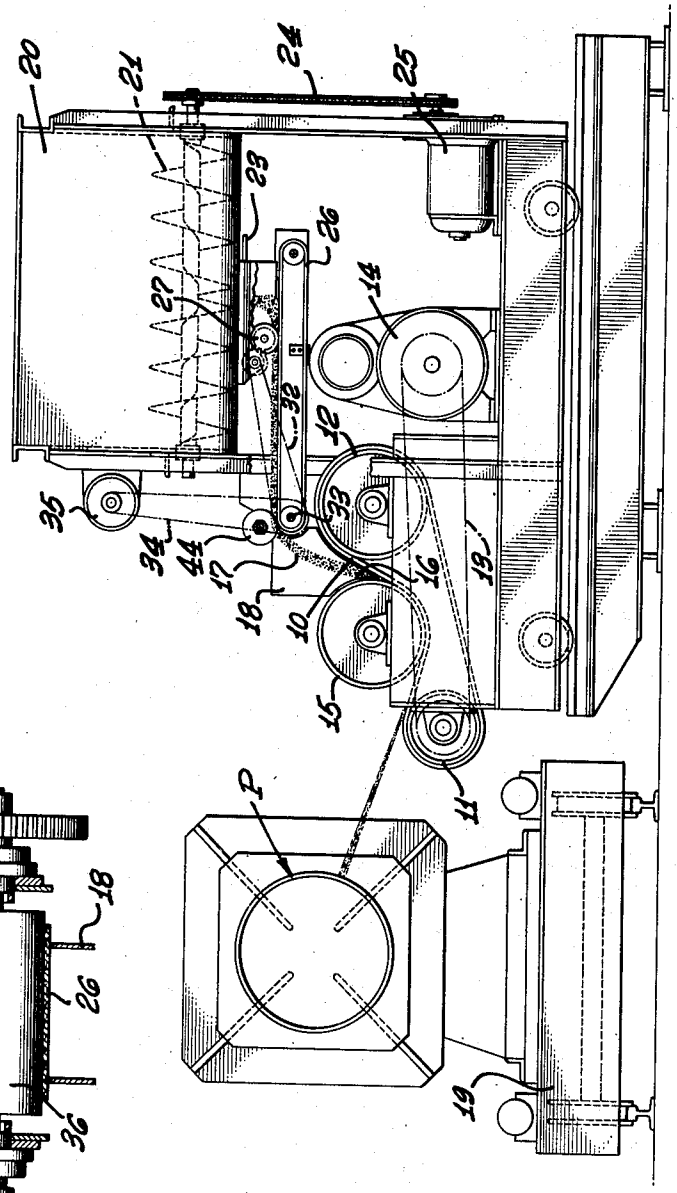
Sept. 8, 1953 K. E. JAMES 2,651,404

MACHINE FOR APPLYING COATINGS

Filed April 2. 1948 2 Sheets-Sheet 1

Fig. 1.



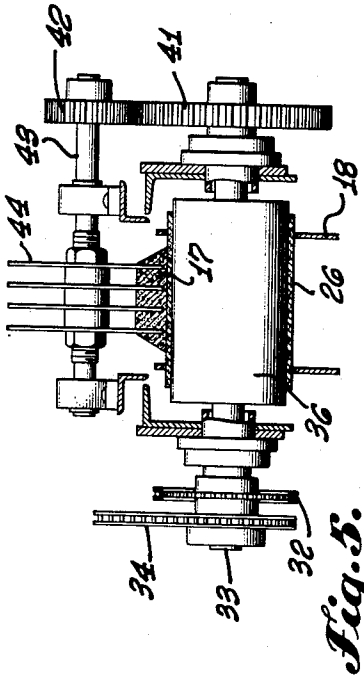


Fig. 5.

Kenneth E. James,
INVENTOR.

