May 3, 1966 R. L. McILVAINE 3,248,761

MIXER

Filed April 14, 1964 2 Sheets-Sheet 1

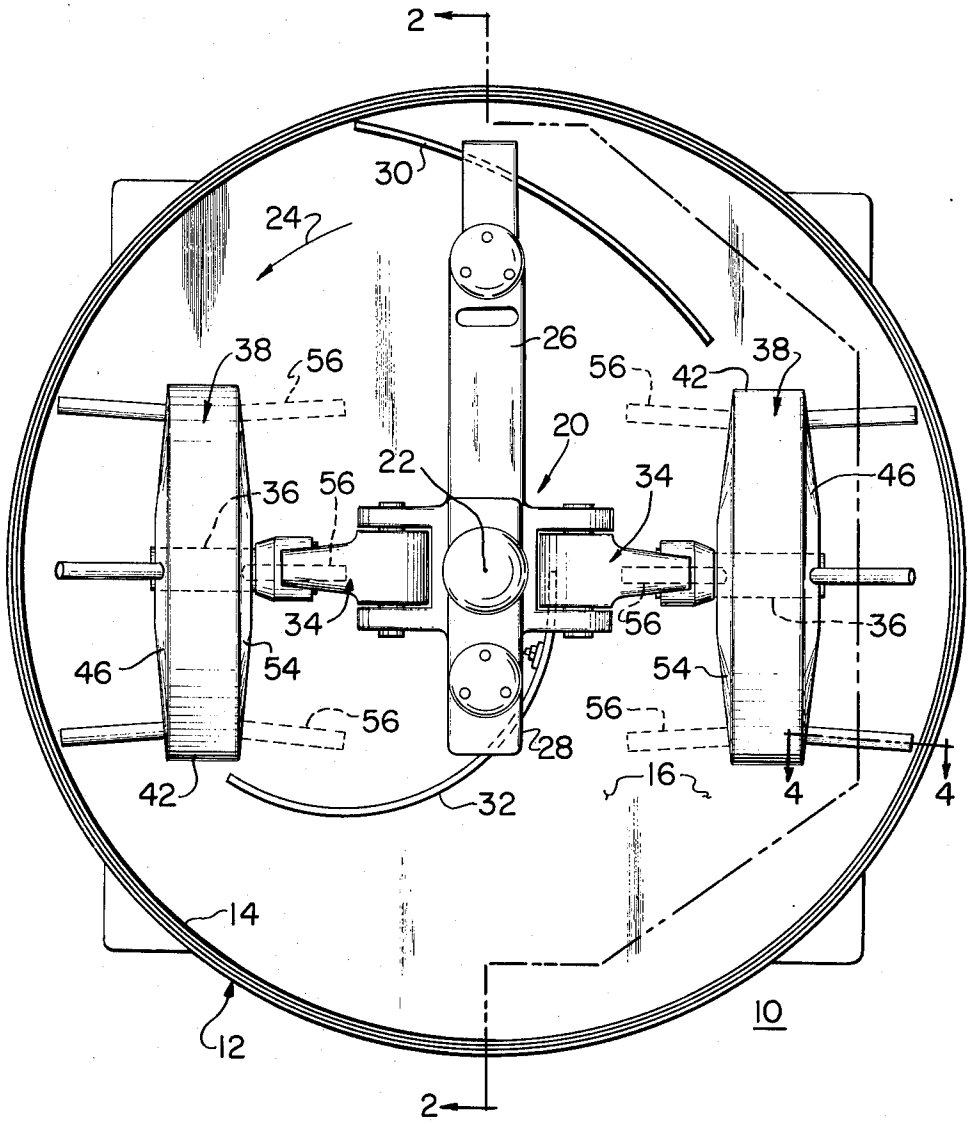

FIG. 1

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Filed April 14, 1964 2 Sheets-Sheet 2

