July 26, 1960 A. W. MATHEWS ET AL 2,946,086

APPARATUS FOR FORMING PELLETS FROM PULVERULENT MATERIAL

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FIG. 1

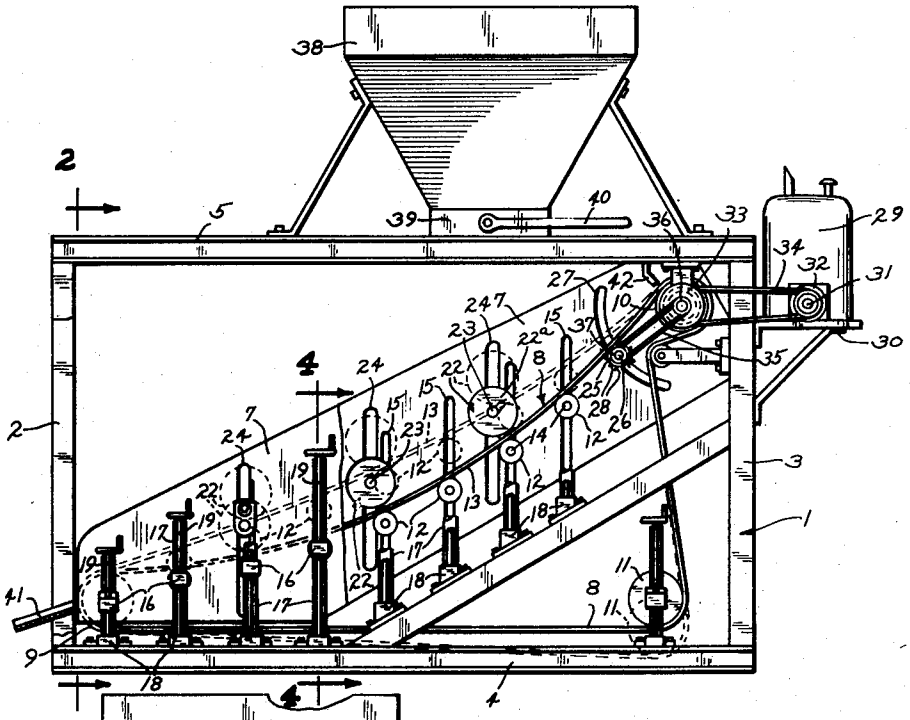
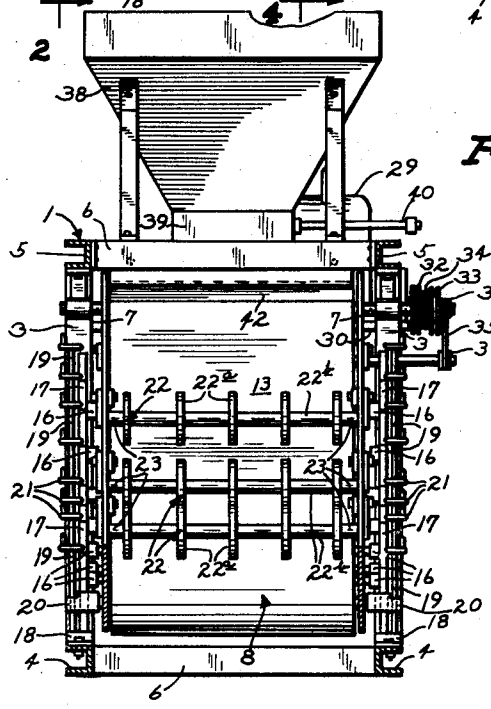