BY Hazard & Miller

ATTORNEYS

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2 Sheets-Sheet 2

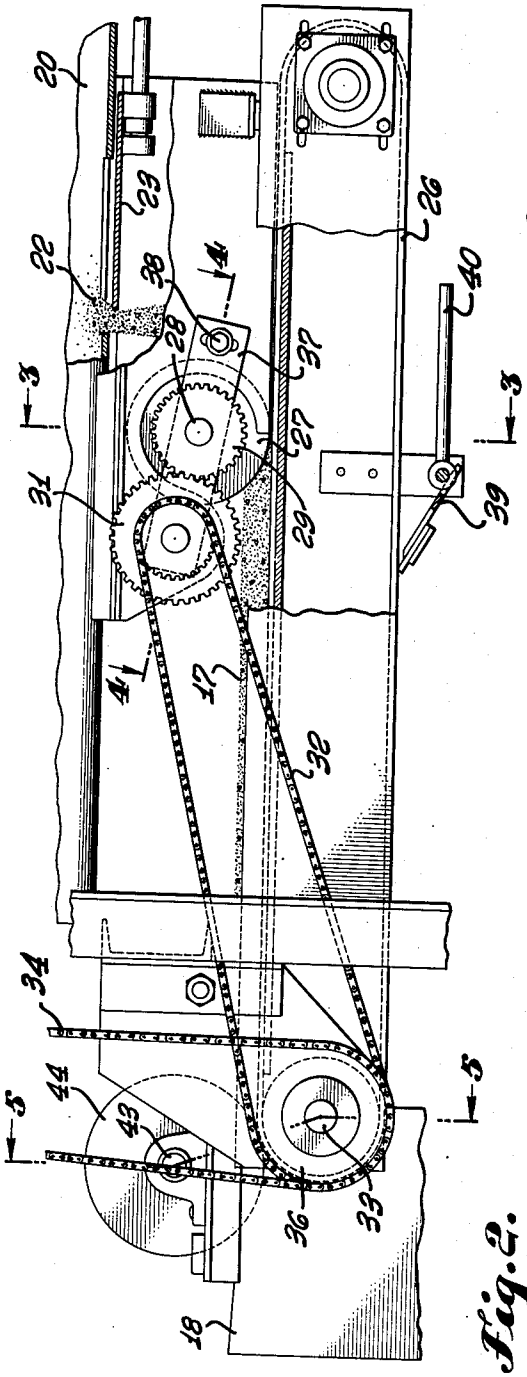

Fig. 2.

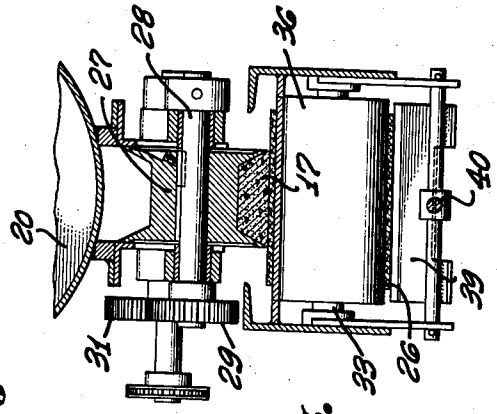

Fig. 3.

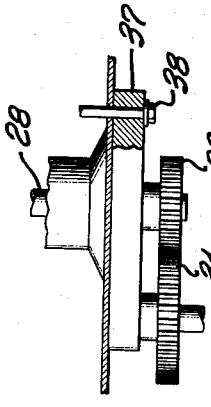

Fig. 4.

Kenneth E. James,
INVENTOR.

BY Hazard & Miller

ATTORNEYS

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UNITED STATES PATENT OFFICE

2,651,404

MACHINE FOR APPLYING COATINGS

Kenneth E. James, Baldwin Park, Calif., assignor to United Concrete Pipe Corporation, Baldwin Park, Calif., a corporation of California

Application April 2, 1948, Serial No. 18,555

5 Claims. (Cl. 198—128)

1

This invention relates to a method and apparatus for projecting or throwing finely divided or comminuted materials at high velocities. The invention is suitable for throwing finely divided materials such as sand in sand blasting, the stock piling of finely divided materials, the segregation of fine particles from coarse particles and the applying of coating materials. As the invention will have a very great use in applying cementitious coatings it will be described in conjunction therewith although it is not restricted thereto.

Heretofore machines for applying coating materials have been provided wherein the coating material of a certain consistency is by some suitable means thrown against the surface to be coated with sufficient velocity to cause a substantial portion of the coating material to adhere to the surface. Where the coating material is of a cementitious nature it has been found that two important factors largely determines the ultimate compressive strength of the finished coating. These are the density of the applied coating and the water cement ratio. The density of the applied coating is determined largely by the velocity with which the coating material strikes the surface to be coated and it has been found that with cementitious coating the velocity should be in the neighborhood of from 5,000 to 10,000 feet per minute in order to obtain the most desirable results.

