

Mixing in 3-D



A new mixer uses three-dimensional movements to quickly and thoroughly mix a variety of materials.

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For many manufacturers, any compromise in the productivity, appearance or characteristics of a product formulation is unacceptable. Mixing must therefore be efficient, precise and repeatable to ensure the highest possible product quality and the lowest possible manufacturing costs. However, many conventional mixers are limited in both capacity and mixing ability, making it difficult for manufacturers to achieve their goals.

Recently, a new mixer* has become available to the North American market that promises to change the way the mixing process is accomplished. The mixer rotates the material on three separate axes, reducing mixing times and resulting in a superior blend. It can handle any size or shape of container, and its fully programmable operation allows mixing to be customized for each product. With the new mixer, manufacturers can quickly and thoroughly mix a wide variety of materials.

Principle of Operation

The new mixer is based on the same operation principle as a gravity mixer, in which the mixing vessel circulates around one axis to achieve a mix that is often referred to as "free-falling." Designed primarily for free-flowing formulations, gravity mixers use the force

of gravity, rather than an external mechanism, to pull and blend the mix.

The new mixer improves on this design by using three axes rather than two to accomplish the mixing process. The container is mounted on a hinged universal joint, and the mixing vessel rotates around both the X (inner) and Y (outer) axes. The direction of rotation of the internal and external shaft changes periodically, and each shaft is driven at a predetermined rotational speed after every directional rotation change (see Figure 1). Due to the intrinsic design of the three-dimensional motion, the homogeneity of

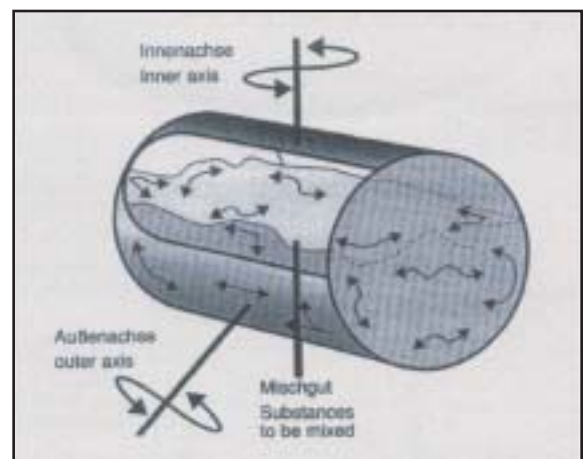


Figure 1. Each shaft is driven at a predetermined rotational speed after every directional rotation change.

The dyna-MIX, manufactured by Willy A. Bachofen AG Maschinenfabrik, Basel, Switzerland, is distributed in North America by Glen Mills Inc., Clifton, NJ.

the mix does not depend on the size or shape of the vessel; instead, the energy input is distributed proportionally throughout the entire volume of the vessel, ensuring a gentle, constant and reproducible mixing process at all times (see Figure 2). The addition of the third axis tremendously increases the effectiveness of the mix, both in speed and uniformity.

Unlike most conventional mixers, which require that the materials be placed into the machine's own mixing vessel, the new mixer can handle any size or shape of container. A sleeve can be constructed for each size container that will be used on the machine, and the clamping device for these containers can be adapted to meet specific mixing needs. For example, manufacturers working with a very high-density mix, such as a homogenized zinc gel used in the battery industry, can specify a reinforced clamping device to ensure that the container is held tightly throughout the vigorous mixing process (see Figure 3). Open containers can also be used—an automatic locking device affixed to the machine cover seals the container during the mixing process. Mixing in self-contained vessels allows mixing, storing and transporting without transferring the product, thereby eliminating cleanup, additional labor costs, product loss, dust emissions from the vessel and the possibility of cross-contamination between products.