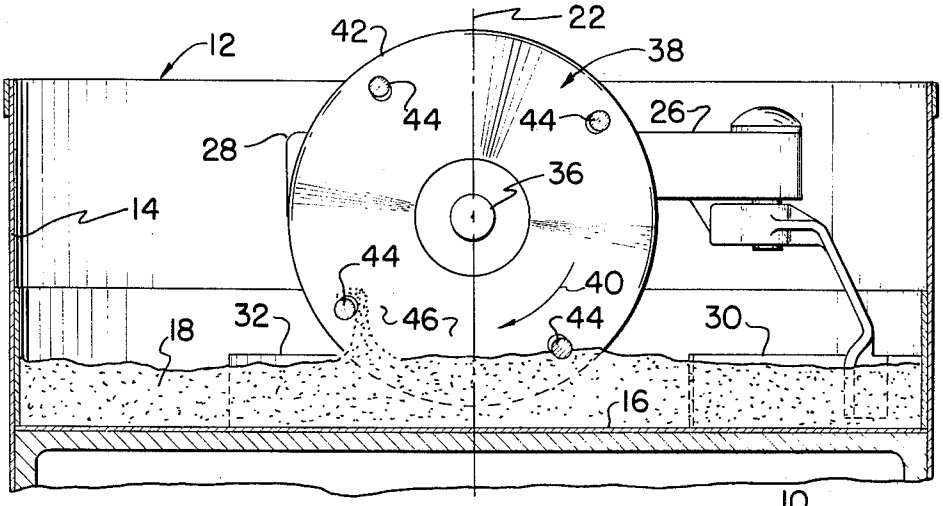

FIG. 2

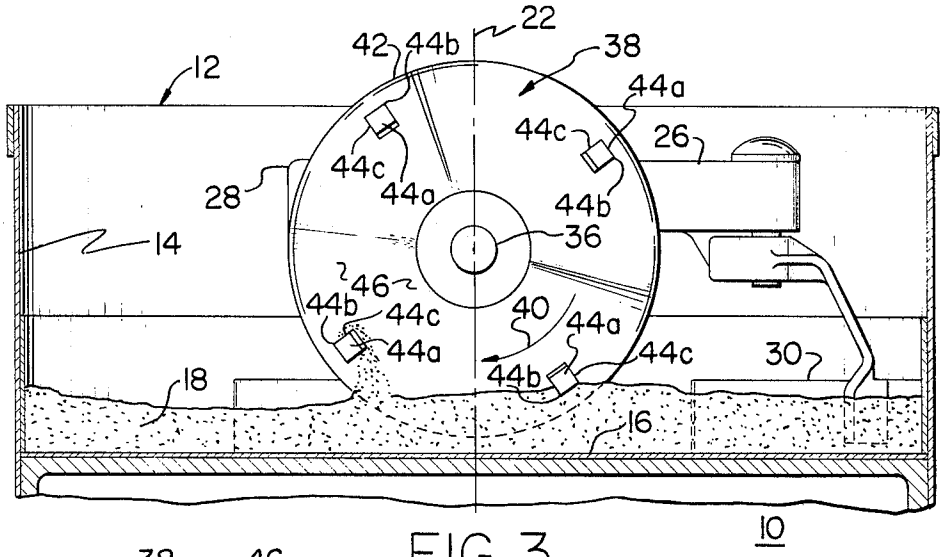

FIG. 3

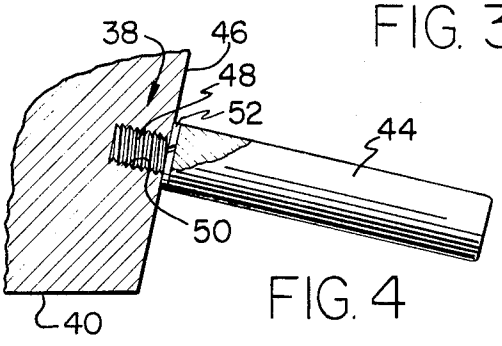

FIG. 4

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3,248,761
MIXER

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4 Claims. (Cl. 22—89)

The present invention relates to a new and improved mixer for granular material and the like and more particularly to mixers of the type employing rotatable mulling wheels for mulling and mixing materials such as those described in United States Patents Nos. 2,978,147 and 2,970,778, which patents are assigned to the same assignee as the present application.

It is an object of the present invention to provide a new and improved mixer of the type described wherein the mulling wheels are provided with means for agitating and mixing the material as they rotate in order to mix more thoroughly the material and to break up any lumps formed by the mulling action of the wheels.

Another object of the present invention is the provision of a new and improved mixer of the type described wherein there are provided means associated with the mulling wheels for lifting and aerating the sand as it is mulled.

Yet another object of the present invention is the provision of a new and improved mixer of the type described having means associated with the mulling wheels for cleaning and breaking up any material accumulating around the periphery of the material receiving crib of the mixer.

Another object of the present invention is the provision of a new and improved mixer with mulling wheels having outwardly extending cleat means thereon for lifting and aerating material disposed adjacent the periphery of the material receiving crib of the mixer.

