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(71) Applicant: **IMPERIAL CHEMICAL INDUSTRIES LIMITED**
Imperial Chemical House Millbank
London SW1P 3JF(GB)

(72) Inventor: **Halsted, David John**
10 Orme Crescent
Tytherington Macclesfield, Cheshire(GB)

(72) Inventor: **Sparks, Michael Harry**
4 Longdown Road
Congleton, Cheshire(GB)

(74) Representative: **Kolker, Peter Leigh**
Imperial Chemical Industries Limited Legal Department:
Patents Thames House North Millbank
London SW1P 4QG(GB)

(54) **Mixing drum and batch mixer including same.**

(57) A mixing drum having a first portion (1) which is either convergent or has a uniform transverse cross section and a second portion (2) which is convergent, the two portions being arranged end to end and symmetrically about a common longitudinal axis with the smaller end of the convergent portion or portions outermost, the outermost ends (3) of each of said portions being closed or closable to provide a sealed container, attached to the drum being a support frame which includes two parallel closed channels (7) which are adapted for attachment through attachment means to a forked yoke (12) provided on the drive shaft of a rotating means (11) and a combination which comprises the mixing drum and means for rotating the drum.

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BATCH MIXER AND MIXING DRUM INCLUDING SAME

This invention relates to a mixing drum and a batch mixer of the tumbler type including same.

British Patent Specification 999568 describes batch mixing drum which has frusto-conical upper and lower portions; British Patent Specification 1159261 describes a mixing drum having a cylindrical base and conical upper portion which is pivoted about its cylindrical base during mixing process; British Patent Specification 1500842 describes a container having grooves which co-operate with projections provided on arms on a support device.

According to the present invention we provide a drum having a first portion which is either convergent or has a uniform transverse cross section and a second portion which is convergent, the two portions being arranged end to end and symmetrically about a common longitudinal axis with the smaller end of the convergent portion or portions outermost, the outermost ends of each of said portions being closed or closable to provide a sealed container, attached to the drum being a support frame which includes two parallel closed channels which are adapted for attachment through attachment means to a forked yoke provided on the drive shaft of a rotating means.

According to the present invention we also provide a batch mixer comprising in combination a mixing drum and means for rotating the drum, the drum having a first portion which is either convergent or has a uniform transverse cross section and a second portion which is convergent, the two portions being arranged end to end symmetrically about a common longitudinal axis with the smaller end of the convergent portion outermost, the outermost ends of each of said portions being closed or closable to provide a sealed container, permanently attached to the drum being

a support frame which includes two parallel closed channels which are attached, through attachment means, to a forked yoke provided on the drive shaft of the rotating means.

5 The drum may take a variety of shapes.

 We prefer, in order to achieve particularly efficient mixing, that the first portion has a uniform cross section and is substantially rectangular; most preferably it has square, transverse cross section and the
10 second portion has then substantially the shape of a four-sided pyramid, but the drum may have other shapes. In particular the first portion when having a uniform cross section may have a cylindrical shape and the second portion may have a conical shape; however storage volume is
15 greater if the first portion is square.

 The overall dimensions of the drum in order to ensure effective blending of the product mix will, of course, be dependent on the volume of the product load. However, we have found it advantageous for the ratio of
20 the height of the convergent portion to the height of the uniform cross section portion to be in the range of 3 : 1 to 0.25 : 1 preferably in the range 2.1 : 1 to 1.9 : 1, e.g. 2 : 1.

 We also prefer that when the convergent portion
25 has the shape of a symmetrical four-sided pyramid and in an orientation where the longitudinal axis of the drum lies in a vertical plane the faces of the pyramid are inclined at an angle of not more than 70° and more preferably not less than 60° to the horizontal.

30 The invention is now described by way of an example with references to the accompanying drawings in which :-

 Fig.1 shows diagrammatically a view, in elevation, of a mixing drum in accordance with the invention.

35 Fig.2 shows a section through a portion of the mixing drum in the vicinity of one of the two parallel closed channels.

Fig.3 shows, in section, a detailed view of one of the parallel closed channels attached by means of attachment means to one of the forks of the yoke provided on the drive shaft of a rotating means in the form of a
5 blending machine.

Fig.4 shows, diagrammatically, a view, in elevation, of a mixing drum attached in position between a forked yoke attached to the drive shaft of a blending machine.

Fig.5 is an isometric view showing the mode of
10 interaction between the rotating means, the mixing drum and the forks of a fork lift truck.

The stainless steel mixing drum illustrated in Fig.1 has a uniform cross section portion 1 having a substantially square transverse cross section and a
15 convergent portion 2 having substantially the shape of a four sided pyramid apart from an outermost portion 3 which is cylindrical and which is provided with a removable valve 4 which, when the drum is inverted, allows the contents of the drum to be discharged. Any convenient type of valve
20 may be used for example a butterfly or slide valve or preferably an iris valve having conveniently a flexible rubber/cloth sleeve. For safety opposite possible valve failure during mixing, a cap may be provided.