FIG. 2



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FIG. 3

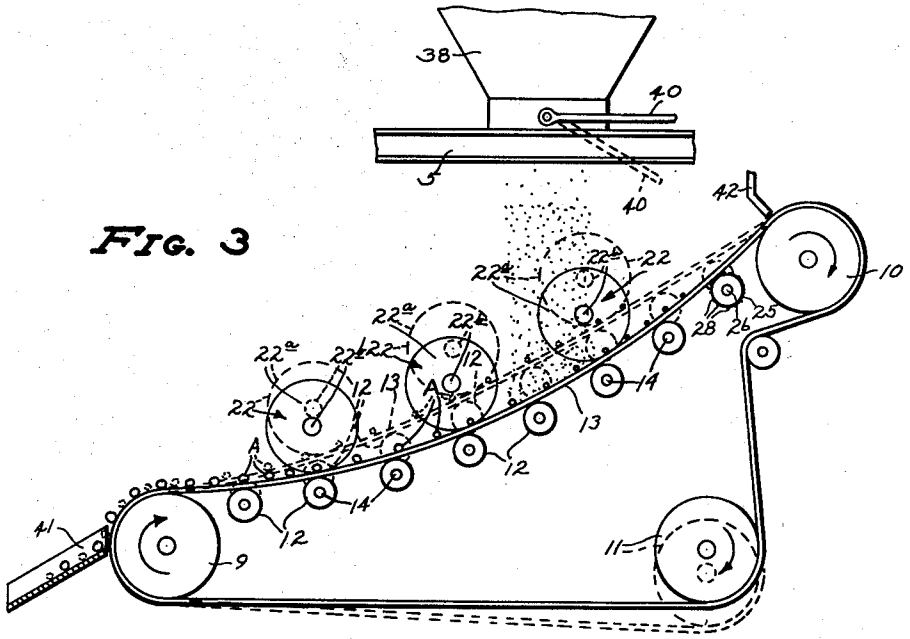
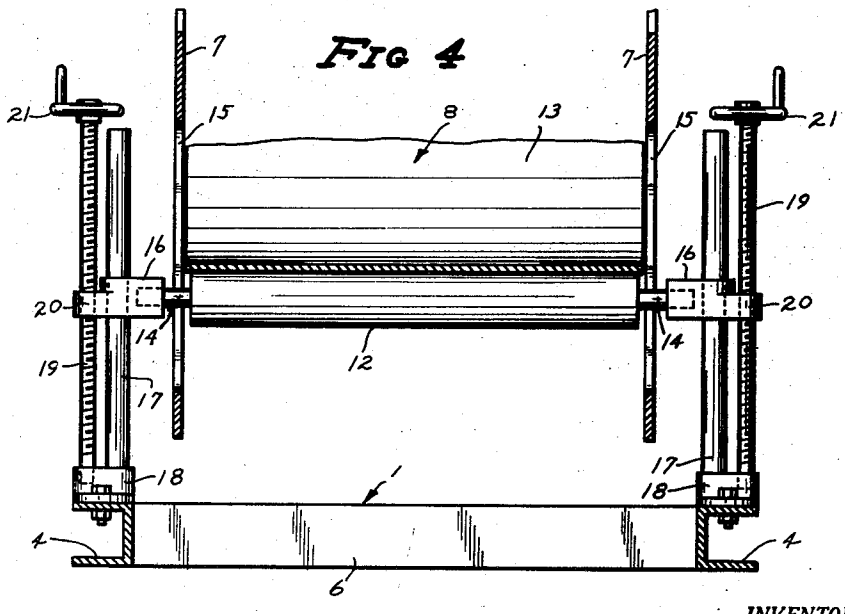


FIG 4



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APPARATUS FOR FORMING PELLETS FROM PULVERULENT MATERIAL

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2 Claims. (Cl. 18—1)

Our invention relates generally to the pelletizing of finely ground or pulverulent material. More particularly our invention relates to the forming into green pellets of finely ground oxidic iron ore and concentrates thereof, such as magnetite produced from taconites, in order that said pellets may thereafter be used in blast furnaces, open hearth furnaces and the like in the iron and steel industry. Such green pellets must subsequently be subjected to a hardening process before eventual use in the blast furnaces and the like. However, our invention relates solely to the formation of such green pellets for such hardening process or processes.

The primary object of our invention is the provision of a process for forming green pellets whch is inexpensive to practice and which is capable of a continuous and efficient production of green pellets at a minimum of expense.

A further object of our invention is the provision of an apparatus for carrying out our novel process, which apparatus is relatively inexpensive to produce and which is highly efficient in its operation.

A further object of our invention is the provision of an apparatus of the class described which requires a minimum of labor to operate and which may be serviced at a minimum of cost and with a minimum of loss of time.

