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Bittner et al.

[11] **3,820,597**

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[54] **MIXER HAVING A DEVICE FOR COOLING OF MATERIAL TO BE MIXED**

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[30] **Foreign Application Priority Data**

Sept. 15, 1971 Germany 2146150

[52] **U.S. Cl.** **165/109,** 259/66, 259/107, 259/DIG. 18

[51] **Int. Cl.** **F28f 13/12**

[58] **Field of Search** ..... 165/109; 74/665 GA; 259/66, 107, DIG. 18

[56] **References Cited**

UNITED STATES PATENTS

1,415,916	5/1922	Barton	74/665 GA
2,085,924	7/1937	Riegler	165/109 X
2,557,622	6/1951	Trier	165/109 X
2,645,461	7/1953	Brown et al.	165/109 X
3,387,651	6/1968	Berker	165/109
3,400,051	9/1968	Hofschneider	165/109 X
3,546,430	12/1970	Kane	165/109 X
3,554,274	1/1971	Herfeld	165/109 X

FOREIGN PATENTS OR APPLICATIONS

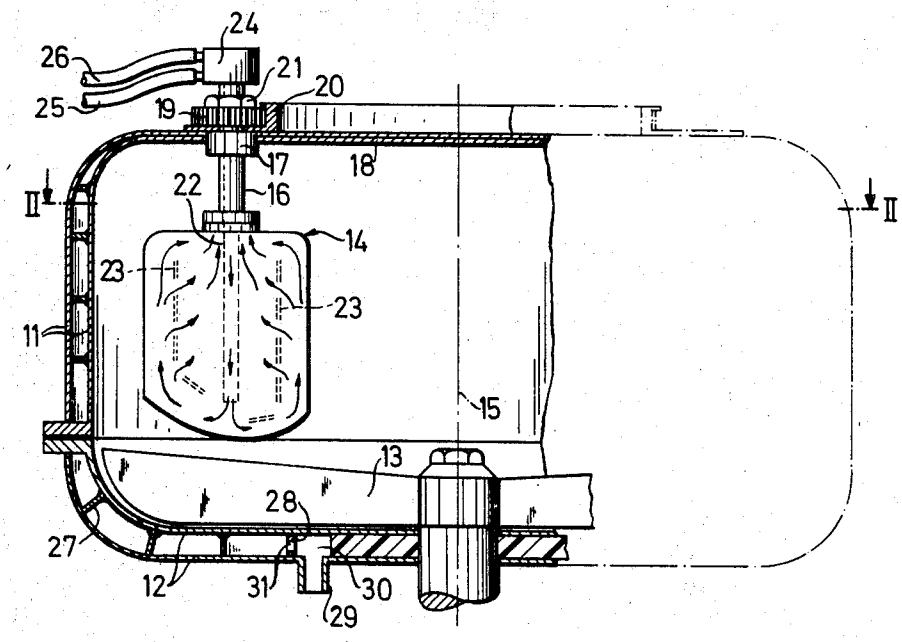
244,267	1910	Germany	165/109

Primary Examiner—Albert W. Davis, Jr.
Assistant Examiner—S. J. Richter

[57] **ABSTRACT**

A mixer having a device for the cooling of powdered, granular, liquid or otherwise flowable material to be mixed, in particular plastics agglomerates or the like, consisting of a cup-shaped mixture container which may be double-walled and through which a coolant flows, and which has a mixing implement rotating in its center over the bottom thereof.

