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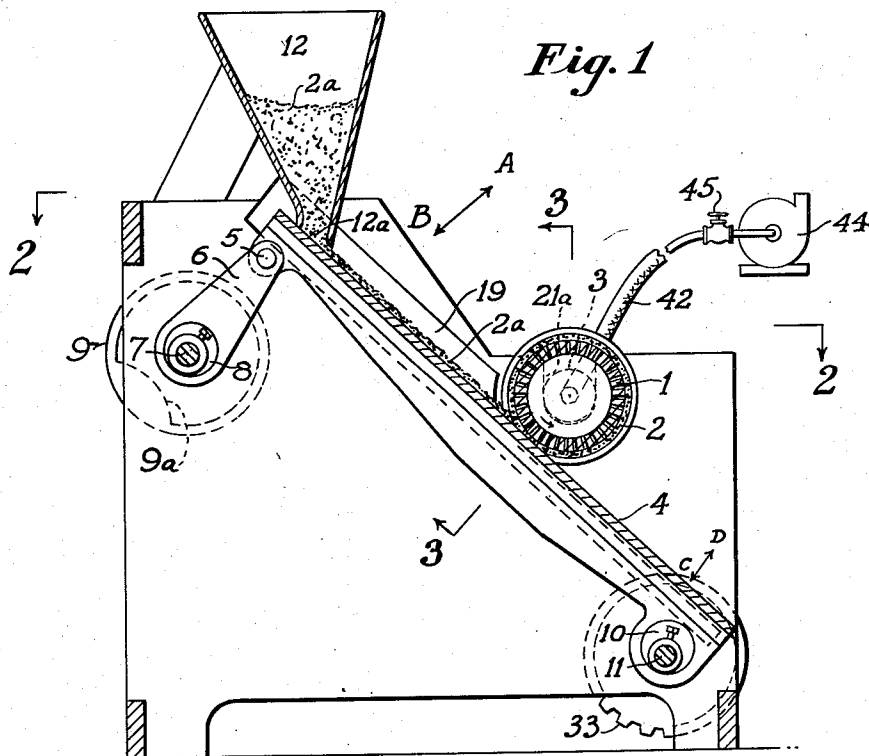
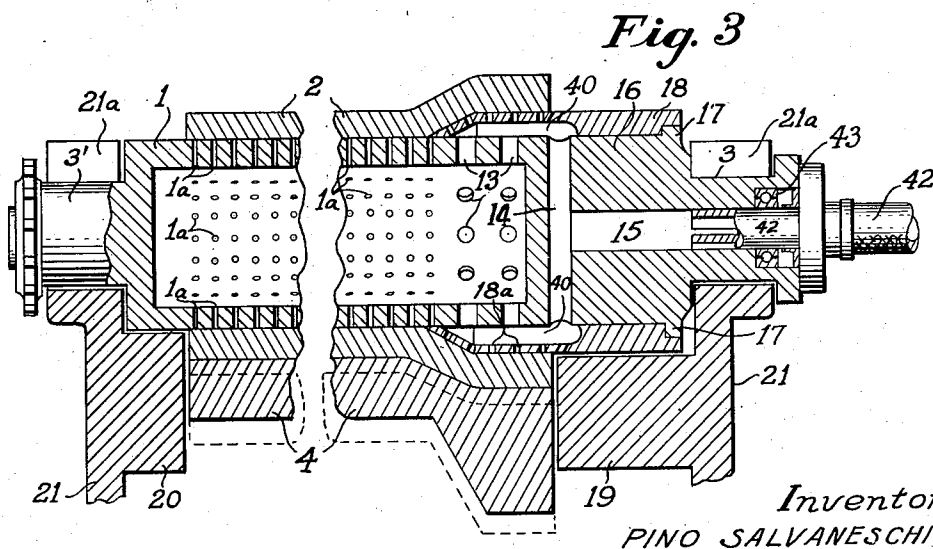
P. SALVANESCHI