The above and still further objects of our invention will become apparent from the following detailed specification, appended claims and attached drawings.

Referring to the drawings wherein like characters indicate like parts throughout the several views:

Fig. 1 is a view in side elevation of our novel apparatus, some parts being broken away and some parts shown in section;

Fig. 2 is a view partly in vertical section and partly in end elevation as seen from the line 2—2 of Fig. 1;

Fig. 3 is a generally schematic view in side elevation; and

Fig. 4 is an enlarged fragmentary view in vertical section as seen from the line 4—4 of Fig. 1.

Referring with greater particularity to the drawings, the numeral 1 indicates in its entirety a frame structure comprising spaced vertical front frame members 2, spaced vertical rear frame members 3, spaced horizontal lower side frame members 4, spaced horizontal upper side frame members 5 and upper and lower horizontal end frame members 6.

Suitably secured to the frame 1, intermediate the side frame members 4, 5 is a pair of laterally spaced mounting plates 7. Mounting plates 7 extend longitudinally of the frame 1 and, preferably and as shown, incline upwardly from the front to the rear thereof.

An endless conveyor belt 8 is shown as being entrained over a horizontally disposed idler roller 9 extending transversely between and journalled in the mounting plates 7 adjacent the lower front end of the frame 1, a horizontally disposed drive roller 10 having opposite ends journalled in the mounting plates 7 adjacent the upper rear end of the frame 1, and a conventional horizontally

disposed take-up roller 11 suitably secured for rotation to the lower side frame members 4 adjacent the lower rear end of the frame 1.

As shown particularly in Figs. 1 and 4, a plurality of horizontally disposed longitudinally spaced supporting rollers 12 underlie and support the upper service flight 13 of the belt 8. Rollers 12 are formed at their opposite ends to provide trunnions 14 which extend through vertical slots 15 in the mounting plates 7 and which are journalled in travelers 16 slidably mounted on vertical guide posts 17. The lower ends of the posts 17 terminate in brackets 18 which are suitably secured to opposite sides of the frame 1. For the purpose of imparting vertical adjustments to the travelers 16 and the rollers 12 carried thereby vertical screws 19 are provided. The lower ends of the screws 19 are journalled for rotation in the brackets 18, have threaded engagement with lateral extensions 20 of the travelers 16, and are provided with handles 21 at their upper ends. Overlying the belt 8, comprising the upper service flight 13 thereof, and forcing the belt 8 downwardly into engagement with the supporting rollers 12 are longitudinally spaced hold down rollers 22 having their reduced trunnion-forming opposite ends 23 slidably received within generally vertically extended slots 24 in the mounting plates 7. Preferably, and as shown in Fig. 2, the hold down rollers 22 comprise a plurality of laterally spaced relatively narrow disc-like roller elements 22*a* mounted for common rotation on axles 22*b*. By this novel arrangement, it should be obvious that the radius of the service flight 13 of the belt 8 may be varied at will in its increasingly upturned path of travel from the front to the rear end of the frame 1, for an important purpose which will hereinafter be explained in greater detail.

Underlying the upper end of the service flight 13 of the belt 8, so as to impart vibrations thereto generally transversely of the path of travel thereof, is a rapper roller 25 having its reduced opposite ends 26 journalled in segmental slots 27. The axes of the segmental slots 27 are generally concentric to the axis of the drive roller 10. The peripheral surface of the rapper roller 25 is provided with a plurality of radially projecting circumferentially spaced ribs 28 which may be formed from rubber or other suitable material. Obviously as the radius of the flight 13 of the belt 8 is varied it will be desirable, if not necessary, to vary the position of the rapper roller 25 in the slot 27, and means, not shown, is provided for locking the rapper roller 25 in adjusted positions in the slots 27.

A suitable source of power, such as a motor 29, is mounted on a bracket 30, adjacent the upper rear end of the frame 1. The motor 29 is provided with a drive shaft 31 upon which is mounted for common rotation a conventional multi-diameter sheave 32. Entrained over the sheave 32 and over a cooperating multi-diameter sheave 33 on one end of the drive roller 10 is a V-belt 34. This arrangement obviously makes it possible to impart varying rates of speed to the belt 8 as varying situations may require.