In the usual situation the strongest concrete or cementitious coating has only sufficient water to complete hydration of the cement when added to the mixture. From four to five times this quantity is usually required in order to make the mixture suitable for placing. By use of the present invention a relatively dry cement mortar may be employed using very little if any more water than is required to complete hydration of the cement and this relatively dry coating material can be projected or thrown at the required high velocity to secure the desired density on the surface to be coated.

In methods and machines heretofore devised for this general purpose the coating material or other comminuted material has been fed onto a flat or substantially flat endless belt which is traveling in the direction that it is desired to throw the material. The material is usually allowed to fall onto the belt by gravity with the intention of its being brought up to the speed of the belt by reason of its frictional engagement therewith. Then when the belt is diverted from such direction by passing around a roller or

2

pulley the material deposited thereon will continue in its initial direction by inertia. Where the particles of the material deposited on the belt are individually of no great mass such as particles of sand used either in sand blasting or in cementitious coatings the frictional engagement between the individual particles and the belt surface is insufficient to bring the particles up to the speed of the belt. In some instances due to the high speed of the belt the particles on falling onto the belt are merely scattered by it instead of being brought up to belt speed. Under these circumstances the speed of the belt must be lowered in order for the particles deposited thereon to be brought up to its speed before they are thrown therefrom.

An object of the present invention is to provide a novel method and apparatus for bringing the comminuted material almost instantaneously up to the speed of a belt traveling at high velocity so that the particles can be thrown from the belt in the desired direction and at the desired high velocity when the belt is diverted by passing around a roller or pulley. In accordance with the present invention the comminuted material is fed into an upwardly open bight formed between a reach of the belt and a roller or other moving surface against which the belt is urged in the course of its travel. The comminuted material on being fed into this bight is effectively compressed or pinched between the belt and the roller so that a very high frictional engagement is created between the particles and the belt which is many times greater than that frictional engagement existing when the comminuted material merely rests on the belt by gravity. In this manner it is possible to drive the belt at a very high rate of speed so that the coating material will not only be brought up to the speed of the belt almost instantaneously but will be thrown therefrom with the desired high velocity and scattering of the material is largely if not entirely eliminated.

In a machine of this character particularly when used to apply coatings it is of considerable importance that the coating material be fed into the bight at a uniform rate or in an evenly distributed manner. I have found if it is desired to apply a smooth coating that if the coating material is fed into the bight unevenly the uneven feeding will result in the material being thrown in an uneven manner so that the applied coating will also be uneven. It is therefore another object of the invention to provide an apparatus that will evenly feed the coating material into

the bight so that the applied coating will be even and relatively smooth.

With the foregoing and other objects in view, which will be made manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the accompanying drawings for an illustrative embodiment of the invention, wherein:

Fig. 1 is a view in side elevation of an apparatus embodying the present invention and illustrating it as being employed to apply cementitious coating to a metal pipe;

Fig. 2 is a view in side elevation parts being broken away and shown in vertical section of a portion of the apparatus illustrated in Fig. 1;

Fig. 3 is a vertical section taken substantially upon the line 3—3 upon Fig. 2 in the direction indicated;

Fig. 4 is a sectional view taken substantially upon the line 4—4 upon Fig. 2 in the direction indicated; and

Fig. 5 is a vertical section taken substantially upon the line 5—5 upon Fig. 2.

Referring to the accompanying drawings wherein similar reference characters designate similar parts throughout, the projecting or throwing portion of the apparatus consists essentially of an endless belt 10 which is trained over a drive pulley or roller 11 and an idler pulley or roller 12. The drive pulley 11 may be driven in any suitable manner such as by a belt or chain 13 from a variable speed electric motor 14. The upper reach of this endless belt passes beneath an idler roller or pulley 15 so as to be depressed thereby and to form an upwardly open bight 16. The belt is continually urged against the underside of the roller 15 with considerable force by the initial tension of the belt and the comminuted material or coating material indicated at 17 is fed into the bight. The ends of the bight may be closed such as by side plates 18 the bottom edges of which are shaped to conform to the exterior of the roller 15 and the portion or reach of the belt that leads from roller 12 to roller 15 to thus confine the material 17 in the bight.

After passing beneath the roller 15 the belt is directed in the direction that it is desired to throw the coating material or as illustrated that portion of the belt running from the underside of roller 15 to the drive roller 11 is directed toward a metal pipe "P" which in this instance constitutes the surface to be coated. The pipe P is illustrated as having been mounted on a suitable carriage 19 for longitudinal movement with relation to the belt. The pipe is also mounted on the carriage for rotary movement about its longitudinal axis so that the coating may be evenly distributed thereon as the machine is operated. In other words, the pipe P while being rotated about its longitudinal axis is moved with the carriage in a longitudinal or axial direction in front of the belt so that the coating applied thereto will be applied in a generally helical manner.