2,369,608

APPARATUS FOR FORMING HOLLOW BODIES

Filed Jan. 16, 1940

2 Sheets-Sheet 1



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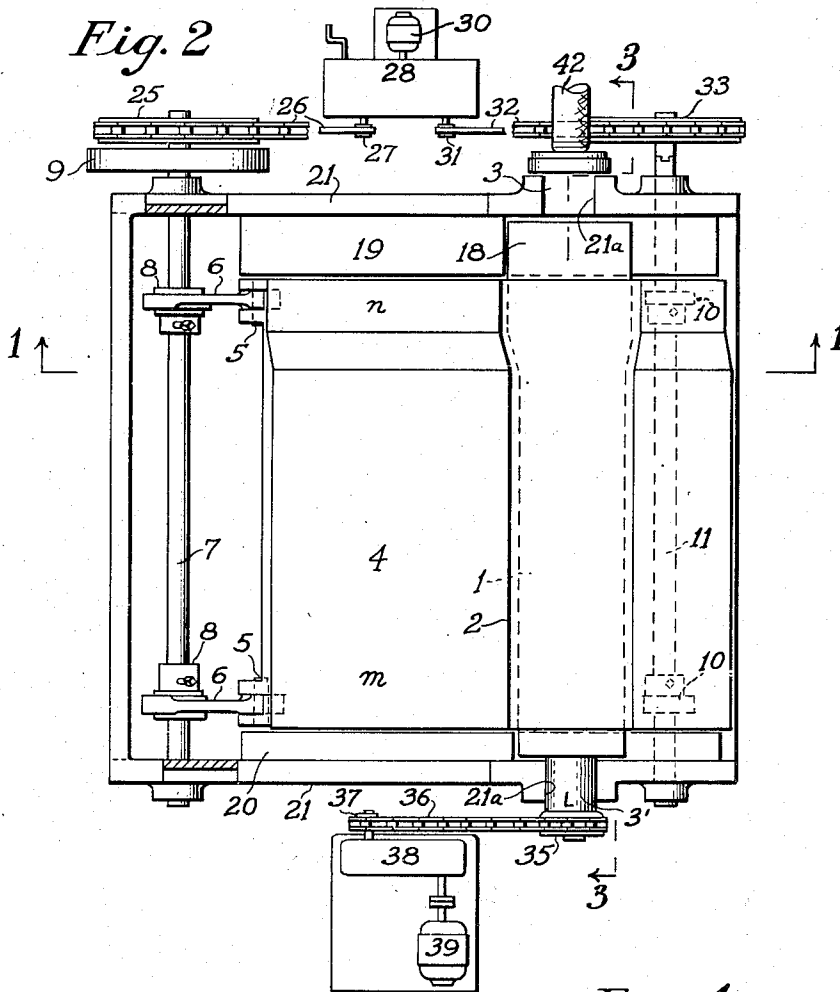
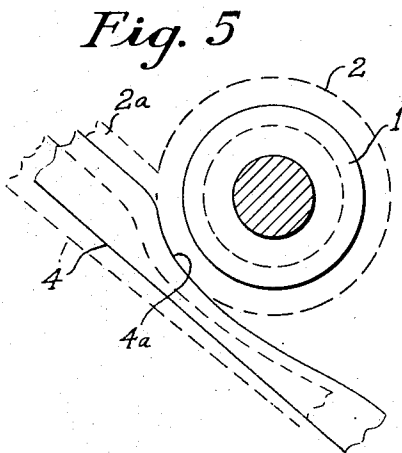
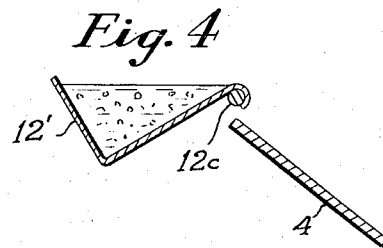
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APPARATUS FOR FORMING HOLLOW BODIES

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APPARATUS FOR FORMING HOLLOW BODIES

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Alien Property CustodianApplication January 16, 1940, Serial No. 314,030
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13 Claims. (Cl. 92—66)

Processes for manufacturing pipes with or without sockets, of cement paste which may contain fibrous matter, are well known. In many such processes a wrapping drum or cylinder is provided on which the pipe is formed in successive compressed layers. The speed of the wrapping drum in many of the above-mentioned processes depends on the speed of a felt band, of a ribbon, or of a roller.

