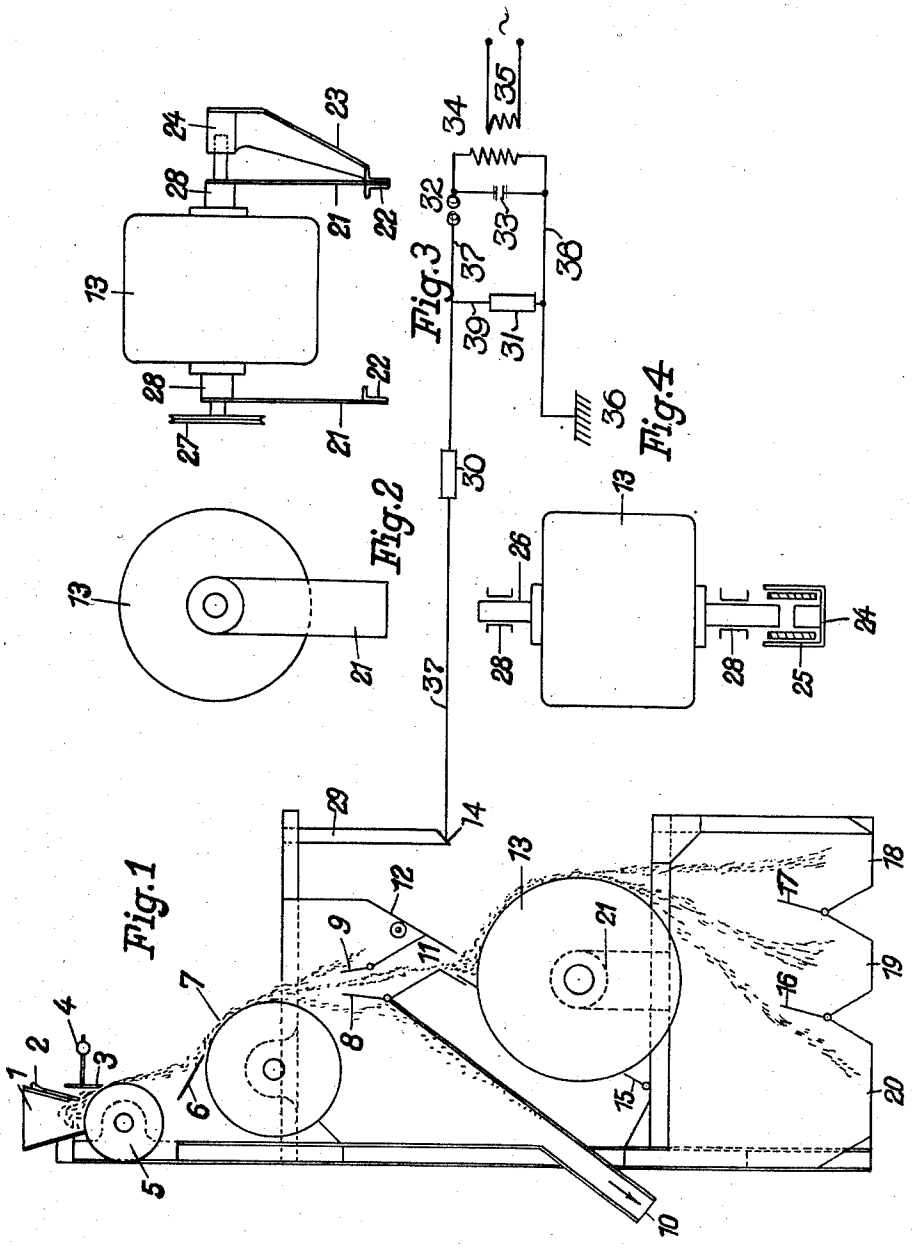
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APPARATUS FOR ELECTROSTATIC SEPARATION

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APPARATUS FOR ELECTROSTATIC SEPARATION

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This invention relates to apparatus for electrostatic separation.

In accordance with the invention apparatus is provided for the classification of particles comprising an electrostatic separator, preferably of the rotary drum type, and mechanical means for delivering to the electrostatic separator, material the particles of which have substantially the same projection path.

Apparatus in accordance with the invention is illustrated in the accompanying drawing in which

Fig. 1 is a diagrammatic side elevation of the complete apparatus comprising means for the mechanical separation of the material into fractions according to the projection paths of the particles and electrostatic means for the treatment of the mechanically classified material.

Figs. 2, 3 and 4 are front elevation, plan and side elevation respectively of means for vibrating the drum 13 of Fig. 1.

