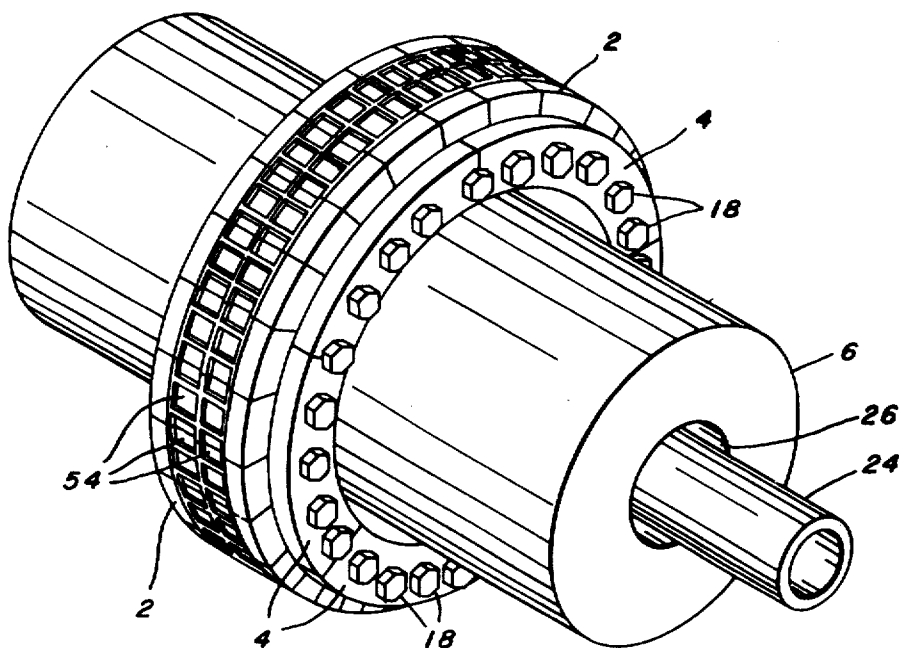


FIG. 1.