19 Claims, 3 Drawing Figures



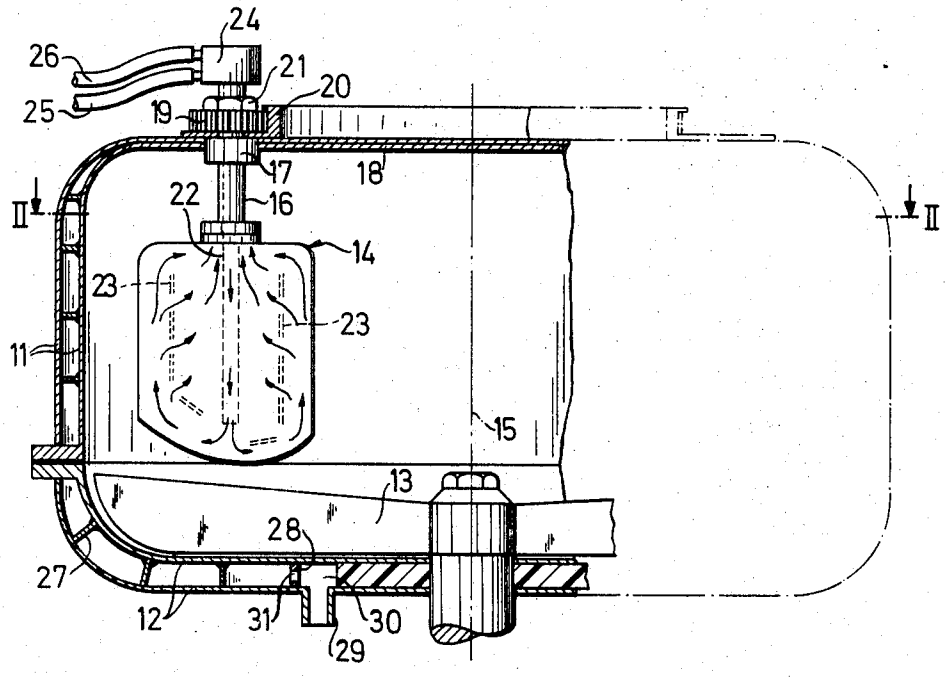

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Fig.1

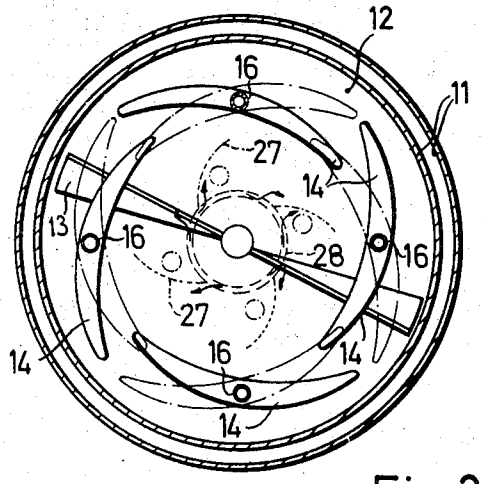
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Fig.2

