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H. L. CERNIK

2,530,858

AGITATOR

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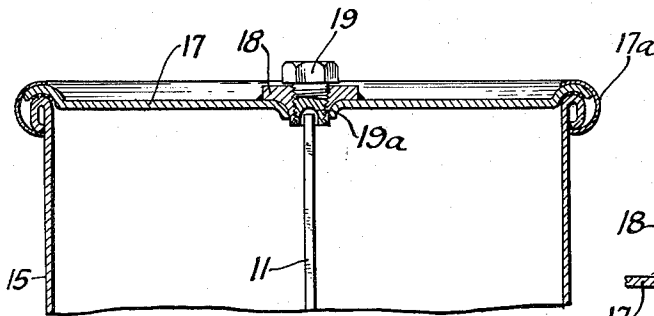
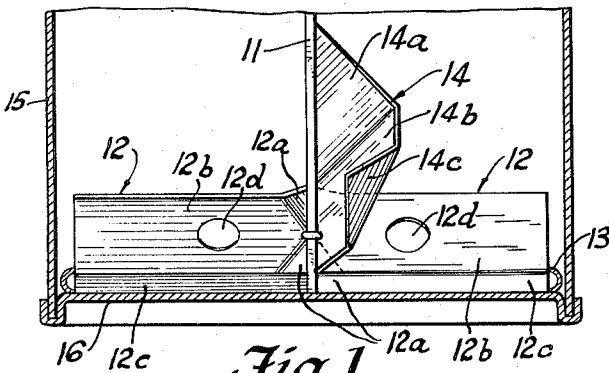


Fig. 1

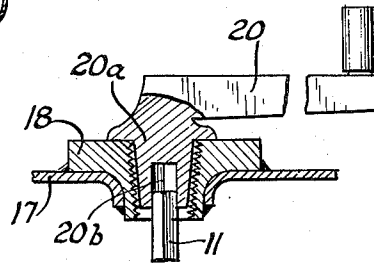


Fig. 4

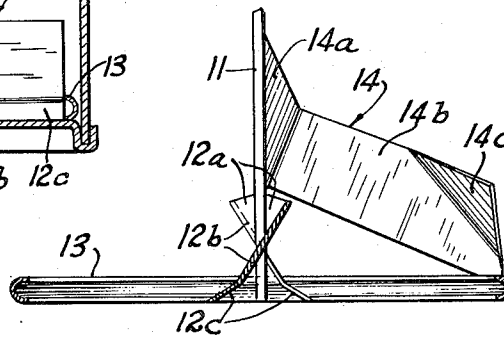


Fig. 3

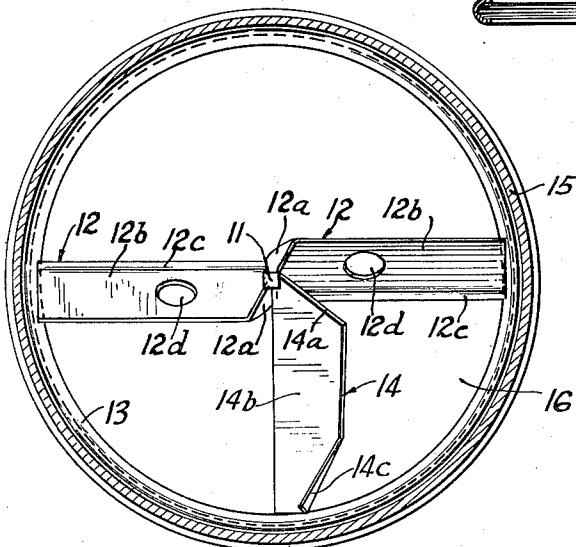


Fig. 2

INVENTOR
Henry L. Cerniak

By
Messrs. Olson & Mack
Attorneys.

UNITED STATES PATENT OFFICE

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AGITATOR

Henry L. Cerniak, Chicago, Ill., assignor to National Steel Container Corporation, Chicago, Ill., a corporation of Illinois

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6 Claims. (Cl. 259—108)

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This invention relates to agitators and has particular relation to agitators suited for use in drums and like containers for the purpose of thoroughly mixing the contents thereof or for any other desired purpose.

Agitators heretofore proposed and used for the purposes indicated above have been subject to numerous objections and disadvantages, among the most common of which has been the necessity of providing a bracket or other mounting or supporting member on the inner surface of the bottom head of the container, to which the agitator must be rotatably secured in such manner that it cannot be removed or can be removed only with considerable difficulty and inconvenience.