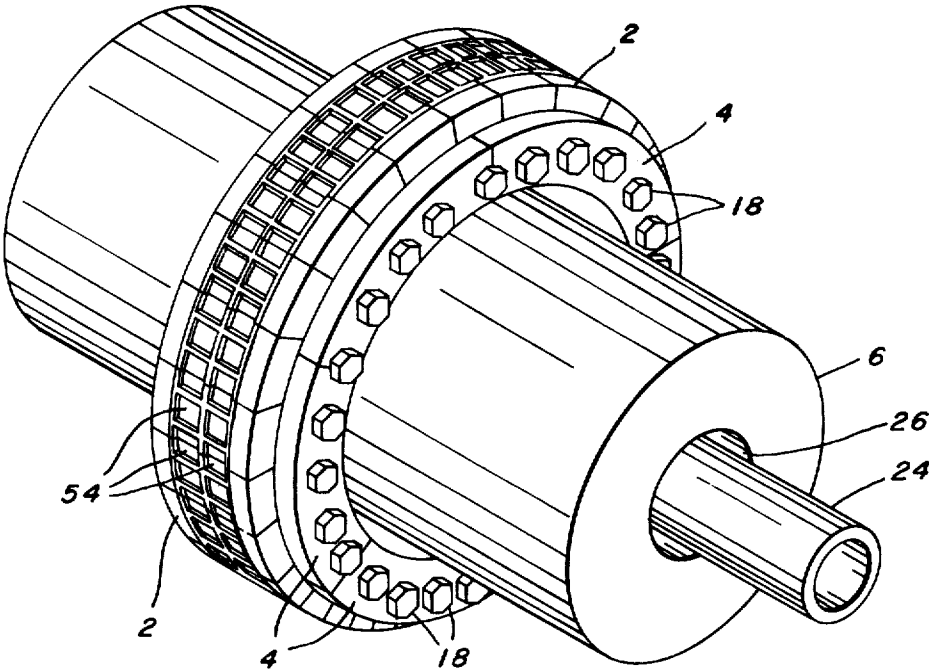
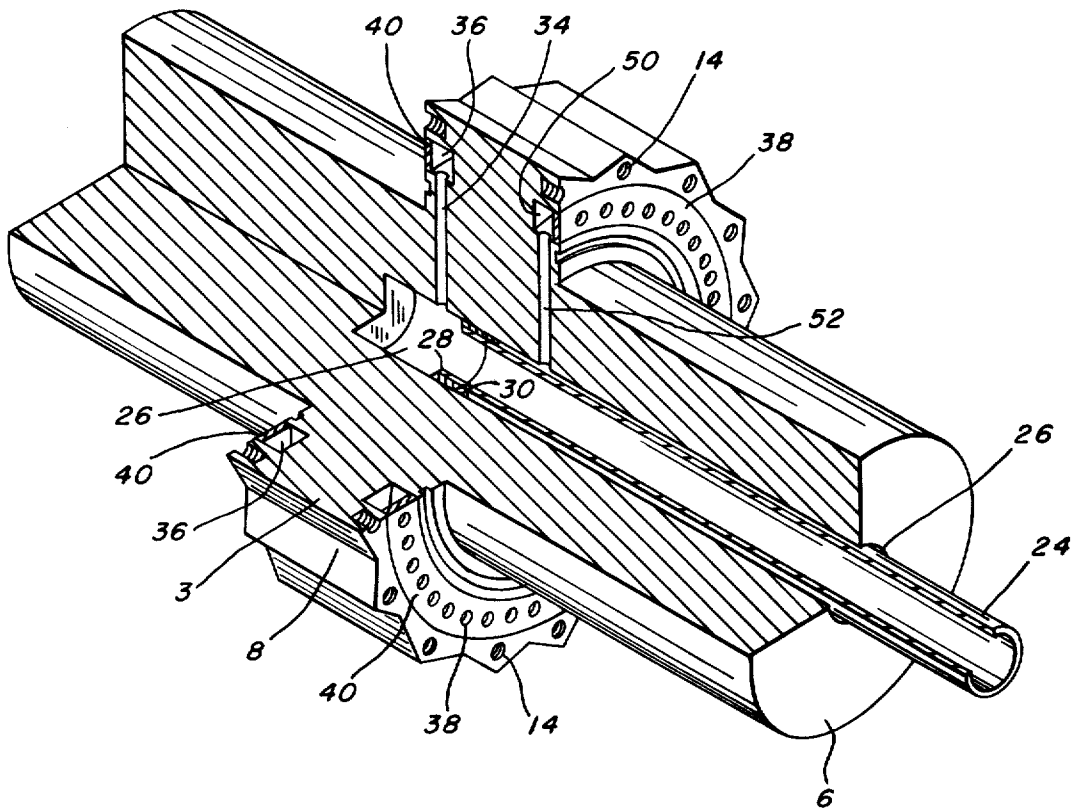