Therefore, when a pipe having a socket is being wrapped, the angular speeds of the contacting rollers, or the linear speed of the felt band or ribbon, cannot be constant for the whole of the pipe length, since these speeds must be proportional to the various diameters of the pipe. In other words, the socket portion usually is of a greater diameter than the remaining portion of the pipe and, therefore, the speed of the felt-band or ribbon must be varied accordingly.

Consequently, whatever mechanical device is adopted, the portion of the pipe disposed between the small and large diameters is always a region of least structural resistance and of least impermeability, and the tools required are always complex and expensive. The same may be said concerning the compression, simultaneous or subsequent to the shaping of the pipe. There is an additional disadvantage during the compression on account of the pipe pressure requiring heavy tools to avoid flexural stresses. These high pressures, however, are sometimes partially reduced by mechanical means.

The weight of the parts in motion and the inherent friction cause, in general, the whole compression system to be insensitive in its operation.

Other processes for manufacturing pipes from fibrous pastes are also known, whereby a rotatable supporting cylinder having holes therein is employed. The cylinder and holes are covered by a filtering fabric and the fabric is smeared or covered with a given thickness of paste, the inside of said cylinder being subjected to a reduced pressure or suction for draining the water from the applied paste in a manner practiced in the operation of any drum-filter. (See, for instance, "Die Asbest-Zement-Schleifer-Fabrication"—a practical handbook—by K. A. Weniger, M. Krajin editors, Berlin, 1926, from page 160 to page 164). In these processes, however, the condensing and compression of the material are limited.

The present invention is characterized by the feature that the kneaded paste, whatever be its nature, is deposited upon a vibrating or oscillating table. This table is preferably inclined with respect to a horizontal plane and mounted for

movement at a certain distance toward and away from a revolving cylinder, which cylinder is formed from porous or permeable material. A reduced pressure or suction may be maintained within the porous or permeable cylinder, and the paste is thrown against the cylinder and deposited on it by the vibrating or oscillating table. The angular speed of the cylinder upon which the paste is applied, is independent of the speed of the other members of the apparatus, regardless of the diameter or diameters of the pipe.

The other distinguishing features of the present invention will be disclosed in the specification with the help of the attached drawings which are intended to give purely an example of an embodiment which is likely to vary in practice in its details, without thereby exceeding the limits of the present invention.

In said drawings:

Figure 1 is a longitudinal section of the apparatus, taken along the line 1—1 in Figure 2;

Figure 2 is a sectional plan view taken along line 2—2 in Figure 1, but omitting portions of the feed hopper;

Figure 3 is an enlarged transverse sectional view, with the central portion thereof broken away, said view being taken along lines 3—3 in Figures 1 and 2;

Figure 4 is a sectional view illustrating a modified form of feed hopper;

Figure 5 is a sectional view illustrating a modified form of table construction in association with the revolving cylinder upon which the pipe is formed.

Referring more particularly to the drawings, the numeral 1 designates a hollow perforated cylinder or drum over which paste 2a is strewn or deposited to form a pipe 2, said cylinder having trunnions 3 and 3' which are removably and rotatably supported in U-shaped notches 21a in side frames 21. An inclined vibrating or oscillating table 4 is disposed between side frames 21, the lower end of said table being supported by eccentrics 10 and its upper end being pivotally connected to the upper ends of suitable links 6 as at points 5. The lower ends of links 6 are mounted around rotating eccentrics 8 which are fixedly secured upon a shaft 7. Likewise, the eccentrics 10 are fixedly secured upon a shaft 11.

The eccentrics 10 on shaft 11 may be turned gradually during operation for adjusting or varying the degree of rapid oscillation of the upper end of the table, said rapid oscillation being si-

multaneously effected by eccentrics 8, links 6 and drive shaft 7.