This gives rise to numerous disadvantageous conditions. The agitators cannot be removed from and inserted in different containers at will so that they can be conveniently used wherever desired, but a separate agitator must be initially provided and shipped in each container in which it is intended that one be used. Such an agitator is operable at only one position in the container and after use the container and the agitator cannot be readily cleaned and re-used. A further serious disadvantage lies in the fact that containers of this character are particularly subject to damage and wear on account of the attachment of the bracket or other support to the inner surface of the bottom head, and containers thus damaged are rendered useless or defective because of resulting leakage and spoilage of their contents.

Moreover, agitators of the type requiring special supporting parts at the bottoms of the containers in which they are used are inefficient in accomplishing complete mixing or agitation of the contents of the containers because the entire inner surfaces of the bottom heads of the containers are not accessible in such manner that all of the contents can be scraped or otherwise removed therefrom to be thoroughly mixed with the remainder of the contents of the containers. The agitator supporting parts are also objectionable because they interfere with free re-use of the containers, such as for the storage and shipment of solid materials, etc.

The primary object of the present invention is to overcome the above-indicated objections and disadvantages by providing an agitator which is readily removable from and insertable into different containers and which requires no attachment of the agitator to any internal parts in the containers.

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More specifically, it is an object of the invention to provide an agitator which may be substantially centered within a drum or similar container by means carried by the agitator and having only bearing contact with the interior surfaces of the container.

It is a further object of the invention to provide an agitator of the above-indicated character which may be operated at any desired position or depth within a drum or like container.

A further object of the invention is to provide an agitator of the above-indicated character which will serve more efficiently than those heretofore known for agitating and mixing the contents of containers.

A still further object of the invention is to provide an agitator of the above-indicated character in combination with a drum or like container, including means for positioning the agitator within the container during shipment, if desired, and also accommodating the application to the agitator of rotating means for operation thereof.

According to a preferred embodiment, the invention comprises an agitator having a rotatable shaft with a plurality of agitator blades secured thereto and extending outwardly therefrom adjacent one end thereof and provided with a bearing ring disposed peripherally with respect to said blades and secured to the extremities thereof and adapted to fit freely within a drum or like container to substantially center the agitator therein. The bearing ring has contact only with the inner side wall surface of the container to maintain the agitator substantially centered therein and is preferably of U-shaped cross-section with the convex surface thereof facing outwardly for such contact. The reduced peripheral area of the bearing ring coming into contact with the inner side wall surface of the container thus gives rise to a negligible amount of friction in the rotation of the agitator, while still maintaining the same in substantially perfect concentricity with the container.

The head of the container is provided with a centrally located bung hole or other opening into which is inserted a bung or other closure device when the container is prepared for shipment, storage, or the like. The closure device is provided with a recess in the inner face thereof which is positioned and adapted to receive and support the adjacent end of the agitator shaft to hold the same in proper position. Upon removal of the closure device, a crank or other

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rotating means may be inserted through the opening to engage the adjacent end of the shaft for the purpose of rotating the agitator, or, if desired, the agitator may be raised to an upper or intermediate position in the container for commencement of the agitating operation, in which event the crank or other rotating device is applied to the projecting end of the shaft and the same is intermediately supported by the edges of the opening in the head through which it projects.

The head may be of either the removable or the non-removable type and in the former case the agitator may be completely and freely removed from the container upon removal of the head thereof. This renders the entire agitator accessible for inspection, cleaning, coating, or other desired treatment, and likewise leaves the entire interior surface of the container completely accessible and free of any obstruction such as is encountered in presently known types of container and agitator assemblies wherein a special bracket or other supporting parts must be provided and secured to the inner surface of the bottom head of the container and to which the agitator must be secured.

In the preferred form of agitator construction referred to above, the previously mentioned blades are inclined to exert lifting effect upon the contents of the container when the agitator is rotated in a predetermined direction therein and to scrape solid material and the like from the bottom surface of the interior of the container. In addition, a supplemental lifting blade is secured to an intermediate portion of the shaft and extends outwardly and downwardly therefrom to a point of securing with the bearing ring previously described. The main body portion of this supplemental lifting blade is likewise inclined to exert lifting effect upon the contents of the container when the agitator is operated therein, whereby the contents of the lower portions of the container are lifted and caused to be thoroughly mixed with the contents of the upper portions thereof. The upper outside corner portion of the supplemental lifting blade is preferably turned forwardly from the main body portion thereof with respect to the predetermined direction of rotation of the agitator. This feature serves to enhance the lifting effect of the supplemental blade by deflecting more of the contents of the container into contact therewith during rotation of the agitator. The lifting effect of both the agitator blades and the supplemental lifting blade is accompanied by a corresponding downward reaction force on the agitator, which urges it toward the bottom of the container at all times when it is being rotated in the proper direction for agitation, and when it is raised to an upper or intermediate position before the operation is started this reaction force assists greatly in causing the agitator to work downwardly through any solid material or the like in the lower portion of the container.