Briefly, the foregoing and other objects and advantages of the present invention are accomplished by the provision of a new and improved mixer comprising a material receiving crib having a side wall and rotary mixing head mounted for rotation in the crib about a vertical axis. The mixing head is provided with a pair of mulling wheels disposed on opposite sides of the head, each mounted for rotation on an outwardly extending spindle. Each wheel is provided with an outer side face disposed to face the side wall of the crib and cleat means are provided on the wheels which extend outwardly from these side faces for lifting and aerating the material in the crib disposed around the periphery thereof as the wheels rotate on their spindles during rotation of the mixing head. In the embodiments shown in the drawings and described in the specification the cleat means preferably include a plurality of cleat members circumferentially spaced around the spindle axis of the respective wheels and disposed inwardly from the outer periphery of the wheels. As the mulling wheels rotate to mull the material in the crib, successive cleat members move downwardly into the material in the crib breaking up any accumulations or lumps around the periphery of the crib and then move upwardly carrying with them quantities of the material to further mix and aerate the material. Similar cleat means may also be disposed to extend inwardly from inner side faces of the mulling wheels in order to breakup, mix and aerate material in the central portion of the crib.

For a better understanding of the invention, reference should be had to the following detailed description taken in conjunction with the drawings, in which:

FIG. 1 is a top plan view of a mixer constructed in accordance with the features of the present invention;

FIG. 2 is a sectional elevational view taken substantialy along line 2—2 of FIG. 1;

FIG. 3 is a sectional elevational view similar to FIG. 2 but showing a different embodiment of the cleat means of the invention; and

FIG. 4 is an enlarged, detailed fragmentary sectional view taken substantially along the line 4—4 of FIG. 1 showing a detailed construction of the cleat means of the present invention.

Referring now more specifically to the drawings there is illustrated a mixer **10** of the general type shown and described in the aforementioned United States Patents Nos. 2,978,147 and 2,970,778. The mixer **10** includes a material receiving crib **12** having an upstanding cylindrical side wall **14** joined to the periphery of a bottom or wear plate **16** and adapted to contain a quantity of sand **18** or other material which is to be pulverized and mixed.

Within the crib **12**, there is provided a mixing head **20** which is mounted for rotation about a centrally disposed vertical axis **22** in the direction as indicated by the arrow **24** (FIG. 1). The head **20** is provided with a pair of oppositely extending, radially outwardly disposed support arms **26** and **28** which carry an outer scraper **30** and an inner scraper **32**, respectively. The lower edges of the scrapers **30** and **32** are disposed in close proximity to the wear plate **16** in order to move and mix the material in the crib and prevent the material from building up on the wear plate. The outer edge of the outer scraper **30** is positioned to move in close proximity to the side wall **14** of the crib and the scraper is curved in order that material around the periphery of the crib will be continually moved inwardly into the path of the muller wheels as the mixing head **20** rotates. The inner edge of the inner scraper **32** is disposed toward the central portion of the crib and is curved in order to move material outwardly from the central portion of the crib into the path of the muller wheels as the mixing head rotates.

The mixing head **20** is also provided with muller wheel support assemblies **34** which extend oppositely outward from the central axis **22** in directions generally normal to the support arms **26** and **28**. Each of the assemblies **34** is provided with an outward extending spindle **36** on which is journalled a mulling wheel **38**. The wheels **38** are journalled to freely rotate on the spindles **36** and as the mixing head **20** is rotated in the crib the wheels **38** are rotated in the direction of the arrows **40** by frictional engagement with the material in the crib **12**.

The wheels **38** are preferably constructed of a heavy material such as cast iron or steel and are provided with cylindrical outer peripheral surfaces **40** for mulling engagement with the material in the crib to pulverize and break up any lumps or agglomerations that may be present therein. As the material in the crib is engaged by the mulling surfaces **42** of the rotating wheels **38** it is compressed against the wear plate **16** tending to break up lumps therein and tends to move out from under the wheels as they move through the material.

In accordance with the present invention, for further aiding in the puverization of the material and the breaking up of lumps or agglomerations of material encountered by the wheels and to further aid in mixing and aeration of the material, cleat means are provided which extend outwardly from the sides of the wheels.

Preferably the cleat means may take the form of a plurality of individual cleat members **44** which are disposed in spaced circumferential relation about the axes of the spindles **36** as clearly shown in FIGS. 2 and 3. The cleat members **44** are spaced inwardly from the mulling surfaces **42** of the wheels so that they do not extend below these surfaces to interfere with rotation of the wheels. As the wheels **38** rotate, as shown by the arrows **40**, successive cleat members **44** move downwardly into the material in the crib breaking up any lumps or agglom-

erations present and then continue to move upwardly out of the material carrying a portion of the material along. The material carried upwardly on the cleat members **44** then falls downwardly into the crib and is aerated and mixed in the process.