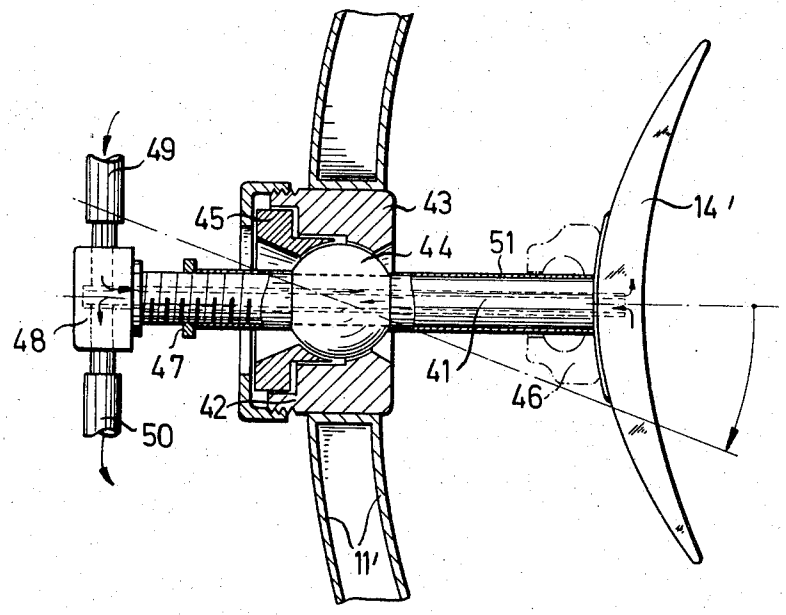

Fig. 3

MIXER HAVING A DEVICE FOR COOLING OF MATERIAL TO BE MIXED

BACKGROUND OF THE INVENTION

In a known mixer shown in German Auslegeschrift No. 1,270,536 and serving for the processing of plastics or the like, the device for cooling the material to be mixed consists of at least one double-walled, flat annulus, arranged parallel to the double-walled container shell and through which coolant flows, the material to be mixed being displaced "between" the said annulus by a cooled mixing implement and the mixing implement, which is arranged substantially below the annulus over the bottom of the container and is designed in particular as a bucket wheel, extending in the radial direction to a location beyond the cooling annulus preferably to a location a short distance upstream of the container inner wall. It is true that, in this way, there is achieved on the material being circulated a travel path of the mixing material to be cooled which is such that the latter is displaced through the annular chamber between the outer surface of the annulus and the inner surface of the container and also along the inner surface of the annulus, so that the cooling time is considerably reduced relative to that achieved in a mixer of hitherto-conventional design. However, this is true only if specific conditions are observed.

It has been found that materials to be mixed behave in very different ways depending on their composition, nature and type, in particular in a cooling mixer of the prior-known and above-described type. The difference in behavior consists above all in that the flow pattern of the material to be mixed varies on mixing for the purposes of cooling, so that the cooled surfaces over which the material to be mixed passes are of varying size, the result of this being a longer or shorter treatment time for the material to be mixed in order to cool the latter down to a predetermined, desired temperature.

The invention is based on the problem of how to provide a cooling mixer which is able to bring the material to be mixed, in the shortest possible time, to a desirbed temperature and, in particular, to achieve the result that the treatment time during cooling always corresponds with maximum exactitude to the time required for the preparation of the material to be mixed in a high-speed mixer, being at least not substantially longer. Such disadvantages have frequently been encountered in particular in mixer combinations consisting of a processing high-speed mixer and a sequentially connected cooling mixer, so that the efficiency of the high-speed mixer cannot be fully utilized because the efficiency of the cooling mixer was lower, unless the cooling mixer was designed to be disproportionately larger and more efficient so as to achieve the same treatment times as in the high-speed mixer. This requires, however, a considerable additional expenditure. Thus, it is highly desirable to improve the cooling efficiency of the cooling mixer.

SUMMARY OF THE INVENTION

As a solution to the aforementioned problem, according to the present invention, a cooling mixer of the type under consideration is proposed and includes novel cooling elements which project into the inner space of the mixing container. The cooling elements

are double-walled, "spade"-shaped elements, through which coolant flows, and which are designed as baffle plates. Such cooling elements are preferably concavely curved with reference to the central axis of the mixing container, and are arranged one after the other in spaced relationship relative to the inner wall of the mixing container and in spaced relationship relative to each other in the peripheral direction, and being adapted to be so adjusted relative to the incident flow of mixing material that the run-off edge is located radially further inwardly than the incident-flow edge. Due to such design of the cooling elements projecting into the internal space or chamber of the mixing container, the cooling elements may be adjusted into an optimum position, in adaptation to the material to be mixed in each particular instance and retained in this position, so that the material to be mixed passes, during operation, in every case over the largest possible cooled surface of the cooling elements.

Advantageously, the cooling elements are disposed on a holding shaft or the like through which the coolant is fed to or discharged from the cooling elements. The holding shafts of the cooling elements may be mounted in the upper zone of the mixing container and/or at any optional location on the walls of the mixing container. Preferrable mounting locations are in the upper zone of the walls of the mixing container or in the lateral wall.

A further improvement in the cooling efficiency can be achieved by designing the bottom of the mixing container to be double-walled and introducing into it a coolant routed in the desired manner by baffle plates arranged preferably spirally in the double bottom.

Further novel features and other objects of this invention will become apparent from the following detailed description, discussion and the appended claims taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

Preferred structural embodiments of this invention are disclosed in the accompanying drawings, in which:

FIG. **1** is a partial, radial section through one half of a mixing container of a mixer;

FIG. **2**, drawn on a smaller scale, is a horizontal section taken on line II—II of FIG. **1**, and diagrammatically illustrates the disposition of the coolant elements; and

FIG. **3** is an enlarged scale, detail section through the mixing container walls of a second embodiment at the zone of a modified retaining means for a cooling element.