It is, therefore, seen that a rapid alternating motion in the direction A—B and B—A is imparted to the upper portion of the table 4 when the shaft 7 and eccentrics 8 are turned. At the same time a slower or gradual motion is imparted to the lower portion of the table in the direction C—D and D—C when the shaft 11 and eccentrics 10 are turned. There is also a longitudinal motion imparted by the eccentrics to the table.

As stated above, the lower end of the table 4 is supported by eccentrics 10, and, therefore, upon gradually revolving the eccentric in a clockwise direction from the position shown through an angle of 180°, the inclined top surface of the table will be moved away from the cylinder or drum 1 in a direction D—C substantially normal to said surface, while at the same time the upper end of the table is vibrating or oscillating rapidly. The table will also be moved longitudinally downwardly in the direction of incline during the first 90° rotation of eccentrics 10 and longitudinally upwardly in the direction of incline during the succeeding 90° rotation. Therefore, each oscillation of the table resulting from eccentrics 8 will follow a slightly different path from the path of the preceding oscillation, on account of the gradual shifting of the lower pivot point 10. Of course, the relative rates of rotation of the respective eccentrics 8 and 10 varies the frequency and the paths of oscillation followed by the table. The shaft 7 at the upper end of the table structure is driven very rapidly by any suitable conventional means such as disclosed in Figure 2. As an example of the driving means, the upper shaft 7 has a sprocket 25 fixedly secured thereon upon which a chain 26 is mounted, said chain being also mounted upon a sprocket 27 of a speed reduction unit 28. The reduction unit is driven by any suitable means such as an electric motor 30 in a conventional manner.

The lower shaft 11 is driven slowly or gradually in a similar manner by sprocket 31, chain 32 and sprocket 33. Although, a common driving means is employed for the upper and lower eccentrics 8 and 10, a separate driving means may be employed. It is evident that good results may be obtained if the eccentrics 10 are manually rotated while the table oscillates or vibrates. In the present showing the two pulleys 27 and 31 are geared so that pulley 27 will be driven very rapidly while pulley 31 is driven very slowly. In other words, the vibratory or oscillating motion is imparted to the upper end of the table 4 through members 5, 6, 7, 8, 25 and 26 while the table is moved away from cylinder 1 by members 10, 11, 31, 32 and 33 to provide clearance for the paste 2a which is being deposited on the rotating cylinder 1 to form pipe 2. Usually, the entire amount of paste is deposited during the first 180 degrees revolution of eccentrics 10, and during the second and successive turns of eccentrics 10 the pipe is compressed and consolidated. Although the entire amount of paste may be deposited upon the rotating cylinder or mandrel 1 during the first 180° of revolution of eccentric 10, it should be borne in mind that the mandrel may rotate several revolutions. In other words, when the table is located in its uppermost position as shown in Fig. 1, there is a minimum space between the periphery of the mandrel and the top of the table, and this minimum space is substantially equal to the sheet of pasty substance 2a which is being ap-

plied to the mandrel. After the mandrel has made substantially one revolution, the eccentric 10 will have turned downwardly a sufficient amount to increase the initial space over and above the thickness of sheet 2a. Therefore, during the second revolution of the mandrel, another layer of plastic material will have formed on top of the first layer. In other words, when the mandrel is rotated a plurality of revolutions during the formation of the pipe, the plastic material will be applied in the form of a spiral winding. At all times, the uppermost limit of the travel of the table approaches the periphery of the cylinder sufficiently to compress the pasty substance which is being applied.

A fly wheel 9 is fixedly secured upon shaft 7 so that a greater momentum will be maintained after the shaft has reached the operating speed. Since the table oscillates at a high rate, the shaft 7 must rotate correspondingly fast, and under such conditions it is sometimes necessary to counter-balance the fly-wheel as at 9a to balance the centrifugal weight of the eccentrics 8 about rotating shaft 7.

