Nov. 3, 1953 E. J. UPTON 2,657,430

FEEDING OF MATERIALS

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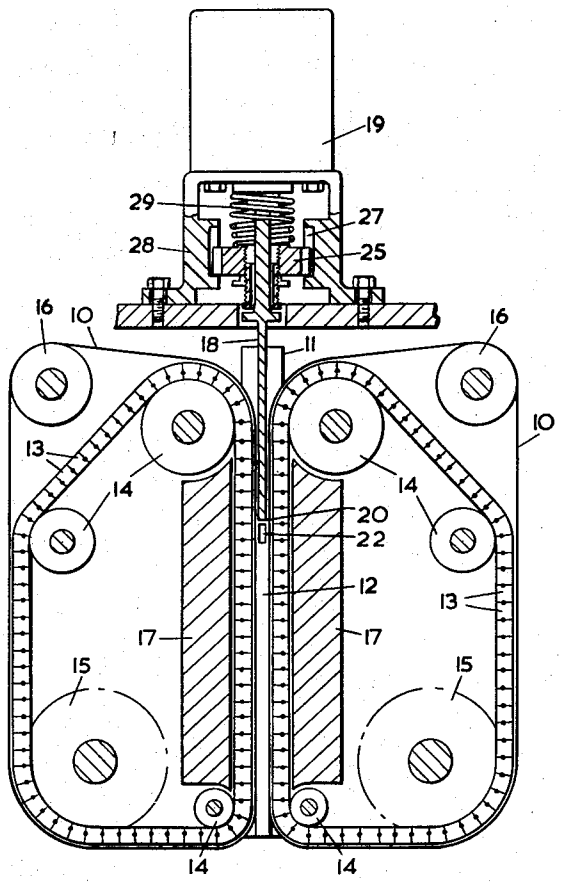


FIG. 1.

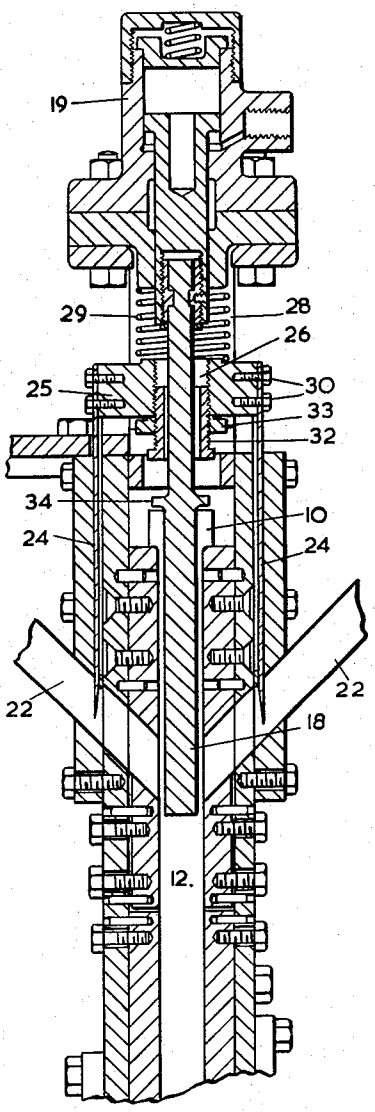


FIG. 2.

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FEEDING OF MATERIALS

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Claims priority, application Great Britain July 19, 1950

1 Claim. (Cl. 18—30)

1

This invention relates to the feeding of materials, and particularly to the feeding of powdered or granular solid materials, and has for its object the provision of a method and apparatus for the feeding of such materials in which jamming or "bridging" of a stream of solid material supplied to a receiving space is avoided.

According to the present invention a method of feeding powdered or granular material comprises causing the material to flow by gravity down a passage into a receiving space, subjecting the level of the material in said space to the intermittent feeling action of an oscillating member and, when said level is low, using the excess motion of said member consequent upon such lowness to effect a movement of the boundaries of said passage so as to encourage the flow of material down said passage. An apparatus for carrying out this method comprises a downwardly extending duct for the flow of material into a receiving space, a feeler member, means for oscillating said member into and out of contact with the surface of the powdered or granular material in said receiving space, and means for transmitting excess motion of said member, beyond a predetermined range of oscillation, to the boundaries of said duct. The excess motion which is made use of in this way may be either the excess at that end of the range of oscillation at which feeling takes place, or it may be an excess of motion by way of reaction at the other end of the range, or use may be made of the excess motion at both ends.

By the use of the method and apparatus defined above, disadvantages arising from the tendency of powdered or granular material flowing through a passage to assume a meta-stable state in which the flow is inhibited by a jamming or "bridging" of the particles of material across the passage, are substantially overcome by disturbing such state whenever the space supplied is starved of material by reason thereof. It may be observed that any kind of movement of the boundaries of the passage will be effective in disturbing the jammed condition of the material though it is usually undesirable to employ movements which have the additional effect of closing or restricting the cross-section of the passage. Thus the movement may be of the nature of a mere vibration of the duct carrying the passage, either laterally or longitudinally of the passage. Preferably, however, the movement is such as to enlarge the passage through the duct momentarily and to bring about a flow of material greater than average to make up the deficiency

2

originally causing the movement. Thus, the normal flow of material may be controlled by a constriction in the duct, e. g. a gate extending partway across it, and the movement taking place upon jamming or "bridging" of the material may consist of an opening of the gate or other constriction. The average rate of flow of the material along the duct may be such as to call for a continual movement of the boundaries of the passage, such movements varying in extent, however, in accordance with the level of material in the space supplied.