As can be seen from the drawings, a mixing container is provided with double walls **11** and a double bottom **12** and has a mixing implement **13** for circulating the material to be mixed in the mixing container. Arranged in inwardly spaced relationship relative to the inner wall of the mixing container are double-wall cooling elements **14** of "spade" shape, or some similar shape, and which are arranged disposed one behind the other with predetermined spacing relative to each other in the peripheral direction. Cooling elements **14** preferably have a concave curvature relative to the central axis **15** of the mixing container (FIG. **2**), and are carried by a shaft **16** mounted for pivoting in bearings **17** in the upper zone **18** or top wall of the mixing container.

It is possible, using conventional means, to lock the shaft **16** of the cooling elements **14** in their bearings **17** after they are adjusted to a desired position. Advantageously, each shaft **16** has, externally of the mixing container, a pinion **19** secured thereto and meshing with a toothed rim **20** rotatably mounted on the mixing container. Thus, by rotating the toothed rim **20,** all of the pinions **19** of the cooling elements shafts **16** can be simultaneously adjusted through the same angular value. The shaft **16** of each cooling element is, however, also vertically adjustable, for example by means of a threaded ring **21** screwed on to the cooling elements and bearing on the pinion **19.** Shaft **16** is hollow and disposed in it is a coolant feed pipe **22** routing the coolant into the lower zone of the cooling element **14.** Arranged in the cavity in the cooling element **14** are, advantageously, baffle plates **23** which may if so desired be perforated for more satisfactorily distributing the coolant as it flows through the inner space of the cooling element. Arranged at the upper end of the shaft **16** is a head member **24** for connection to the coolant feed and discharge hoses **25** or **26.**

The double-walled bottom **12** also should preferrably contain baffle plates **27** extending outwardly from a central partition ring **28.** The coolant feed stub **29** debouches into the annular chamber **30** within the coolant guide ring **28** and formed in that ring are apertures **31** enabling outflow of the coolant.

The rotating mixing implement **13** adjacent the container bottom wall circulates the material being mixed within the mixing container, centrifugally hurling it outwardly. The material flows along the cooled inner wall and ascends at the lateral wall up to a predetermined level, whereupon it undergoes a radial inflow and flows back in the center of the container again passing to the mixing implement. The cooling elements **14** are so adjusted into the flow path of the mixing material, i.e., they are so adjusted with respect to their height and angular position that the cooled inner and outer faces of the cooling elements **14** have an optimum flow of mixing material to be cooled passing over them.

In a mixer made according to the embodiment illustrated in FIG. **3,** the cooling elements **14'** are carried by a holding tube or shaft **41** arranged with a ball joint bearing **42** in the double-walled lateral wall **11'** of the mixing container. A tensioning ring **45** on the ball **44** and with the ball cup **43** retains the ball in the adjusted position. Thereby, it is possible to dispose and retain the cooling elements **14'** in a desired position. The holding tube **41** may be adjusted in all directions within a predetermined range. Furthermore, it is advantageous to arrange between the cooling elements **14'** and the holding tube **41** a joint **46** affording further possibilities for adjustment. In order to be able to vary the spacing of the cooling element **14'** relative to the inner wall of the mixing container, there may be arranged on the holding tube **41** between the cooling element **14'** or the joint **46** and the ball **44** of the joint **46** spacer sleeves or rings locked together by a threaded ring **47** on the outer end of the holding tube **41.** Disposed on the outer end of the holding tube **41** is a head member **48** to which are connected the flexible tubes **49** or **50** for the infeed or discharge of the coolant. The coolant is supplied to the cooling elements **14'** through the holding tube.

Tests have shown that it is possible to achieve with a cooling mixer of the type according to the invention cooling times which correspond to the processing times for plastics in a high-speed mixer, without it being necessary (as had hitherto been necessary) to design the cooling mixer to be larger, to an extreme degree, than the high-speed mixer.

The mixer having the device according to the invention is not restricted to the embodiments described purely by way of example. On the contrary, it is possible to provide in the holding means for the cooling elements for a wide range of variants, without thereby departing from the basic idea underlying the invention. Thus, for many applications, the cooling elements may be carried by a holding tube or shaft without a ball joint bearing, i.e., arranged rigidly in the double-walled lateral wall of the mixing container or under the cover or lid of the mixing container. It is also possible (with further advantage in respect of costs and with reference to the range of application) to employ the cooling mixer designed in accordance with the invention as a heating mixer for the processing of granular, gellike or similar plastics or the like.