FIG. 2.



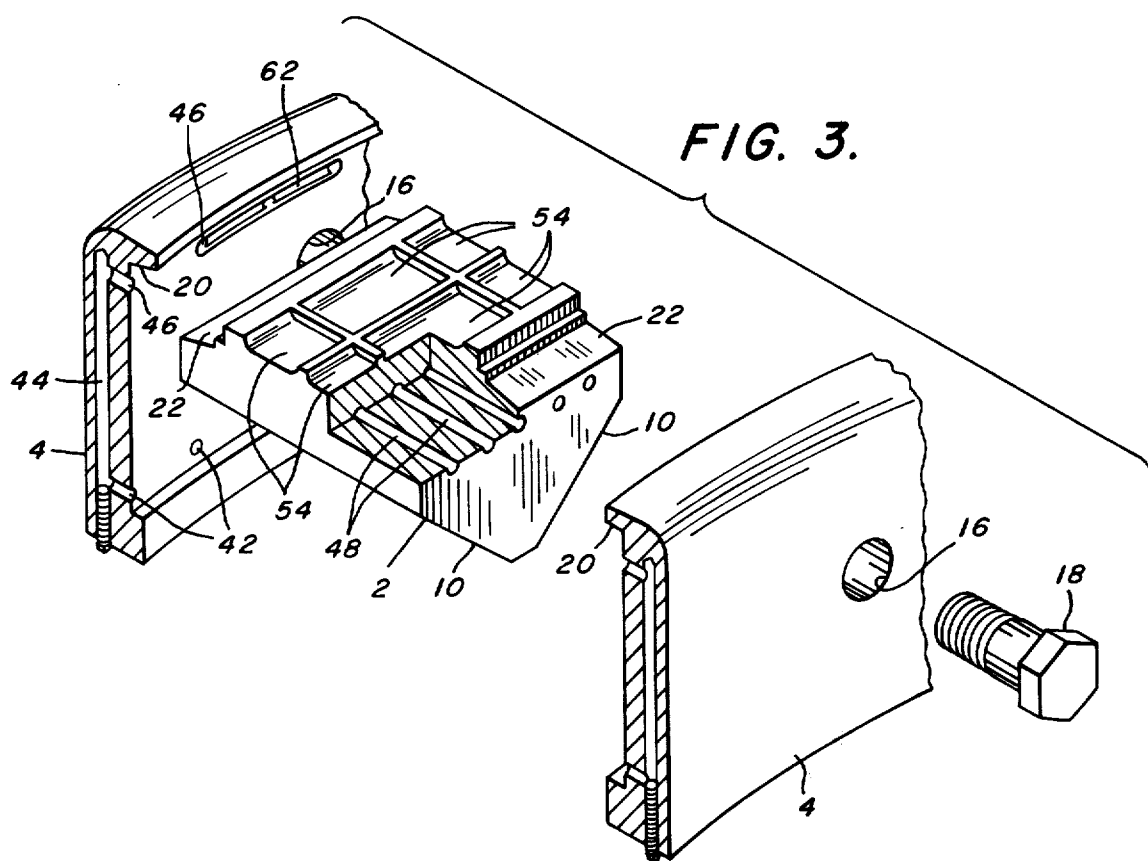


FIG. 4.

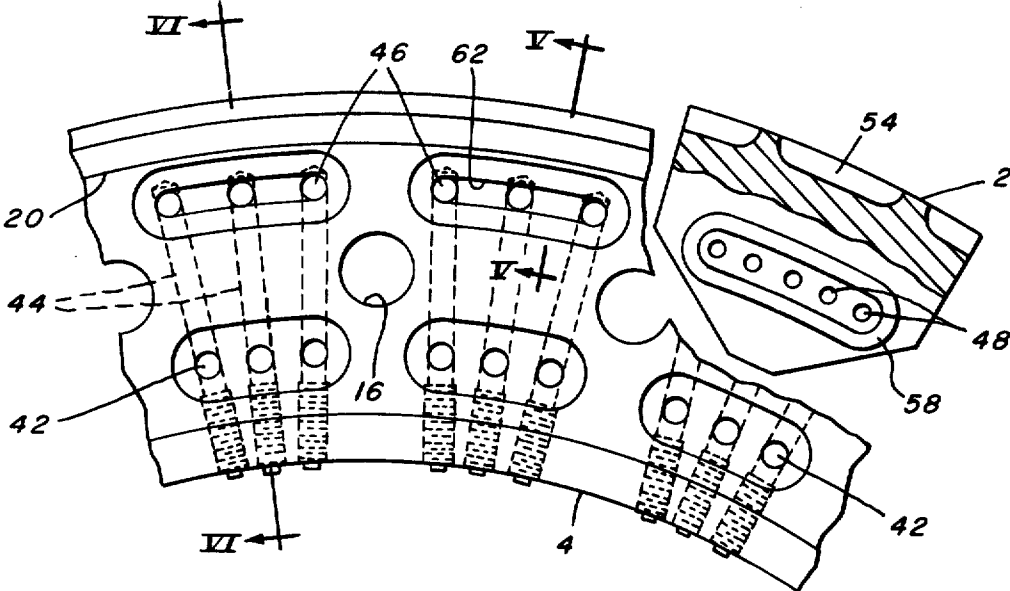


FIG. 6.

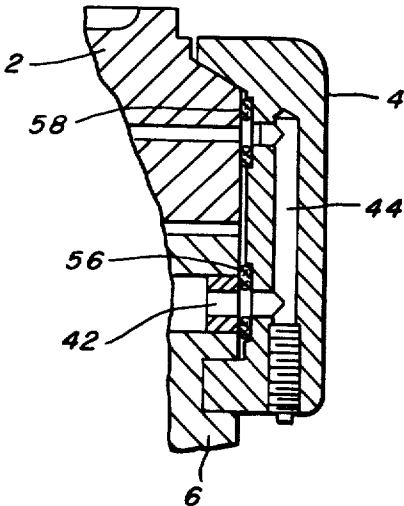
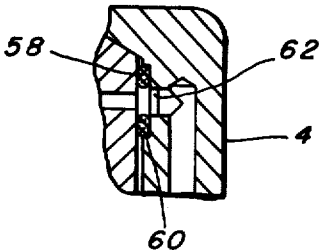


FIG. 5.



MEANS FOR INTERNALLY COOLING BRIQUETTING MACHINE ROLLS AND SEGMENTS

This is a division of application Ser. No. 422,641, filed Dec. 7, 1973, now U.S. Pat. No. 3,873,259.