As the apparatus is operated the finely divided material 17 is effectively compressed or pinched between the belt 10 and the underside of roller 15 so that by reason of its high frictional engagement with the belt due to the pressure imposed by roller 15 it will be almost instantly brought up to the high speed at which the belt may be traveling. After passing beneath the roller 15 the material is then directed by the reach of the belt extending toward the top of drive roller 11

and will be thrown from the belt toward the pipe P when the belt is diverted around the drive roller. In applying cementitious coatings with this apparatus the sand and cement are merely dampened with water sufficiently to supply the water required for hydration of the cement and when thrown at the high velocity (5,000 to 10,000 feet per minute) a very large proportion of the coating material will adhere to the surface to be coated. When the cement sets it will be found that it is not only of the desired high density but as the amount of water used is very low that a very strong cementitious coating can be obtained.

Any suitable means for feeding the comminuted material into the bight 16 may be employed but where it is desired to throw the material from the belt in a highly uniform rate so as to secure a very even application of the coating the material 17 must be fed into the bight at a highly uniform rate. If fed unevenly the coating applied will be likewise uneven. In order to secure an even feeding of the material into the bight 16 I employ a hopper 20 into which the ingredients of the coating such as sand, cement and water may be dumped. A paddle mixer 21 is disposed in the bottom of this hopper and has helically arranged paddles mounted thereon in opposite directions so as to feed the material in the course of mixing toward a central outlet indicated at 22. This outlet can be controlled by a gate 23. The paddle mixer may be driven in any suitable manner such as by a chain 24 from a motor 25. The ingredients of the coating material after having been mixed by the paddle mixer are constantly fed through the outlet 22 past the gate 23 onto an endless belt 26 arranged therebeneath. A flanged roller 27 is rotatably mounted on a transversely extending shaft 28. This flanged roller is arranged behind the outlet 22 and has its flanges contacting with the belt 26. This flanged roller is designed to shape the material 17 that is deposited on the belt into an even mound preferably of trapezoid shape in cross section. As a means for so shaping this mound and causing it to be of suitably uniform density the shaft 28 is equipped with a gear 29 which meshes with a gear 31 driven by a chain 32 and sprockets off of a countershaft 33. The countershaft 33 may be driven such as by a chain 34 from an electric motor 35. The drive roller 36 for the forward end of the belt 26 may also be mounted on the countershaft 33 so that the belt 26 can be driven thereby. The arrangement of the chains 32 and 34, their respective sprockets and the gears 29 and 31 is such that the flanged roller 27 is driven at a peripheral speed considerably higher than the linear speed of the belt 26. The flanged roller 27 may be driven in a direction either sympathetically with the direction of movement of the belt 26 or in opposition thereto. During its rotation it tends to somewhat trowel or smooth off the material 17 that is deposited on the belt and to work the material into a mound which is of uniform maximum height and of uniform maximum width. As a means for adjusting the roller 27 toward or away from the belt the shaft 28 has its end mounted on links 37 which are pivotally mounted on the ends of the shaft carrying the gear 31. These links are slotted and may be held in adjusted position such as by cap screws 38. Beneath the bottom of the belt there may be a pivoted scraper 39 equipped with a counterweight 40 that is urged thereby into engagement with the return reach of the belt to keep it clean.

The above described construction serves to deliver from the hopper a uniform amount of material 17 that is to be fed into the bight. This material may drop from the belt 26 by gravity as it passes over the drive roller 36. However, as the material 17 in the case of cementitious coatings is damp and consequently will tend to cling together when smoothed off by the roller 27, it is desirable to prevent the material from extending beyond the end of roller 36 and then falling into the bight in the form of lumps. To this end a gear 41 is mounted on the end of the countershaft 33 meshing with a spur gear 42 on a rotary shaft 43. The shaft 43 carries a series of parallel discs 44 which are arranged in the path of the mound as it passes over the drive roller 36. These discs may be rotated at a suitable speed in either direction with relation to the direction of movement of the mound so that the discs will tend to break up the mound and cause it to fall freely and uniformly into the bight 16. In this manner although the cementitious material may be deposited unevenly on the belt 26 from the hopper the roller 27 will tend to arrange the material in a uniform mound which is carried by the belt toward the bight. Then the material as it falls from the belt over the roller 36 is effectively broken up by the rotating discs 44. Where the comminuted material that is to be thrown at high velocity is of a dry nature such as in sand blasting such elaborate precautions of feeding the material into the bight need not be resorted to and the same is true when the apparatus is used merely for stock piling comminuted materials or separating fine from coarse particles. In making such separations although all particles will be discharged or thrown at the same initial velocity the wear resistance on the small particles will cause these particles to lose their velocity quicker than large particles so that an effective separation may be accomplished.