Other features and advantages of the invention will be apparent from the detailed description appearing hereinafter, taken in conjunction with the accompanying drawings forming a part hereof, in which:

Figure 1 is a front elevational view of an agitator embodying the invention, in place within a drum or like container, which latter is shown in vertical section for clarity of illustration of the agitator, with parts of the agitator shaft and drum broken away;

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Fig. 2 is a view illustrating the same assembly as Fig. 1, showing the agitator in top plan and the container in horizontal section;

Fig. 3 is a side elevational view of the agitator shown in Fig. 1 with a portion of the shaft thereof broken away; and

Fig. 4 is a fragmentary view, partly in side elevation and partly in vertical section, showing a crank applied to the upper end of the shaft of the agitator shown in the other figures of the drawings, through an opening provided in the head of the container for that purpose.

Referring to the drawings in detail, Fig. 1 shows an agitator comprising a rotatable shaft 11 of square cross-section and a pair of diametrically opposed agitator blades 12 secured thereto and projecting radially outwardly from the lower extremity thereof. These blades comprise attaching portions 12a which are welded or otherwise suitably secured to the shaft 11 and project angularly therefrom, main body portions 12b formed integrally with the portions 12a and bent therefrom to extend outwardly in generally radial directions with respect to the shaft 11 but inclined from the vertical to exert a lifting effect upon the contents of a container when the agitator is rotated in a predetermined direction therein, and lower marginal portions 12c, which are still further inclined to the vertical to serve as scrapers to remove solid material and the like from the bottom surface of the interior of the container, as well as contributing to the desired lifting effect. Apertures 12d are provided in the main body portions 12b of the blades to decrease the resistance to rotation of the agitator, but obviously may be omitted if not desired or required for any particular application of the agitator.

A bearing ring 13 is disposed peripherally with respect to the blades 12 and is secured by welding or other suitable means to the outer extremities thereof. This bearing ring is of U-shaped cross-section with the convex surface thereof facing outwardly to provide an annular bearing upon the inner surface of a cylindrical container such as a drum or the like. The ring 13 also serves to add rigidity to the agitator blade assembly. As shown in Figs. 1 and 3, the bottom surface or edge of the ring 13 lies in the same horizontal plane with the scraping edges of the agitator blade portions 12c and with the lower extremity of the shaft 11.

A supplemental lifting blade 14 comprises an attaching portion 14a welded or otherwise suitably secured to an intermediate portion of the shaft 11 and extending angularly therefrom; a main body portion 14b formed integrally with the attaching portion 14a and bent therefrom to extend outwardly and downwardly into contact at its lower outside corner portion with the bearing ring 13, to which it is secured by welding or other suitable means, in the same manner in which the outer extremities of the blades 12 are secured to said ring; and an upper outside corner portion 14c which is turned forwardly from the main body portion 14b with respect to the predetermined direction of rotation of the agitator. The body portion 14b of the blade is inclined to the vertical in the same direction as the body portions 12b of the blades 12, so that the blade 14 supplements the lifting effect of the blades 12 throughout a large part of the container and further promotes complete agitation and mixing of the contents. The forwardly turned corner portion 14c contributes to this

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effect of the blade 14 by deflecting a greater proportion of the contents into contact therewith.

Figs. 1 and 2 show the agitator disposed within a drum or like container 15 having a fixed bottom head 16 and a removable top head 17, the latter being secured in sealing relation to the top opening of the container by means of a locking ring 17a which may be of any suitable construction well known in the art. A bushing 18 is extended through the top head 17 and is welded or otherwise properly secured thereto to provide a threaded opening in the nature of a bung hole at the center of the top head for receiving a threaded bung or similar closure device 19, whereby the container may be completely closed and sealed. The inner face of the closure device 19 is provided with a recess 19a which receives and supports the upper end of the shaft 11 of the agitator to locate the same in proper position when the container is prepared for shipment or storage with the agitator therein. The bottom of the agitator then rests upon the bottom head of the drum and is maintained in substantially centered position within the container by reason of the fact that there is only sufficient clearance between the bearing ring 13 and the inner side wall surface of the container to provide a free running fit between these parts for ready rotation of the agitator within the container.

