Dec. 28, 1937. V. MIKAN 2,103,374

APPARATUS FOR ELIMINATING SOFT STONE FROM GRAVEL

Original Filed Dec. 27, 1933 2 Sheets-Sheet 1

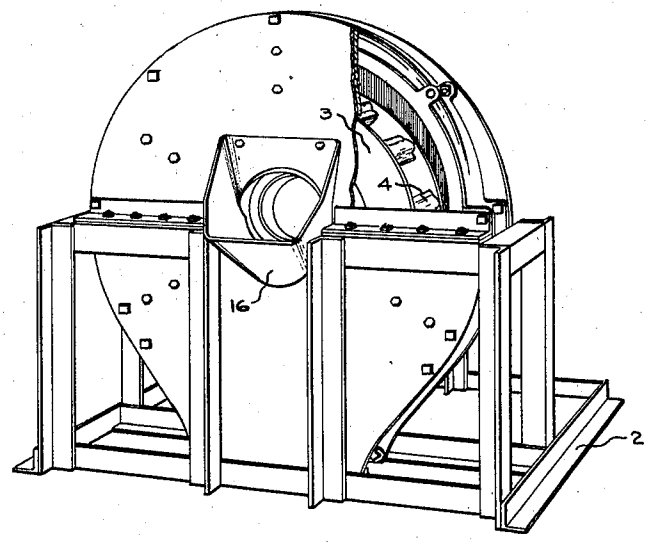

Fig. 1

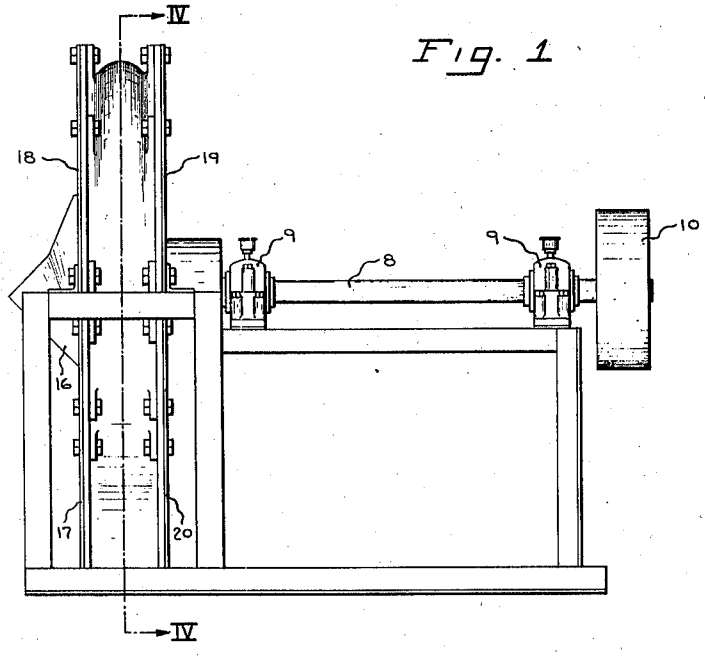

Fig. 2

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APPARATUS FOR ELIMINATING SOFT STONE FROM GRAVEL

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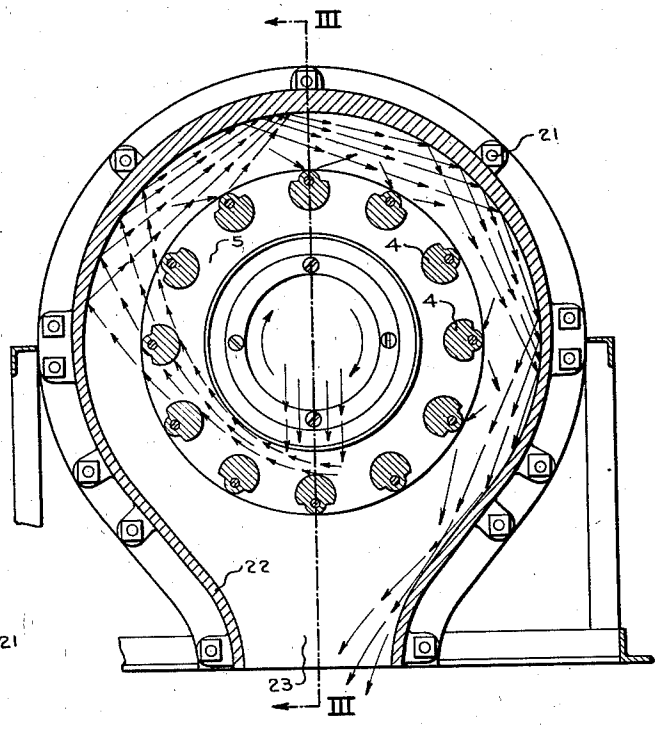

Fig. 4

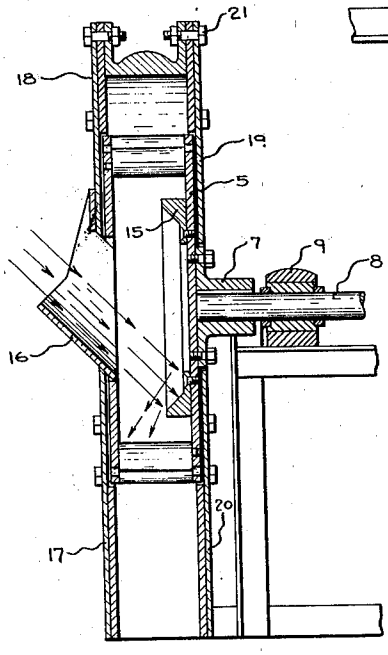

Fig. 3

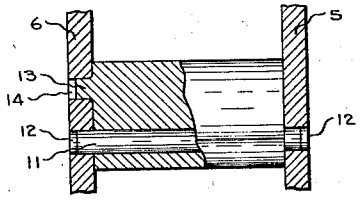

Fig. 5

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Patented Dec. 28, 1937

2,103,374

UNITED STATES PATENT OFFICE

2,103,374

APPARATUS FOR ELIMINATING SOFT STONE FROM GRAVEL

Victor Mikan, Durand, Mich.

Original application December 27, 1933, Serial No. 704,159. Divided and this application March 20, 1937, Serial No. 132,116

2 Claims. (Cl. 83—11)

This invention relates to a machine for the reduction or disintegration of soft particles present in a mixture of soft and hard particles to permit the separation of one from the other. More particularly the invention relates to the breaking up or reduction of soft stone to facilitate its removal from gravel, this application being a division of my application Serial No. 704,159, filed December 27, 1933.

In certain types of gravel found in natural deposits there are found varying percentages of soft stone which make the gravel unsuitable for use in concrete. Practically all of the present mechanical eliminators are built on the principle of throwing the individual stones against a wall or plate with sufficient force to cause the soft stone particles to break. In the theory and practice this design is incorrect, and it is usually found that quite a high percentage of good stone is reduced and rendered unfit. The reason is, that the kinetic energy, in the thus thrown stone, is a function of its mass, and the hard stone being heavier than the soft stone, a large portion of the good or hard stone is thrown with sufficient force to reduce the same to an objectable extent during the reducing of the soft stone. A further undesirable feature of these machines is that the impact which the individual particles receive is wholly uncontrolled. A still further undesirable feature is that due to the inherent design of the machines of this type, replacements of wearing parts are frequent and usually quite costly.

It is an object of this invention to eliminate the above undesirable features and to provide a machine which will readily and effectively eliminate soft stone from the gravel.

A further object of this invention is to provide a machine by which a controlled impact can be given to a mixture to break the soft particles and to pass the hard particles without necessarily a change in form unless it is desired to reduce the hard particles to some degree.