A V-belt 35 has one end entrained over a sheave 36, mounted for common rotation with the sheave 33, and over a sheave 37 fast on one end of the rapper roller 25, thus imparting rotation to the rapper roller 25.

Suitably secured to the upper portion of the frame 1 is a supply hopper 38, the valve-equipped lower end 39 of which overlies the longitudinally intermediate portion of the service flight 13 of the belt 8, whereby to uniformly deposit a mass of pulverulent material to be pelletized upon the upper surface of the belt 8. Discharge of pulverulent material from the hopper 38 may be constant or intermittent, as the situation requires, through the means of a suitable valve 40.

In carrying out our novel process with our novel ap-

paratus above described, a given mass of pulverulent material is fed into the supply hopper 38. Normally this material is rendered compactible (and by compactible we mean capable of being formed into balls or other such shapes by compression) by the addition of a suitable amount of moisture. As such compactible material is uniformly discharged from the lower end 39 of the hopper 38 onto the upper surface of the flight 13 of the belt 8, it rolls backwardly against the belt 8 as the pitch thereof progressively increases from the lower end to the upper end of the flight 13. This rolling backward of the mass causes the formation of pellets A which increase in size and specific gravity, in direct proportion to the extent of rolling action imparted thereto. As these pellets A approach the upper end of the flight 13 their size and specific gravity is such that, aided by the rapping action of the rapper roller 25, they roll backwardly under the action of gravity, and against the upward movement of the belt, off the lower end thereof where they are received on a discharge chute 41. As above indicated, vertical adjustment of the supporting rollers 12, whereby to vary the radius of the path defined by the service flight 13 of the belt 8 from its lower to its upper end, together with variation of the rate of speed of the belt 8, may be required depending upon the compactibility of the pulverulent materials being formed into pellets A.

Not infrequently some of the pulverulent material fed onto the upper surface of the belt 8 adheres thereto. The rapper roller 25 removes most of such material. However, in order to positively remove any material adhering to the belt 8 we provide an elongated transversely extending wiper or scraper blade 42 which, as shown, is longitudinally beyond the rapper roller 25 and preferably in overlying relationship to the drive roller 10 so as not to be affected by vibrations imparted to the belt 8, in the service flight 13 thereof, by the rapper roller 25.

While we have described our novel process and apparatus in rather basic and simplified forms, we wish it to be specifically understood that each is capable of modification without departure from the scope and spirit of the invention as defined in the appended claims.

What we claim is:

1. Apparatus for forming pellets from compactible material comprising, frame structure, an endless belt mounted in said frame structure and defining an upper service flight, means for positioning and retaining the belt in said service flight in an increasingly upturned path of travel including a plurality of longitudinally spaced supporting rollers underlying said belt and a plurality of independent longitudinally spaced hold down rollers engageable with the upper face of said belt and retaining said belt in engagement with said supporting rollers, said hold down rollers each comprising a plurality of transversely spaced relatively narrow roller elements mounted on common axes, means for imparting vertical adjustments individually to each of said supporting and hold down rollers, means for uniformly depositing a mass of said material on the upper surface of the belt defining said service flight intermediate the upper and lower limits thereof, and power means for imparting movements to said belt at varying rates of speed.

2. Apparatus for forming pellets from compactible material comprising, frame structure, an endless belt mounted in said frame structure and defining an upper service flight, means for positioning and retaining the belt in said service flight in an increasingly upturned path of travel including a plurality of longitudinally spaced supporting rollers underlying said belt and a plurality of independent longitudinally spaced hold down rollers engageable with the upper face of said belt and retaining said belt in engagement with said supporting rollers, said hold down rollers each comprising a plurality of transversely spaced relatively narrow roller elements mounted on common axes, means for imparting vertical adjustments individually to each of said supporting and hold down rollers, means for uniformly depositing a mass of said material on the upper surface of the belt defining said service flight intermediate the upper and lower limits thereof, a power operated rapper roller underlying said belt adjacent the upper limit of said service flight and mounted in said frame for adjustments generally transversely of the path of travel of said belt in said flight, power means for imparting rotary movements to said rapper roller, and power means for imparting movements to said belt at varying rates of speed.

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