The improved apparatus may also be employed to apply cementitious coatings to canal walls and the faces and approaches of earth filled dams and when so used the entire apparatus may be mounted on a tiltable turntable that can be turned and tilted to vary the direction in which the coating is discharged from the belt 10.

The velocity at which the belt 10 is driven may, of course, vary with different materials but velocities at which the belt is driven for most cementitious coatings will normally be between 5,000 and 10,000 linear feet per minute. The arrangement and velocity of the belt 26 should be such that the material discharged therefrom will fall by gravity into the center of the bight 16. It is undesirable to allow the material on belt 26 to fall directly against the upper surface of the belt 10 due to the fact that this belt under normal conditions will be traveling at such high speed that the material will merely slide thereon without being brought up to speed and will be merely scattered by it. By feeding the material into the center of the bight a pinching action between the belt and the roller 15 immediately commences with the result that the frictional engagement between the material and the belt 10 is such that the material is almost instantly brought up to the speed of the belt 10.

The belt 10 is preferably formed of some yieldable material such as a rubber coated or rubber impregnated fabric and the roller 15 may similarly be coated with rubber or rubber-like material.

Various changes may be made in the details of construction without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. An apparatus for applying coatings of materials at high velocity which includes an endless belt, means for driving the belt, movable means against which the belt presses and arranged to cooperate therewith to form an upwardly open bight into which the coating material may be fed whereby the material can be quickly brought up to the speed of the belt by being pinched between the belt and the movable means, and means for feeding the coating material into the bight comprising an endless belt, means for depositing the coating material thereon, means for shaping the coating material on the belt in a continuous uniform mound, said belt being arranged to discharge into the bight, and means for breaking up the mound as it is discharged from the belt into the bight.

2. An apparatus for applying coatings of finely divided materials at high velocities comprising an endless belt, a roller depressing the upper reach of the belt and cooperating therewith to form an upwardly open bight, means for feeding material into the bight, there being a roller over which the belt is trained after passing beneath the mentioned roller so that the material after being pinched between the roller and the belt and brought up to the speed of the belt will be carried thereby in the direction in which it is desired to throw the material, the feeding means including an endless belt on which the material is deposited which conducts the material to the top of the bight and means for breaking lumps of the material as it is fed from the last mentioned belt into the bight.

3. An apparatus for applying coatings of finely divided materials at high velocities comprising an endless belt, a roller depressing the upper reach of the belt and cooperating therewith to form an upwardly open bight, means for feeding material into the bight, there being a roller over which the belt is trained after passing beneath the mentioned roller so that the material after being pinched between the roller and the belt and brought up to the speed of the belt will be carried thereby in the direction in which it is desired to throw the material, the feeding means including a second endless belt on which the material is deposited, a roller over the second endless belt for pressing the material into a mound thereon, means for rotating the last mentioned roller and means for breaking up the mound into finely divided material as it falls from the second endless belt toward the bight.

4. An apparatus for applying coatings of finely divided materials at high velocities comprising an endless belt, a roller depressing the upper reach of the belt and cooperating therewith to form an upwardly open bight, means for feeding material into the bight, there being a roller over which the belt is trained after passing beneath the mentioned roller so that the material after being pinched between the roller and the belt and brought up to the speed of the belt will be carried thereby in the direction in which it is desired to throw the material, the feeding means including a second endless belt on which the material is deposited, a roller over the second endless belt for pressing the material into a mound thereon, means for rotating the last mentioned roller, and a plurality of circular discs in the path of the mound of material on the second

endless belt as the material passes therefrom into the bight and means for rotating said discs.

5. A mechanism for feeding finely divided material into a throwing apparatus therefor including an endless belt on which the material is deposited, means for driving said belt, a flanged roller arranged thereover adapted to shape the material carried by the belt into a mound thereon, means for rotating the flanged roller, a plurality of discs arranged in the path of the mound where it leaves the endless belt and means for rotating said discs.

KENNETH E. JAMES.

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