A further object is to provide a machine in which wear caused by relatively moving particles of stone or gravel is controlled by varying the point of greatest wear on certain parts, thereby prolonging the life of such parts.

A still further object of the invention is to provide a machine for eliminating soft stone from gravel which comprises a series of impact bars capable of being driven with controlled velocity against which the gravel containing both hard and soft stone is directed and uniformly acted upon by the impact bars to reduce only the soft stone and permitting the hard stone to pass through the machine with a relatively small amount of reduction.

These and other objects will be apparent when taken with the specification and accompanying drawings in which,

Fig. 1 is a perspective view of the invention,

Fig. 2 is a side elevation,

Fig. 3 is a vertical section taken on the line III—III of Fig. 4.

Fig. 4 is a vertical section taken on line IV—IV of Fig. 2, and

Fig. 5 is a vertical section taken on the central axis of an impact bar.

The soft stone eliminator 1 is mounted on a supporting frame 2. The principal element of the invention is the rotor 3 which consists of impact bars 4, a mounting plate 5 and an annular plate 6. The mounting plate 5 is supported and attached to a flanged hub 7 which is driven by the driving shaft 8. The driving shaft 8 is mounted in pillow blocks 9 and is driven by the pulley 10. The impact bars are mounted concentrically between the mounting plate 5 and the annular plate 6 at the peripheries thereof on pins 11, as shown in Figs. 3 and 5. The pins 11 are fixed in position by welding them to the plates into which they are fitted, as at 12. The impact bars 4 are prevented from rotating on their own axes by lugs 13 fitting in small bores 14. It has been found that there is a great amount of wear on the inside faces of the impact bars 4 and practically none on the outside faces. The impact bars 4 are therefore designed as shown in Fig. 4 heavily built up on the wearing side. To the inside of the mounting plate 5 is attached a frustro-conical deflecting ring 15 to deflect the gravel which enters the machine through the hopper 16 to the impact bars 4.

The rotor 3 is enclosed in front by plates 17 and 18 and in the rear by plates 19 and 20. Between the front and rear plates the casing casting 22 is mounted by means of bolts 21. The casing casting 22 surrounds substantially the entire periphery of the rotor 3 and with the plates 17 and 20 defines the exit chute 23 through which treated gravel is discharged onto a sizing screen not shown, or into any suitable container. The plates 17 and 18 are constructed with a suitable opening to permit the reception and attachment of the hopper 16.

The operation is as follows: Gravel containing soft stone is introduced to the machine through the hopper 16. It strikes the deflecting ring 15 and is deflected downwardly to the impact bars 4, which are rotating with the rotor 3, and the individual particles are struck one or more blows. The characteristics of the hard and soft stone in the gravel will vary with each gravel pit and for this reason it is necessary to regulate the peripheral speed of the rotor until a satisfactory reduction in soft stone is accomplished. By regulating the rate of rotation of the rotor the intensity of the impact of the bars 4 may be

controlled to the point that substantially all the soft stone is reduced without breaking up the good or hard stone to any objectionable amount. In some cases it may even be desired to increase the speed of the rotor **3** to the point where the hard stone is reduced to a controlled degree to improve its characteristics for certain types of construction work. In practice it has been found that with most grades of gravel rotation of a 36 inch rotor between 475 to 600 revolutions per minute will result in the reduction of soft stone in the gravel to less than 1% without objectionable reduction of good or hard stone. Following impact by the bars **4**, the gravel is carried by its own velocity and in some cases by additional impacts out against the casing casting **22**. From there it is carried around the rotor **3**, bearing heavily, due to centrifugal force against the casing casting **22** and is discharged unharmed out of the exit chute **23**. In the event that a soft piece of stone drops through the hopper **16** into the machine it is struck one or more blows by the impact bars **4**. Usually the first blow breaks the soft stone into many smaller pieces, and these pieces are carried through the same manner as the good stone. The blows of the impact bars **4** and the abrasive action of the casing casting **22** on the soft stone particles as they are carried around between the casing casting **22** and the rotor **3**, together with the scrubbing action they receive from the other pieces of stone in the machine, disintegrates or reduces them to fine sand or very small stone before they can be carried around the rotor **3** to a point where they can drop out of the outlet chute **23**.