As can be seen by reference to the drawings, each of the wheels **38** is provided with an outer side face **46** which is disposed to face the side wall **14** of the crib. Preferably these side faces **46** are annular, frusto-conical surfaces and the cleat members **44** are secured at right angles thereto so that the cleat members extend in an outwardly divergent relationship to the axes of the spindles **36**. It should also be noted that the cleat members **44** are of sufficient length so that the outer ends thereof are in close proximity to the side wall **14** of the crib and the wear plate **16**. Because of the outward divergence of the cleat members **44** and the close proximity of their outer ends to the side wall of the crib, any lumps of material adjacent the peripheral corner of the crib are broken up by the cleat members and moved inwardly toward the mulling wheels.

As can be seen in FIG. 4, the cleat members **44** may be secured to the annular conical side faces **46** of the muller wheels **38** by the provision of threaded end shanks **48** formed at the inner ends of the cleat members which are threadedly engaged in recesses **50** provided in the muller wheels. Lock washers **52** are provided to prevent the cleat members **44** from becoming unthreaded from the recesses **50** during rotation of the muller wheels. As the cleat members wear during use they can readily be replaced by unthreading the worn cleats and inserting new ones into the threaded recesses **50** on the wheels.

Referring now to FIG. 3 there is illustrated another form of cleat members **44*a*** which are rectangular in transverse cross section instead of round as are the cleat members **44** of FIG. 2. The rectangular cross sectioned cleat members **44*a*** are advantageous in that they have a relatively sharp leading edge or corner **44*b*** which aids in cutting into and breaking up the lumps of material. Additionally, the cleat members **44*a*** have flat surfaces **44*c*** which aid in carrying and lifting the material on upward movement of the cleats and thus provide for increased aeration and mixing of the material.

As can be seen in FIG. 1, the mulling wheels **38** are provided with inner side faces **54** which may be annular frusto-conical surfaces similar to the outer side faces **46**. Cleat members **56** (shown in dotted lines on FIG. 1) similar to the members **44** or **44*a*** may be provided to extend inwardly from the inner side faces **54** toward the central portion of the crib. These inwardly extending cleat members **56** are preferably outwardly divergent at their outer ends from the axes of the spindles **36** and thus tend to aid in breaking lumps or agglomerations of material in the central portion of the crib and move the material outwardly into the path of the mulling wheels. These inwardly extending cleat members **56** also aid in aerating and mixing the material as previously described in connection with the outwardly extending cleat members.

While particular embodiments of the invention have been shown, it will be understood, of course, that the invention is not limited thereto since many modifications may be made and it is therefore contemplated by the appended claims to cover any such modifications as fall within the true spirit and scope of the invention.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. A mixer for granular material and the like comprising a material receiving crib having a bottom wall and an upstanding side wall around the periphery thereof, a mixing head assembly in said crib mounted for rotation about an upstanding axis therein, said mixing head assembly including a mulling wheel journaled for rotation about an axis extending outwardly from said upstanding axis toward side side wall, said mulling wheel including an outer peripheral mulling surface and an outer side surface facing said side wall, a plurality of spaced-apart, rodlike, aerating cleats mounted on said mulling wheel, spaced inwardly of said mulling surface to extend outwardly of said side surface toward said side wall for breaking up, lifting, and aerating said material as said mulling wheel rotates.

2. The mixer of claim **1** wherein said mulling wheel includes an inner side surface facing toward the central portion of said crib, and a plurality of spaced-apart, rodlike, aerating cleats mounted on said wheel spaced inwardly of said peripheral mulling surface thereof and extending inwardly toward the central portion of said crib for breaking up, lifting, and aerating said material as said mulling wheel rotates.

3. A mixer for granular material and the like comprising a material receiving crib having a bottom wall and an upstanding side wall around the periphery thereof, a mixing head assembly in said crib mounted for rotation about an upstanding axis therein, said mixing head assembly including a mulling wheel journaled for rotation about an axis extending outwardly from said upstanding axis toward said side wall, said mulling wheel including an outer peripheral mulling surface and an outer, frusto-conical side surface facing said side wall, a plurality of spaced-apart, rodlike, aerating cleats mounted on said wheel spaced inwardly of said mulling surface to extend outwardly of said side surface toward said side wall for breaking up, lifting, and aerating said material as said wheel rotates, said cleats having outer ends diverging outwardly from the axis of rotation of said wheel.

4. The mixer of claim **3** wherein said mulling wheel includes an inner, frusto-conical side surface facing toward the central portion of said crib, and a plurality of spaced-apart, rodlike, aerating cleats mounted on said wheel spaced inwardly of said mulling surface to extend outwardly from said inner side surface toward the central portion of said crib, said cleats having outer ends diverging outwardly from the axis of rotation of said wheel.

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