BACKGROUND OF THE INVENTION

This invention relates particularly to the cooling of roll-type briquetting machines. It will be discussed particularly in connection with briquetting machines of the type disclosed in Komarek U.S. Pat. Nos. 3,077,634, 3,143,769 and 3,269,611. These patents describe a roll-type briquetting machine in which two rolls in tandem are rotated tangentially and in opposite directions. The material to be made into briquettes is forced between the rolls into the area known as the nip of the rolls. On each side of the nip is a retaining wall known as a cheek plate. As the hot, reduced ore or other material to be briquetted is forced into the nip of the rolls, and as the pressures of compaction distribute the material throughout the mold pockets, surface heat is generated on the segments which must be dissipated in order to reduce the wear and erosion of the segment parts and the means used to force the material into the nip.

The buildup of heat in the nip of the rolls also stimulates and encourages the adherence of material to the roll pockets. Adhesion of material such as heated, reduced iron ore to the mold pockets is highly undesirable because it results in deformed briquettes, breakage of segments, and reduces the efficiency of the briquetting process. Production rates of the briquetting machines are typically at the rate of 30 to 43 tons per hour. Also typically, the rolls move at from 15 to 28 revolutions per minute; a roll may contain as many as 36 to 250 pockets around the circumference of the roll, which is about 3 feet in diameter. Accordingly, it will be seen that it is typical for a given pocket to appear in the nip of the rolls every two or four seconds.

Prior to the present invention, the heating problem was for a time considered to be extremely difficult, if not insoluble. Thereafter, a spray system was developed on the outer circumference of the roll at 180° from the nip. The use of water sprays at one point only, however, has limitations which arise mainly from the rapid increase and decrease of segment temperature with each revolution. My invention involves the use of a particular system of internal water circulation which provides cooling continuously throughout the rotation of the roll, thus maintaining a relatively constant temperature throughout.

Prior to the present invention, it has been known to use water for the internal cooling of such devices as rolls. See, for example, U.S. Pat. No. 2,650,034. Water cooling has also been used for various types of presses, molds, and dies, such as disclosed in U.S. Pat. Nos. 3,556,201, 3,525,098, 3,735,805, 3,213,491, 3,259,175 and in German Pat. No. 1,071,733. The control of temperature during an iron briquetting process is discussed in U.S. Pat. No. 3,556,722.

SUMMARY OF THE INVENTION

I have invented a system for internal water cooling of briquette mold segments during operation on a tandem roll briquetting machine. The system permits the use of relatively high temperatures and compaction pressures while at the same time decreasing the incidence of

sticking, and increasing the ready release of briquettes from the roll pockets.

My invention provides the circulation of water in a closed system within the roll and briquetting mold segments. It is capable of removing at least 500,000 btu/hour from a typical machine as described herein.

A preferred embodiment of my invention is shown in the drawings, of which

FIG. 1 is a perspective view of an assembled roll unit including briquette mold segments,

FIG. 2 is a cutaway view of the roll and its shaft, showing the mold segment seats and part of the internal water circulation system of my invention,

FIG. 3 is an exploded view of a roll segment showing the seating within the segmented clamps,

FIG. 4 is a detailed portion of a clamp ring, and

FIGS. 5 and 6 are sectional views of the subject of FIG. 4.

Referring to FIG. 1, the assembled briquette roll unit comprises roll core 6, a pipe 24 axially within it, and peripheral roll segments 2 secured by clamps 4 having bolt and nut assemblies 18 to secure them. The roll segments 2 include briquette pockets 54.

Referring to FIG. 2, the cutaway briquette roll assembly shows the roll core 6 placed around the pipe 24. Centered on roll core 6 is the segment-supporting roll body section 3. The purpose of the roll body section 3 is to provide seats 8 in the shape of V's. The seats 8 are designed to hold segments 2, not shown in FIG. 2.

Pipe 24 is inserted into larger trepanned hole 26 to provide equal passages through the pipe 24 and around its circumference. Collar 28 is welded to pipe 24 and ring 30 is attached to provide a watertight barrier when pipe 24 is threaded or otherwise affixed to roll core 6.

Water is introduced into pipe 24 and channeled to radial passages 34 and thence to annular grooves 36 which functions as a supply manifold. The holes 38 are drilled into cover plate 40.

In FIG. 3, an exploded view of two opposed clamps and the manner of fitting on a segment is shown. The clamps 4 may be seen to be connected by bolt 18. Between them is a roll segment 2 which contains pockets 54. This assembly, as the previously described roll assembly, is conventional except for the water circulation elements described below. Operation of my invention is illustrated as follows.

Water flows through holes 38 from groove 36 to holes 42 in clamp ring 4. The holes 44 channel water into holes 46 then through holes 48 in segment 2.