The proximate faces of side frames 21 have sides 19 and 20 extending inwardly therefrom into close proximity to opposite edges of table 4, to thereby prevent the paste from falling from the sides of the table when the table is oscillating. The top surfaces of the side members 19 and 20 are shaped in such a way as to closely approach, without touching, the large and small peripheries at each end of the cylinder 1, the intermediate portion of said cylinder disposed between said sides being adapted to receive the paste 2a from the table 4. (See Figure 3).

The removable cylinder 1 to which paste 2a is applied may be driven either in a continuous or a non-continuous way. A conventional continuous driving means is shown, comprising a sprocket 35 fixedly mounted on the end of trunnion 3', a sprocket chain 36, a second sprocket 37, a gear reduction unit 38 and a motor 39. It is evident that the rate of rotation of cylinder 1 will be much slower in relation to the rate of rotation of shaft 7 which operates to oscillate or vibrate the table so that the paste can be properly deposited on the cylinder in successive layers.

The charging hopper is designated by reference character 12 wherein is deposited the whole amount of paste 2a for obtaining a pipe of a given size, said hopper having an opening 12a in the lower end thereof which is substantially closed by table 4 when the link 6 is at the uppermost position of its stroke.

Upon rapidly oscillating the upper end of inclined table 4, the paste 2a intermittently falls out of the hopper onto the uppermost portion of the table and is caused to flow downwardly, with the assistance of gravity toward revolving cylinder 1. As the paste approaches the cylinder it is applied thereto by the above-described oscillations to thereby form a pipe 2. The lower end of the table is gradually moved away from the cylinder due to the rotation of shaft 11 during the application of the paste 2a and the formation of the pipe 2.

The drum or cylinder 1 is porous or permeable only in the part which receives the paste, said pores in the cylinder being indicated by 1a (Figure 3). Cylinder 1 is also provided with holes 13 and with a head 16, having projections 17, integral therewith, said holes 13 establishing communication between the interior of cylinder 1 and an annular space 40 in sleeve 18. The sleeve 18

slidably fits over the cylinder 1 in the manner shown in Figure 3, and when so positioned the annular space 40 establishes communication between holes 13 and passageways 14 and 15, the passageway 15 being disposed substantially in alignment with the axis of rotation of cylinder 1. Attention is called to the perforations 18a in sleeve 18, which perforations occur only in those areas adapted to be covered by the paste 2a.

A suitable suction unit is removably connected to one end of cylinder 1. This unit, in part, comprises a conduit 42, one end of which is removably inserted into passageway 15 and is connected to the cylinder by any suitable means such as a sealed ball bearing 43. A suction pump 44 is connected to the other end of the conduit, and a valve 45 is employed in the conduit to regulate the amount of suction produced.

The excess water in the paste 2a filters through the pores 1a into the cylinder 1 and is discharged therefrom through openings 13, 40, 14, 15 and into suction conduit 42, as a result of the suction means.

The operation is as follows:

The required paste 2a for a given pipe 2 is placed in hopper 12, after having set the vibrating or oscillating table at its top-dead-center so as to close or reduce the opening 12a. The eccentric 10 is also set in the position shown so as to reduce the space between cylinder 1 and table 4 to the desired minimum. The upper portion of the table is then set in motion due to the rapid rotation of drive shaft 7, and the paste flows with the aid of gravity from opening 12a towards the cylinder 1. At the proper moment the cylinder 1 is rotated and also the vacuum or suction apparatus is placed in operation. A slower rate of rotation is simultaneously imparted to the lower shaft 11 and eccentrics 10 to gradually move the table downwardly from the cylinder to give space for the pipe thickness, during which downward movement the contents of the hopper are deposited upon cylinder 1.

If the vibro-compression, produced by the vibrating or oscillating table 4 upon the pipe during its formation, is not considered sufficient, the operation of cylinder 1 and table 4 is continued to thus consolidate the pipe.

As soon as the pipe is considered finished, after the above-stated operations, it is possible to go on with the vibro-compressing, i. e. by continuing the oscillation of the table, and if desired the suction within cylinder 1 may be reduced so as to insure that the inside surface of the finished pipe may separate from the outside surface of the cylinder.