The invention may be embodied in other specific forms without departing from the scope, spirit, or essential characteristics thereof. Present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, the scope and spirit of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are, therefore, intended to be embraced therein.

What is claimed and desired to be secured by Letter Patent is:

1. A mixer including means for the cooling of powdered, granular, liquid or otherwise flowable material to be mixed, in particular plastics agglomerates or the like, comprising: a double walled cup-shaped mixing container through which coolant flows; said mixing container having a mixing implement rotating in the center over its bottom; and a plurality of double-walled cooling elements through which coolant flows and which are concavely curved relative to the middle axis of the container mounted in the inner container space in spaced relationship relative to the container inner wall; said plurality of cooling elements having "spade"-shape and arranged in spaced relationship in the peripheral direction and including adjustable means enabling variations in disposition of the run-off edge located radially further inwardly than the incident-flow edge.

2. A mixer including means for varying the temperature of material to be mixed comprising: a cup-shaped mixing container comprising confining double bottom and double side walls through which coolant flows; a mixing implement; means mounting the mixing implement within the container for rotation about the vertical axis of the container and disposed adjacent the container bottom wall; a plurality of arcuate, spade shaped hollow heat exchange elements each element with a concave radially inwardly facing surface and with leading and trailing edges disposed in circumferentially spaced relationship in an annular zone around the axis of the container, and spaced inwardly from the container side wall, each element having means enabling circulatin of a heat exchange medium therethrough

from exterior of the container; and means mounting said elements for selective adjustment so the edges can be variably located at different dispositions with the trailing edges disposed closer to the container axis than are the leading edges.

3. A mixer as defined in claim **2,** wherein the means mounting said cooling elements are pivotal mounting means for each element.

4. A mixer as defined in claim **3,** wherein said means mounting said elements include a shaft for each mounted in a side wall of said container.

5. A mixer as defined in claim **4,** wherein each said pivotal mounting means journals its associated shaft for rotation about a fixed axis.

6. A mixer as defined in claim **4,** wherein said elements are mounted for pivoting about an axis offset from a vertical axis.

7. A mixer as defined in claim **4,** wherein said pivotal mounting means is a ball and sockect bearing joint.

8. A mixer as defined in claim **7,** wherein said joint has means enabling adjustable axially positioning of the shaft and rotary adjustment of the shaft and associated element.

9. A mixer as defined in claim **7,** wherein said mounting shafts provide the flow passages for the heat exchange medium to communicate to the interior of said associated elements.

10. A mixer as defined in claim **3,** wherein each element includes internal flow directing baffles.

11. A mixer as defined in claim **4,** wherein each element is adjustable about a vertical axis.

12. A mixer as defined in claim **11,** wherein said elements are adjustable as to vertical position along the axis of the shafts.

13. A mixer as defined in claim **12,** wherein the elements are arranged so that the radial spacing from the inner wall surface of the mixing container is adjustable.

14. A mixer according to claim **2,** wherein said adjustable element mounting means enable the elements to be pivoted and adjusted about a vertical axis.

15. A mixer according to claim **14,** wherein said adjustable mounting means enable the elements to be adjustable as to vertical position.

16. A mixer according to claim **14,** wherein the incident-flow edge of the elements are shaped to a contour complementing the profile of the inner wall surface of the mixing container.

17. A mixer according to claim **14,** wherein the elements have a sharp-edged incident-flow edge.

18. A mixer according to claim **14,** wherein each adjustable element mounting means includes a shaft journalled in an upper mixing container wall.

19. A mixer according to claim **18,** characterized in that a pinion is secured to each of the shafts of the vane elements and an adjusting ring gear is mounted for rotation on the mixing container and meshes with all of said pinions to enable simultaneous cooling element adjustment.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,820,597 Dated June 28, 1974

Inventor(s) Wolfgang Bittner et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 43, change "desirbed" to --desired--.

Column 3, line 49, change "the" (third occurrence) to --an--.

Column 4, line 22, change "gellike" to --gel-like--.

Column 4, last line (Claim 2), change "circulatin" to --circulation--.

Signed and sealed this 29th day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

USCOMM-DC 60376-P69