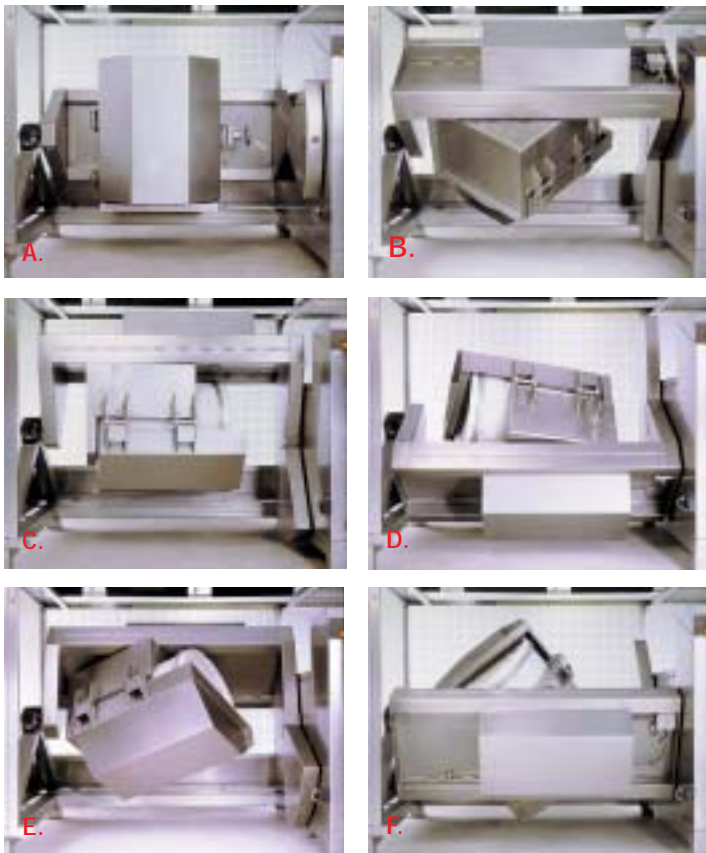


Figure 2. The operation of the new mixer, as shown in these time lapse images, ensures gentle, constant and reproducible mixing.



Figure 3. A reinforced clamping device ensures container stability with high-density mixes.

Customized Mixing

In addition to its optimized mixing design and flexibility, the new mixer is also fully programmable. The user programs the rotating speed of both axes into an operating panel, which is affixed to the machine. The mixing action can be customized for each product by adjusting the speed, direction and time on each individual axis, and these predetermined parameters help develop the optimal mixing program for each product. For example, products that tend to agglomerate can undergo a high speed process, while very sensitive products or viscous blends might only be subjected to a gentle cycle.

The mixer's programmable logic controller (PLC) can store up to eight different recipes, with as many as nine different rotational speeds and mixing times for each recipe. Each program, or set of parameters, contains instructions for the rotational time (the time in which an axis turns in one direction), total mixing time, direction (clockwise or counterclockwise) and speed (as a percentage of maximum rpm). For example, Program 1 might run for a total of 30 minutes, with the mixing performed on the outer axis in a clockwise direction for 15 minutes at the maximum rpm; the inner axis clockwise for 7.5 minutes, still at maximum rpm; and then counterclockwise for 7.5 minutes at 50% of maximum rpm.

The PLC allows for reproducible results without having to reprogram the machine each time. A printer or other electronic device can also be connected to the system at the serial-interface to enable the mixing operation to be documented and/or linked to other stages in the manufacturing process.

Automated Material Handling

For manufacturers who regularly handle large, heavy batches of material, the new mixer can also be equipped with an automatic lifting scaffold to enable the mixing containers to be changed within a short period of time and with minimal effort (see Figure 4). The user simply transports the mixing container to the mixer using a wagon or lift truck and places it into the scaffold. With the touch of a button, the scaffold

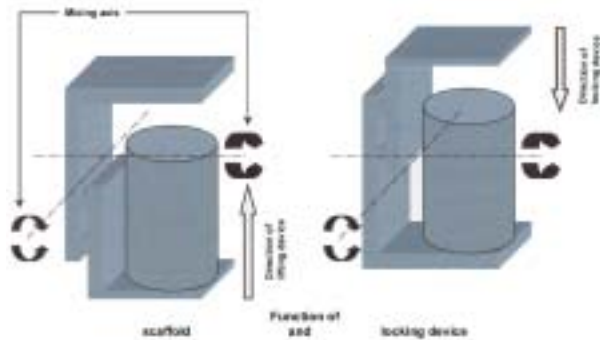


Figure 4. The automatic lifting scaffold enables mixing containers to be changed within a short period of time and with minimal effort.

lifts the container into the mixer and locks it into place, ready for the mixing process to begin. After the mixing cycle is complete, the scaffold automatically moves the vessel into its final position in the holder, and the holder descends and places the vessel on the ground or on a wheeled base. The container can then be moved manually or automatically for further processing.

Enhanced Mixing Efficiency

Due to its versatile nature, the new mixer can be used to enhance mixing capabilities in a variety of applications. Available in sizes ranging from 50-1200 liters, the mixer is primarily designed to mix solids, such as pigments, metals and oxides, with different sizes, shapes, densities and flow characteristics. However, it can also successfully handle emulsions (liquid-liquid) and dry pow-



Figure 5. The system's intense mixing action and atomization capabilities ensure that the product is moistened homogeneously.

der or granulates mixed with a small amount of water, thin liquid oils or solvents, as long as the product on the whole remains dry. The system's intense mixing action and atomization capabilities ensure that the product is moistened homogeneously, making it useful for chemical additives, dopants and other dry-liquid applications (see Figure 5).

The new mixer has already been successfully used to mix materials for powder coatings, dental ceramics, glass, batteries and other applications. In the future, it will undoubtedly enhance the mixing speed and efficiency of a range of other materials as well. ☺

For more information about mixers, contact Leslie Horn at Glen Mills Inc., 395 Allwood Rd., Clifton, NJ 07012; phone 973/777.0777; fax 973/777.0070; e-mail leslie@glenmills.com; or visit www.glenmills.com.