Water flow is through segment 2 into outlet clamp 4, further into outlet annular groove 50 which operates as a discharge manifold, thence to radial passage 52.

It can be seen that the water exiting through the trepanned hole 26 does not intermix with the inlet water inside the pipe 24. A divided flow of cooling water is directed in a once through passage 48 inside the segments 2 to cool the segment surfaces 54. Pipe 24 rotates with the roll; water is introduced to it from a conventional rotary joint not shown. If it is desired for the pipe to be stationary, a conventional rotary joint may be used in the interior of the roll.

A unique design feature of my invention is the manner in which the clamp rings 4, segments 2 and roll body 6 are gasketed at 56 and 58 as shown in FIGS. 4 and 6. FIG. 5 shows the obround gasket 58 inserted in retaining groove 60. FIG. 6 shows the obround gasket 56 and 58 in operating attachment with clamp 4, tight-

ened against roll body 6 and segment 2. The recess 62 provides a manifold-type passageway distribution header, or discharge recess, depending on the flow direction, for the cooling water to flow to or from the three holes 46 in clamp 4 to or from the five holes 48 in segment 2. The water is distributed and flows uniformly and with approximately equal velocity (i.e. plus or minus 10%) through each of the five holes, resulting in a uniform temperature over the surface of the segment pockets 54. A once-through system is preferred since no cooling tower or water treatment is required.

The arrangement of the gaskets provides for the expansion and contraction of the various components, without leakage between the joints of abutting parts. The gaskets are resilient to provide tight seals and to permit radial adjustment of the segments 22, to prevent rubbing of the cheek plates (not shown) or other stationary parts of the machine, and to align the segments of one roll with those of the other to obtain symmetrical briquettes.

The diameter of the holes through the segments should be sufficient to avoid the possibility of plugging by entrained solids and scale formation but large enough to remove the heat introduced to the machine during use. In the case of a typical machine used for the manufacture of briquettes from hot reduced ore, where the temperature of the ore itself, without any heat of compaction and friction is likely to be over 900°F, the holes should be large enough, that is, provide enough water, to remove 500,000 btu's/hr when flowing with a velocity sufficient to achieve turbulence. As a practical matter, the holes should not be less than about ¼ inch diameter and not more than ¾ inch diameter, although the upper limit depends mainly on the size of the machine. The achievement of turbulence is important for energy pick-up, proper mixing, and the elimination of channeling and/or dead spots in the system. There should be at least three holes per segment, and the distance between them should not be less than about three-fourths of the diameter of the holes and/or greater than two times the diameter of the hole. The distance from a hole to the nearest point on the surface to be cooled should not exceed three times the distance between hole centers, and should not be less than that distance.

My invention is not limited to the above preferred and illustrative embodiments but may be otherwise practiced within the scope of the following claims.

I claim:

1. Apparatus for making reduced iron ore briquettes comprising a plurality of mold segments adapted to be placed on the periphery of a mold support, said mold segments having transverse passages for conducting water through them, and a mold support in the form of a roll adapted to accommodate a plurality of mold segments around its periphery, said mold support also having transverse passages for cooling water, and manifold means for circulating cooling water from the mold support to the mold segments.

2. Apparatus of claim 1 including an axial passage in the core of the roll and a plurality of radial passages in said roll connected to the transverse passages therein.

3. Apparatus of claim 1 in which the manifolds include annular inlet and discharge passages on the mold support.

4. Apparatus of claim 1 in which the manifolds include distribution headers and discharge recesses for each mold segment.

5. Apparatus of claim 4 in which the headers and recesses are located in clamp rings.

6. Apparatus of claim 4 in which the headers and recesses are sealed by resilient gaskets.

7. A briquette mold roll comprising a roll support, a plurality of mold segments on the periphery thereof, said segments each containing at least three transverse passages therethrough, and means for circulating cooling water through the passages in the segments while the roll support turns.

8. A mold roll comprising a mold roll body, an axial pipe for introducing water thereto, radial water passages leading to the periphery thereof, an annular manifold therefor, means for directing water from said annular manifold to peripheral mold segments, means for receiving water from peripheral mold segments, an annular discharge manifold connected thereto, radial discharge passages leading from the discharge manifold toward the axial pipe, and a passageway concentric to said pipe for removing spent cooling water.

9. Apparatus of claim 7 in which the means for circulating cooling water through the passages in the segments includes segment clamps having manifold recesses and means for conveying water to and from annular recesses in the mold roll.

10. Apparatus of claim 9 including radial passages for conveying water to and from the annular recesses and axial passages for conveying water to and from the radial passages.

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