When the formation of the pipe is completed, the cylinder 1 is disconnected from conduit 42 and from driving chain 36, after which the cylinder and finished pipe is removed from notches 21a. The pipe is then slipped from the cylinder by pushing the sleeve 18 toward trunnion 3', or by holding the sleeve and then extracting the cylinder. Also the pipe may be removed by placing both the pipe and cylinder in upright position and dropping the cylinder and sleeve endwise on the floor so as to leave the pipe vertical.

In the practical embodiment of the process, the oscillations may be very different in nature, frequency, direction, and amplitude. In the apparatus shown in Figures 1 and 2, as an example, the oscillations are in the direction A-B, B-A, and are gradually damped toward the lower end of the table. These oscillations may be replaced by others, whatever be the kinematic or dynamic

law they are obeying, and whatever be the ratio between the oscillations at a certain point and those at any other point of the vibrating table. As above stated, these oscillations may be varied by rotation of the eccentric 10 about its axis 11.

Hopper 12, shown in Figure 1, may be replaced, if desired, by a dumping hopper 12' such as shown in Figure 4, the hopper being adapted to rotate about point 12c.

It is not necessary to uniformly deposit the paste on the vibrating table for the entire length of the pipe generatrix. The vibration of the table provides for the application of the paste where required, that is, the spreading of the paste longitudinally of the cylinder.

The manufacture of the pipe may be obtained even in a single revolution of the drum, in which case the initial distance or the air-gap between the top of the table and the cylinder, when the table is in hold line position, as shown in Figure 5, establishes the thickness of the non-compressed pipe (Figure 5). In such case the table 4 may be suitably concaved as at 4a so that a portion of the concavity will approximately conform to the body of the cylinder. Also in this embodiment, (Figure 5) since only one layer of paste is applied to form a pipe the eccentric 10 at the lower end of the table, should not turn because the space between cylinders 1 and 8 the top of the table will remain constant. The pressing and finishing of the formed pipe by means of vibro-compression may be obtained, whatever be the way the paste is applied over the drum.

Having now particularly described the nature of my invention and its manner of operation, I claim:

1. A machine for manufacturing tubes, pipes or similar hollow bodies from pasty substances comprising in combination a rotatably mounted permeable cylinder, said cylinder adapted to have suction means connected thereto for exhausting air from the inside of said cylinder; an inclined paste-applying member located near the surface of said cylinder, means located near the upper end of said paste-applying member for depositing a pasty substance upon said member, said member being pivotally mounted for oscillation toward and away from said cylinder to thereby apply and compress said deposited pasty substance to said cylinder as said cylinder rotates; and means for gradually moving said table pivot and associated oscillating table away from said cylinder while said paste is applied to thereby provide space for the applied paste on said cylinder.

2. A machine for manufacturing tubes, pipes or similar hollow bodies from pasty substances comprising in combination a rotatably mounted permeable cylinder, an inclined paste-applying member located near the surface of said cylinder, means located near the upper end of said paste-applying member for depositing a pasty substance upon said member, said member being pivotally mounted for oscillation toward and away from said cylinder to thereby apply and compress said deposited pasty substance to said cylinder as said cylinder rotates; and means for gradually moving said table pivot and associated oscillating table away from said cylinder while said paste is applied to thereby provide space for the applied paste on said cylinder.

3. A machine for manufacturing tubes, pipes or similar hollow bodies from pasty substances comprising in combination a rotatably mounted permeable cylinder adapted to have suction means connected thereto for exhausting air from

the inside of said cylinder, an inclined paste-applying table having the top surface thereof located adjacent the lower surface of said cylinder; paste delivery means throttled by said table surface and located at a point above said adjacent table and cylinder surfaces; and means for vibrating said table toward and away from said delivery means and toward and away from said cylinder to respectively facilitate the gravity flow of the pasty substance from the delivery means and to compress the delivered paste upon said rotating cylinder.