Referring to Figure 1 the mixture to be separated is charged into the hopper 1 with slide 2 and flap 3 with regulating weight 4 to provide an even flow of the material to the drum 5. The material falls from drum 5 on to the inclined plate 6, which is so arranged that the material slides therefrom on to the drum 7 at a speed equal to the surface speed of drum 7. By rebounding on plate 6 the particles are shaken up and loosened from adhering dust particles, which may be sucked off by a gas stream if necessary. Beneath drum 7 two adjusting tongues are arranged, 8 and 9. In this way only such particles reach the revolving electrode drum 13 as fall in the same projection parabola. Coarser particles, which may be present, fall from drum 7 into receptacle 12 whence they are removed by a screw conveyor or the like. The particles which are too light pass by a slide into the discharge pipe 10. The metal drum 13 is grounded. Approximately opposite to the throwing-off point of drum 13 the glow-discharge plate 14 is supported from the insulator 29. The plate 14 is adjusted so that its glowing edge is directed towards the axis of the drum 13. A glow-discharge wire could be used instead of plate 14, but it is less appropriate for practical service as its mechanical strength is inferior. Should the apparatus be operated without electric current the material would fall from the revolving drum 13 into box 18. By the effect of the properly regulated impulse energization of uniform polarity the particles on the drum are caused to adhere to the drum by the glow-discharge current. The material is not attracted at all by the glow-discharge plate 14. Each non-conducting particle acts as a condenser in such a manner that the surface directed toward the glow-discharge plate assumes a like charge, whereas the surface toward the drum takes the opposite polarity. Particles which are good conductors give their electric charge to drum 13 immediately, so that they fall down, as soon as the respective particles get out of the range of the glow-discharge field, following the revolving of the drum into the box 18. The particles which are non-conductors, however, adhere to drum 13 for a longer time on account of their condenser charge and according to their electrical conductivity and their dielectric constant, fall into the box 19 or the waste pipe 20. Adjustable tongues 16 and 17 serve to separate the falling particles. A brush 15 serves for keeping clean the drum 13, since it is important that the surface of this drum constitutes a good conductor.

In order to obtain a good distribution on drum 13 of the material to be separated and also to obtain a better contact between the drum and the particles, the drum 13 is submitted to axial vibrations. Figs. 2, 3 and 4 show one means for producing these vibrations, in front elevation, plan and side elevation respectively. The bearings 26 of the drum 13, which is driven by a rope pulley 27 for example, are mounted to the fixed frame 22 by means of ribbon springs 21. On the bracket 23 is mounted an alternating current magnet 24 with a coil 25, producing axial pushing movements of the drum 13 in accordance with the frequency of the alternating current. Of course the pushing movements can also be obtained by mechanical means, for instance by a mechanical vibration device.

It is of particular importance that the charge on the dielectric particles does not become too great, since in that event discharging in the interior of the dielectric body would take place. It is the same as giving a condenser too heavy a charge, which results in the condenser losing its charge at excessive high voltage by short-circuit. When treating materials which are sensitive in this respect it is advantageous, therefore, to connect a high ohmic resistance into the line from the source of the impulse energization to the glow-discharge plate.

The impulse energization can be produced in the known manner by means of a mechanical rectifier by charging a condenser and discharging across a spark gap and connecting a high ohmic resistance in parallel as shown, for instance, in the patent to G. W. Pickard, No. 796,011,

August 1, 1905. In the present case the introduction of a high ohmic resistance in the connecting line to the glow-discharge plate constitutes a new element. There is also used a high ohmic resistance with the already known devices which employ a glow-discharge wire covered by a glass tube. However, a glow-discharge wire sheathed by a glass tube gives the disadvantage, compared to the glow-discharge plate, that instead of a repelling effect even attraction is produced on account of the larger surface. It has been found that many ores and the like cannot at all be separated by such an attraction and that the separation can only be rendered possible by the present invention.

The means for producing the impulse energization described above is illustrated diagrammatically in Fig. 1. As illustrated, the electrode 14 is connected through the conductor 37 in which the high ohmic resistance 30 is located, to the means for generating the high impulse energization. Said means consists of the customary high tension alternating current transformer having the primary coil 35 and the secondary coil 34. One pole of the secondary coil 34 is grounded at 36 through the conductor 38, while the other pole of coil 34 is connected through the spark gap 32 to the conductor 37. Conductors 37 and 38 are connected through the condenser 33. The high ohmic resistance 31 is connected between the conductors 37 and 38 in parallel to the condenser 33 by the conductor 39. The resistance 31 serves to limit the loading of the condenser 33. The resistance 30 serves to give a uniform and limited electrical discharge from the electrode 14 upon the material under treatment with the result that every part of the material receives an accurately measured electrical charge and discharging of the type above referred to of the individual particles does not occur.

We claim:

1. Apparatus for the classification of particles comprising an electrostatic separator and mechanical means for delivering to said electrostatic separator from a supply of a mixture of particles having different projection paths only such particles as have substantially the same projection path comprising a revolving uncharged roll, means for delivering the mixture of particles onto said roll, means for dividing the particles falling from said roll into a plurality of groups corresponding to their projection paths, and means for delivering one of said groups to an electrostatic separator of the rotary drum type.

2. Apparatus as defined in claim 1 in which the mechanical means comprises an inclined plate positioned to deliver particles onto the upper surface of the uncharged roll and means for dropping the mixture of particles through a substantial space onto said inclined plate.

3. Apparatus as defined in claim 1 in which the mechanical means comprises a hopper, an adjustable feed permitting a uniform regulated flow of particles from said hopper, an inclined plate located at a substantial distance below said hopper, said plate positioned to permit the material to slide onto the upper side of said uncharged roll.

4. Apparatus as defined in claim 1 in which said mechanical means comprises a feeding device, an inclined plate positioned a substantial distance below the discharge of said feeding device, said inclined plate positioned to deliver the particles falling thereon from said feeding device onto the upper side of said uncharged roll and being so inclined as to deliver the particles onto the roll at a velocity substantially equal to the surface velocity of the roll.

5. Apparatus for the electrostatic separation of particles comprising a feeding device, an inclined plate positioned a substantial distance below the discharge of said feeding device, an uncharged roll positioned with its upper side immediately below the discharge end of said inclined plate, means for collecting the particles falling from said roll in a plurality of fractions corresponding to their projection paths, an electrostatic separator of the rotary drum type, and means for delivering one of said fractions of particles to said electrostatic separator.

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