In cases where the further use or destination of materials supplied to the space is such as to require the employment of a member in the space for some other purpose than detecting the level of the material therein, e. g. to encourage the movement of the material in the space or to tamp the material into a compact mass, use may be made of such member for the purposes of the present invention. For this purpose the member should be arranged so that the extent of its movement depends upon the level of the material in the space, whereby the variation of the movement arising from changes in that level can be made use of.

Thus, the invention is of particular advantage in connection with the processes and apparatus described in U. S. application S. No. 115,035, filed September 10, 1949, in which, for the purpose of extruding a fusible filament-forming material supplied in powdered or granular form, the material is fed into a zone laterally bounded by moving surfaces which lie parallel to their direction of motion and is compacted in said zone into a coherent rod which is advanced with said surfaces. The compacting of the material into a coherent rod is conveniently effected by means of a tamping rod vibrating longitudinally in the zone, and use may be made of the variations in the amplitude of the vibrations of the tamping rod, consequent on variations in the level of the material contained in the zone, for the purposes of the present invention.

By way of example, one form of apparatus in accordance with the present invention, in its application to the method and apparatus generally described in U. S. application S. No. 115,035, will now be described in greater detail with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic sectional side elevation of an apparatus according to U. S. application S. No. 115,035, and,

Figure 2 is a front elevation of part of the apparatus of Figure 1 showing the feeding means.

In the above specification an apparatus is described which is of the kind shown in Figure 1 and comprises a pair of flexible bands 10 each having a straight operative run opposite to the operative run of the other so that they constitute, in conjunction with two stationary surfaces 11 extending from one band 10 to the other, a parallel-sided passage 12 of rectangular cross-section having two moving walls constituted by the bands 10. Each band 10 is supported by a chain of articulated blocks 13 which pass round pulleys 14 and a sprocket 15 and are continuously driven by means of the sprocket 15. The bands 10 are kept taut by means of jockey pulleys 16. Along the length of the parallel-sided passage 12 the blocks 13 are solidly supported by members 17, and into the early part of the passage 12 enters a longitudinally vibrating tamping rod 18 of rectangular cross-section loosely fitting the passage 12 and actuated by a pneumatic vibrator unit 19. At about the mid-position of the tip 20 of the tamping rod two oblique feed passages 22 communicate with the passage 12. The rod 18 is shown in its uppermost position in Figure 1, in which the mouth of the passage 22 is uncovered, and in its lowermost position in Figure 2. The feed passages extend through the stationary surfaces 11. Through the feed passages 22, powdered or granular material is supplied to the passage 12, and is tamped into a compacted rod by the action of the tamping rod 18. Since the compacted material is carried away by the moving bands 10 at a substantially constant rate, it is necessary that fresh powdered or granular material should be fed through the feeding passages or ducts 22 at a substantially constant rate in order that the resulting rod should be uniformly compacted. It is for this purpose that the apparatus of the present invention is employed.

Across each of the ducts 22, as shown in Figure 2, shortly before they enter the rectangular passage 12, there extends from above a sharp-edged plate or "gate" 24, the upper part of the duct 22 being slotted for its reception. The two gates are connected together by a yoke 25 between their upper edges, which lie at a convenient distance above the uppermost points of the flexible bands 10. The yoke 25 is centrally bored at 26 to allow the vibrating tamper rod 18 to extend through it, and is slidably mounted in slots 27 formed in the standards 28 which carry the vibrator unit 19 actuating the tamping rod 18. The yoke 25 is urged downwards, to the bottom of the slots 27, by means of a light spring 29 abutting against the vibrator unit and, in this position, the lower edges of the gates 24 extend sufficiently far across the ducts 22 to limit the flow of granular material to a rate approximately sufficient for the feeding of the rectangular passage 12. This position of the gates can be adjusted by adjusting the connection of the upper edges of the gates to the yoke. The gates are

secured to the yoke by means of screws 30 passing through vertical slots in the gates which enable this adjustment to be made. In the bore of the yoke is adjustably screwed a tube 32, which can be locked in position by means of a screw-threaded locking ring 33. Extending laterally from the tamping rod 18 are two shoulders 34 adapted, when raised to a sufficient height, to engage the lower edge of the tube 32 and so to lift the yoke 25 and the gates 24 carried thereby.

In the operation of the apparatus described, the powdered or granular material flows through the ducts 22 into the rectangular passage 12 and is there compacted into a coherent rod of rectangular cross-section which is steadily carried away by the motion of the flexible bands 10. In the event of jamming of the powdered or granular material in either of the ducts 22, the rectangular passage 12 tends to be starved of material and the tamped upper surface of the material therein falls. This permits a greater freedom of oscillation to the tamping rod 18 and, as it descends further before engaging the surface of the material, so it reacts to a higher level in the course of its upward movement. This causes the shoulders 34 carried by the tamping rod 18 to engage the tube 32 carried by the yoke 25 and to lift the gates 24, thereby breaking the jam of powdered or granular material and momentarily permitting a more than usually rapid rate of supply to make up the deficiency. When the deficiency is made up, the range of vibration of the tamping rod 18 is again restricted, and the gates 24 across the ducts 22 occupy their normal position undisturbed.

Having described my invention, what I desire to secure by Letters Patent is:

Apparatus for the feeding of powdered or granular material, said apparatus comprising a downwardly extending duct for the flow of material into a receiving space, a gate adapted to extend partly across said duct, a feeler member, means for vibrating said member into and out of contact with the surfaces of the powdered or granular material in said receiving space, with a restoring force variating with its displacement from a standard position, and means for transmitting excess motion of said member away from said surface beyond a predetermined distance from said standard position of said gate so as to open said gate momentarily.

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