In Fig. 4 is shown what is believed to be a true representation of the path of the gravel particles. No way has been found to determine their exact path but from examining the casing casting after it has been subjected to considerable wear the movement of the particles shown in Fig. 4 is substantiated. The particles appear to be given several impacts before they leave the confines of the rotor and casing casting. While it is believed that the particles rebound to a certain extent, between the rotor **3** and the casing casting **22**, this theory is not wholly borne out by the appearance of the machine after continued use, for there is practically no wear on the outsides of the impact bars **4**. It has been found that the best results are obtained when water is admitted to the machine with the gravel, the water reducing wear and assisting in the removal of broken down or disintegrated soft stone.

A novel and important feature of this invention is the operation of the deflecting ring **15** in conjunction with the impact bars **4**. When the deflecting ring is new, its shape causes it to deflect the gravel to a point on the impact bars **4** near the front of the machine. The greatest wear at this time on the impact bars **4**, then occurs on their side near the front of the machine. However, as the use of the machine is continued, the deflecting ring **15** wears and then instead of deflecting the gravel to the impact bars **4** to a point near the front of the machine, it deflects the gravel to a point on the impact bars **4** nearer their center. Thus the point of greatest wear on the impact bars is changed. As the deflecting ring wears down the point of greatest wear on the impact bars moves with the result that the life of the impact bars is considerably lengthened.

By gravel, small stones having a diameter of not greater than three inches, is meant. The soft stone referred to may be either separate or attached to hard or good stone, and includes, for example, such substances as ochre, soft sand stone, weathered schist, soft shale, coated stone with hard and soft core, coal, sailers, floaters and the various border-line stones. While this soft stone eliminator will operate when sand is admitted with the gravel, its presence reduces efficiency and increases the wear. For this reason best results are obtained when sand has been sifted out.

In the claims the reference to gravel and the like is used to designate generally mixtures of hard and soft particles including besides gravel other mixtures having similar characteristics including those specifically mentioned in the foregoing paragraph.

While the specification discloses a single embodiment of the invention it is apparent that it is merely illustrative of the broad principles involved and it is not intended that it be limited except by the scope of the following claims.

I claim:

1. In apparatus for the elimination of soft stone in gravel, the combination of a rotor mounted for rotation in a vertical plane, said rotor having a hollow interior defined by an annular row of circumferentially spaced impact bars with openings defined therebetween for discharge of material directed into the interior of the rotor, disc-like plates spaced by said bars, a deflecting ring concentrically supported on one of said plates having a continuous surface angularly disposed to the axis of rotation of said rotor, means for directing gravel through the plate opposite the plate supporting said deflected ring through an unobstructed course, into engagement with said angular surface of said deflecting ring whereby the soft stone and gravel is directed from said deflecting ring to said impact bars, the direction of flow of gravel against said deflecting ring being substantially normal to said angular surface.

2. In an apparatus for the elimination of soft stone in aggregate gravel, a substantially drum-shaped case having a discharge outlet opening in the lower part thereof, a rotor mounted for revoluble movement within the case and having a hollow interior with a single annular row of a plurality of impact bars arranged and carried on substantially horizontal axes substantially concentrically around the center of rotation of the rotor, said case having an inlet opening laterally to thus communicate with the hollow interior of the rotor, means for directing gravel to flow in a stream through said inlet opening, and means to revolve said rotor at a speed governed to carry the impact bars transversely across a stream of gravel from the inlet opening at a rate of movement to direct impact blows against the particles of gravel of substantially uniform intensity and with sufficient sharpness to disintegrate the soft particles without breaking harder particles, the case and rotor cooperating to return material to the outside of the rotor.

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