4. A machine as defined in claim 3 wherein means are provided for gradually moving the top surface of said vibrating table away from said cylinder surface while said paste is applied to thereby correspondingly increase the thickness of the pipe being formed.

5. A machine as defined in claim 3 wherein means are provided for gradually increasing the distance between the top surface of said vibrating table and the lower surface of said cylinder while said paste is applied to thereby correspondingly increase the thickness of the pipe being formed.

6. A machine as defined in claim 3 wherein said means for delivering the supply of paste to the table comprises a hopper for holding said paste, said hopper having an outlet at its lower end disposed adjacent the top surface of the table.

7. A machine as defined in claim 2 wherein oscillating means are provided for said table comprising an eccentrically mounted member fixed upon a rotating shaft and a link pivotally connecting said eccentrically mounted member with said table.

8. A machine as defined in claim 2 wherein oscillating means are provided for said table comprising an eccentrically mounted member fixed upon a shaft and a link pivotally connecting said eccentrically mounted member with the table, and wherein said means for moving said table pivot comprises a second eccentric rotatably journaled in the table.

9. A machine for manufacturing tubes, pipes or similar hollow bodies from pasty substances comprising in combination a rotatably mounted cylinder, an inclined paste-applying member having the top surface thereof located adjacent the lower surface of said cylinder, the upper portion of said top surface being adapted to have a mass of pasty substances deposited thereon, and means for vibrating said inclined member toward and away from said cylinder, whereby the gravity flow of the deposited pasty substances along said top surface and the compression of said substance upon the cylinder will be facilitated.

10. A machine for manufacturing tubes, pipes or similar hollow bodies from pasty substances comprising in combination a rotatably mounted cylinder, an inclined paste-applying member having the top surface thereof located adjacent the lower surface of said cylinder, the upper portion of said top surface being adapted to have a mass of pasty substances deposited thereon,

means for vibrating said inclined member toward and away from said cylinder, whereby the gravity flow of the deposited pasty substances along said top surface and the compression of said substance upon the cylinder will be facilitated, and means for moving the top surface of said inclined vibrating member away from the lower surface of said cylinder while the paste is being applied to the cylinder to thereby correspondingly increase the thickness of the pipe being formed.

11. A machine for manufacturing tubes, pipes or similar hollow bodies from pasty substances comprising in combination a rotatably mounted cylinder, an inclined paste-applying member having the top surface thereof located adjacent the lower surface of said cylinder, the upper portion of said top surface being adapted to have a mass of pasty substances deposited thereon,

means for vibrating said inclined member toward and away from said cylinder, whereby the gravity flow of the deposited pasty substances along said top surface and the compression of said substance upon the cylinder will be facilitated, and means for increasing the distance between the top surface of said vibrating member and the lower surface of said cylinder while the paste is being applied to the cylinder to thereby correspondingly increase the thickness of the pipe being formed.

12. A machine for manufacturing tubes, pipes or similar hollow bodies from pasty substances comprising in combination a rotatably mounted permeable cylinder, said cylinder adapted to have suction means connected thereto for exhausting air from the inside of said cylinder; an inclined paste-applying member located near the surface of said cylinder whereby pasty substances deposited upon the upper portion of said member will tend to move toward said cylinder, said member being pivotally mounted for oscillation toward and away from said cylinder to thereby apply said deposited pasty substances to said cylinder as said cylinder rotates; and means for gradually moving said table pivot and associated oscillating table away from said cylinder while said paste is applied, to thereby provide space for the applied paste on said cylinder.

13. A machine for manufacturing tubes, pipes or similar hollow bodies from pasty substances comprising in combination a rotatably mounted permeable cylinder, an inclined paste-applying member located near the surface of said cylinder whereby pasty substances deposited upon the upper portion of said member will tend to move toward said cylinder, said member being pivotally mounted for oscillation toward and away from said cylinder to thereby apply said deposited pasty substance to said cylinder as said cylinder rotates; and means for gradually moving said table pivot and associated oscillating table away from said cylinder while said paste is applied to thereby provide space for the applied paste on said cylinder.

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