The agitator is rotatable by means of any suitable rotating device such as a crank 20 having a hub portion 20a adapted to extend into the opening in the bushing 18 upon removal of the closure device 19 therefrom and having an axial socket 20b at its inner end adapted to engage the upper end of the shaft 11 in driving relation to rotate the agitator as desired. As illustrated, the shaft 11 and the socket 20b are of square cross-section to provide the desired driving engagement, but obviously any other desired type of attachment of the rotating device to the shaft may be employed.

If desired, the operation of the agitator may be initiated after first raising the entire agitator assembly to an intermediate or upper position in the container, which may be accomplished by grasping the upper end of the shaft 11 by means of pliers or any other suitable tool after removing the closure device 19 from the bushing 18. In that event the shaft 11 may project a substantial distance outwardly through the opening in the top head of the container and the rotation of the agitator may then be started with the blades thereof at any desired raised position within the container. This may be particularly desirable when the contents consist in part of a liquid and in part of solid or pulverulent material which has settled to the bottom of the container during shipment or storage, such as is commonly the case with paints and the like.

Raising of the agitator assembly to an intermediate position in the container, in which the blades rest upon the top of the layer of pigment or like material, renders the agitator much easier to start in rotation and more efficient in mixing the different ingredients of the contents of the container, since only a superficial layer of the solid material or the like has to be set in motion by the initial rotation of the agitator, as contrasted with the necessity of moving the entire body of such material, or a very substantial part thereof, with the type of agitator which is secured in position within the container with the agitating blades at the bottom thereof.

As previously pointed out, the inclination of

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both the blades 12 and 14 of the agitator embodying the present invention produces a lifting effect upon the contents of the container when the agitator is properly rotated therein, and thus effects thorough agitation and mixing the entire contents. With the blades inclined as shown in the drawings, the proper direction of rotation of the agitator is clockwise as viewed from the top. Such rotation exerts a downward reaction force on the agitator itself, corresponding to the lifting force exerted on the contents of the container, so that when the operation is started with the agitator in a raised position in the container it forces itself downwardly until it comes in full contact with the bottom head 16. In that position it scrapes the entire inner surface of that head and removes all solid material and the like therefrom for complete mixing with the remainder of the contents of the container.

During rotation of the agitator in raised positions within the container the side walls of the opening through the bushing 18 at the center of the top head 17 provide lateral support for the shaft 11 to substantially center the same with respect to the container, while the lowermost portion of the agitator assembly is substantially centered within the container by means of the bearing ring 13 contacting with the inner side wall surface of the container, as previously described. Centering of the agitator assembly at both ends thereof with respect to the container is thus maintained in all operative positions of the agitator, throughout the range of vertical movement of the agitator in the container. This is accomplished with a minimum of friction opposing rotation of the agitator, by reason of the outwardly convex U-shaped cross-section of the bearing ring 13.

The provision of means for centering the agitator within the container at all times, as described, eliminates all need for a fixed support for the lower end of the agitator within the container, and in this manner many of the seriously objectionable features of previously known containers of the agitator type are entirely eliminated. Efficiency of operation is greatly improved because the entire contents of the container are thoroughly agitated and mixed, including all matter settled upon or adhering to the bottom of the container, the entire surface of which is exposed to and scraped clean by the agitator. Purchasers of both empty and filled containers of the open-head type are relieved of the necessity of buying an agitator with each container, as agitators previously obtained by the users may be re-used in new containers by reason of the ready removability of the agitator from one container and insertion thereof in another. This feature of removability and replacement or interchangeability thus provides an important and desirable economy of purchases in the first instance. Savings may also be effected in shipping costs by elimination of the weight of the agitator whenever a new one is not needed. Moreover, important economies are accomplished by making it possible for both the agitators and the containers to be thoroughly inspected, cleaned, coated, or otherwise treated and re-used in a manner which is not possible in the case of containers from which the agitators are not removable and which must be provided with fixed interior parts for support of the agitator, thus making thorough cleaning, etc., impossible.

As previously indicated, the provision of such fixed agitator supports within containers weakens

the container construction and increases the susceptibility thereof to wear and damage in handling and shipment, with resultant leakage and spoilage of their contents, so in these respects also the present invention achieves important savings by eliminating the need for such fixed supports, thus prolonging the life of the containers and minimizing losses of the contents thereof.

In many respects, therefore, the present invention promotes economy as well as efficiency in the use of agitators of the type referred to. While maximum economies may be achieved by the employment of the invention in connection with open-head containers, many important advantages are likewise secured in similar applications to closed-head containers of generally similar construction except that neither head is removable. In such cases the agitators are inserted in the containers in the course of original assembly thereof and this construction has all of the advantages of the open-head construction except those dependent upon complete removability of the agitators from the containers.

While only one embodiment of the invention has been specifically illustrated herein, it will be understood by those skilled in the art that various changes and modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims. For example, any desired number of agitator blades and supplemental lifting blades may be provided; the specific form and arrangement of the blades and other parts may be varied as desired, etc.

What is claimed as new and is desired to be secured by Letters Patent, therefore, is:

1. An agitator for use in drums and the like comprising a rotatable shaft, a plurality of agitator blades secured to and extending outwardly from said shaft adjacent one end thereof, and a bearing ring disposed peripherally with respect to said blades and secured to the extremities thereof and adapted to fit freely within a drum to substantially center the agitator therein, said bearing ring being of substantially U-shaped cross-section with convex surfaces thereof facing both outwardly and downwardly for contact with both the inner side and bottom wall surfaces of the drum.

2. An agitator for use in drums and the like comprising a rotatable shaft, a plurality of agitator blades secured to and extending outwardly from said shaft adjacent the lower end thereof, a supplemental lifting blade secured to and extending outwardly and downwardly from an intermediate portion of said shaft to a point adjacent the bottom plane of said first-mentioned agitator blades, and a bearing ring disposed peripherally with respect to all of said blades and secured to the extremities thereof and adapted to fit freely within a drum to substantially center the agitator therein.

3. An agitator for use in drums and the like comprising a rotatable shaft, a plurality of agitator blades secured to and extending outwardly from said shaft adjacent the lower end thereof, a supplemental lifting blade secured to and extending outwardly and downwardly from an intermediate portion of said shaft to a point adjacent the bottom plane of said first-mentioned agitator blades, and a bearing ring disposed peripherally with respect to all of said blades and secured to the extremities thereof and adapted to fit freely within a drum to sub-

stantially center the agitator therein, said supplemental lifting blade being inclined to exert lifting effect upon the contents of the drum when the agitator is rotated in a predetermined direction therein.

4. An agitator for use in drums and the like comprising a rotatable shaft, a plurality of agitator blades secured to and extending outwardly from said shaft adjacent the lower end thereof, a supplemental lifting blade secured to and extending outwardly and downwardly from an intermediate portion of said shaft to a point adjacent the bottom plane of said first-mentioned agitator blades, and a bearing ring disposed peripherally with respect to all of said blades and secured to the extremities thereof and adapted to fit freely within a drum to substantially center the agitator therein, said first-mentioned agitator blades and said supplemental lifting blade being inclined to exert lifting effect upon the contents of the drum when the agitator is rotated in a predetermined direction therein.

5. An agitator for use in drums and the like comprising a rotatable shaft, a plurality of agitator blades secured to and extending outwardly from said shaft adjacent the lower end thereof, a supplemental lifting blade secured to and extending outwardly and downwardly from an intermediate portion of said shaft to a point adjacent the bottom plane of said first-mentioned agitator blades, and a bearing ring disposed peripherally with respect to all of said blades and secured to the extremities thereof and adapted to fit freely within a drum to substantially center the agitator therein, said supplemental lifting blade comprising a main body portion inclined to exert lifting effect upon the contents of the drum when the agitator is rotated in a predetermined direction therein, and an upper outside corner portion turned forwardly from said main body portion with respect to such direction of rotation.

6. The combination with a drum or the like having a head therein, of a removable closure plug closing an opening in the central portion of said head and having a recess in the inner face thereof, an agitator disposed within the drum comprising a rotatable shaft substantially coaxial with the drum and having one of its ends received and supported in relatively closely fitting relation within the recess in the inner face of said closure plug, a plurality of agitator blades secured to and extending outwardly from said shaft adjacent the opposite end thereof, and a bearing ring disposed peripherally with respect to said blades and secured to the extremities thereof and fitting freely within the drum to substantially center the agitator therein, said bearing ring being of substantially U-shaped cross-section with convex surfaces thereof facing both outwardly and downwardly for contact with both the inner side and bottom wall surfaces of the drum, and rotating means applicable to the first-mentioned end of said shaft through said opening in the head upon removal of said closure plug therefrom, for effecting rotation of the agitator, said rotating means having a hub portion fitting relatively closely but in freely rotatable relation within said opening in the head in place of said closure plug to substantially center said shaft with respect to the drum during such rotation.

HENRY L. CERNIAK.

(References on following page)