The portion 1 is provided with a manhole cover 5
25 which can be removed to allow access to the drum. The base of portion 1 is provided with a plurality of hollow legs 6 on which the drum can be stood. At a position near to the larger end of the convergent portion, are two parallel closed channels 7 which are permanently attached
30 through welds to the drum by vertical plates 8 which are extensions of two of the walls of the uniform cross section portion 1 and horizontal struts 9 which are welded, as at 10, to the appropriate faces of the convergent portion.

The two parallel closed channels, and shown in more detail in Fig.2, constitute part of a rigid support frame by means of which the mixing drum can be firmly attached to, and rotated by, a blending machine 11 shown diagrammatically in Fig.4 and Fig.5. The remaining part of the support frame (see Fig.5) also has a channel section and lies at right angles to, and is welded to, the two parallel closed channels so providing in combination with the two parallel closed channels a rigid rectangular support frame for the mixing drum.

The method by which the support frame on the mixing drum is attached to the blending machine is shown in Figs.3 and 4. The blending machine is provided with a forked yoke, one fork of which is shown at 12 as having an open channel section 13, the dimensions of the channel being such that it can straddle one of the two parallel closed channels on the mixing drum. Each fork of the yoke 12 is rigidly attached to a closed channel section by two locking bolts 14 provided with tapered ends 15 which locate in tapered holes 16 in a vertical face of a closed channel section. Once in position, the locking bolts are locked in position by locking nuts 17. In order to facilitate positioning of the forks for loading and unloading, the yoke may be linked to a handwheel through a worm gear which may be disengaged from the yoke by for example a ratchet during mixing sequence. The blending machine is preferably bolted to the floor so as to minimise axial movement and tilting of the machine, particularly when the drum is loaded.

If desired, and as shown in Fig.4, each fork of the yoke 12 may also be attached to a closed channel section on the mixer by two more pairs of locking bolts 18 and locking nuts 19.

Furthermore, the yoke is provided with a gate 20

which is hinged (not shown) to one of the yoke forks and which, when the mixing drum is located in position between the forks, can be closed and locked to the other fork so preventing possible movement of the mixing drum at right angles to its longitudinal axis. In use therefore the drum is preferably rotated about its dimensional centre and the centre of gravity of the filled drum continuously is changed as the material being mixed therein moves.

The mixing drum can have any suitable volume up to for example, 1,000 litres which we have found appropriate for mixing a product load of 390 kilograms of a mix. In order to achieve adequate mixing of such large product loads we have found it advantageous for the longitudinal axis through the drive shaft of the rotating means to be inclined at an angle of between 20° and 40°, more preferably 30°, to the longitudinal axes of the open channel sections 13 (see Fig.5). A preferred speed of rotation is 15 to 20 revolutions per minute.

The mixing drum of the invention offers a number of advantages over those known in the art in that it is easy to fill and clean, it has good mixing characteristics and that it can easily be picked up and also inverted by means of a fork lift truck, the forks 21 (see Fig.5) on which are adapted to locate into the open ends of the two closed channel sections constituting part of the rigid support frame on the mixing drum, or the forks may lift the drum by inserting them underneath the drum. The drum may be inverted for example so that the drum may be stored on its base, if as in preferred embodiment it is flat.

The batch mixer and mixing drum of the invention are suitable for mixing any drug powders, spheroids or granules including those arising in the pharmaceutical, food, chemical, agricultural and plastics industries.

CLAIMS

What we claim is :-

1. A mixing drum having a first portion which is either convergent or has a uniform transverse cross
5 section and a second portion which is convergent, arranged end to end and symmetrically about a common longitudinal axis with the smaller end of the convergent portion or portions outermost, the outermost ends of each of said
10 portions being closed or closable to provide a sealed container, attached to the drum being a support frame which includes two parallel closed channels which are adapted for attachment through attachment means to a forked yoke provided on the drive shaft of a rotating means.
2. A mixing drum according to claim 1 in which the
15 support frame is attached to the drum where the two portions meet.
3. A mixing drum according to either claim 1 or claim 2 in which the first portion has a uniform transverse cross section.
- 20 4. A mixing drum according to claim 3 in which the ratio of the height of the convergent portion to the height of the uniform cross section is in the range 3:1 to 0.25:1.
5. A mixing drum according to either claim 3 or claim 4 in which the uniform transverse portion has a
25 rectangular cross section and the convergent portion has substantially the shape of a four-sided pyramid.
6. A mixing drum according to claim 5 in which the uniform transverse portion has a square cross-section.
7. A mixing drum according to either claim 5 or 6 in
30 which where the configuration of the longitudinal axis of the drum lies in a vertical plane the faces of the pyramid are inclined at an angle or not more than 70° to the horizontal.
8. A mixing drum according to claim 7 in which said
35 angle is greater than 60° .
9. A batch mixer comprising in combination a mixing

drum and means for rotating the drum, the drum having a first portion which is either convergent or a uniform transverse cross section and a second portion which is convergent the two portions being arranged end to end
5 symmetrically about a common longitudinal axis with the smaller end of the convergent portion outermost, the outermost ends of each of said portions being closed or closable to provide a sealed container, permanently attached to the drum being a support frame which includes
10 two parallel closed channels which are attached, through attachment means, to a forked yoke provided on the drive shaft of the rotating means.

Peter L. Folter

Peter L. Folter

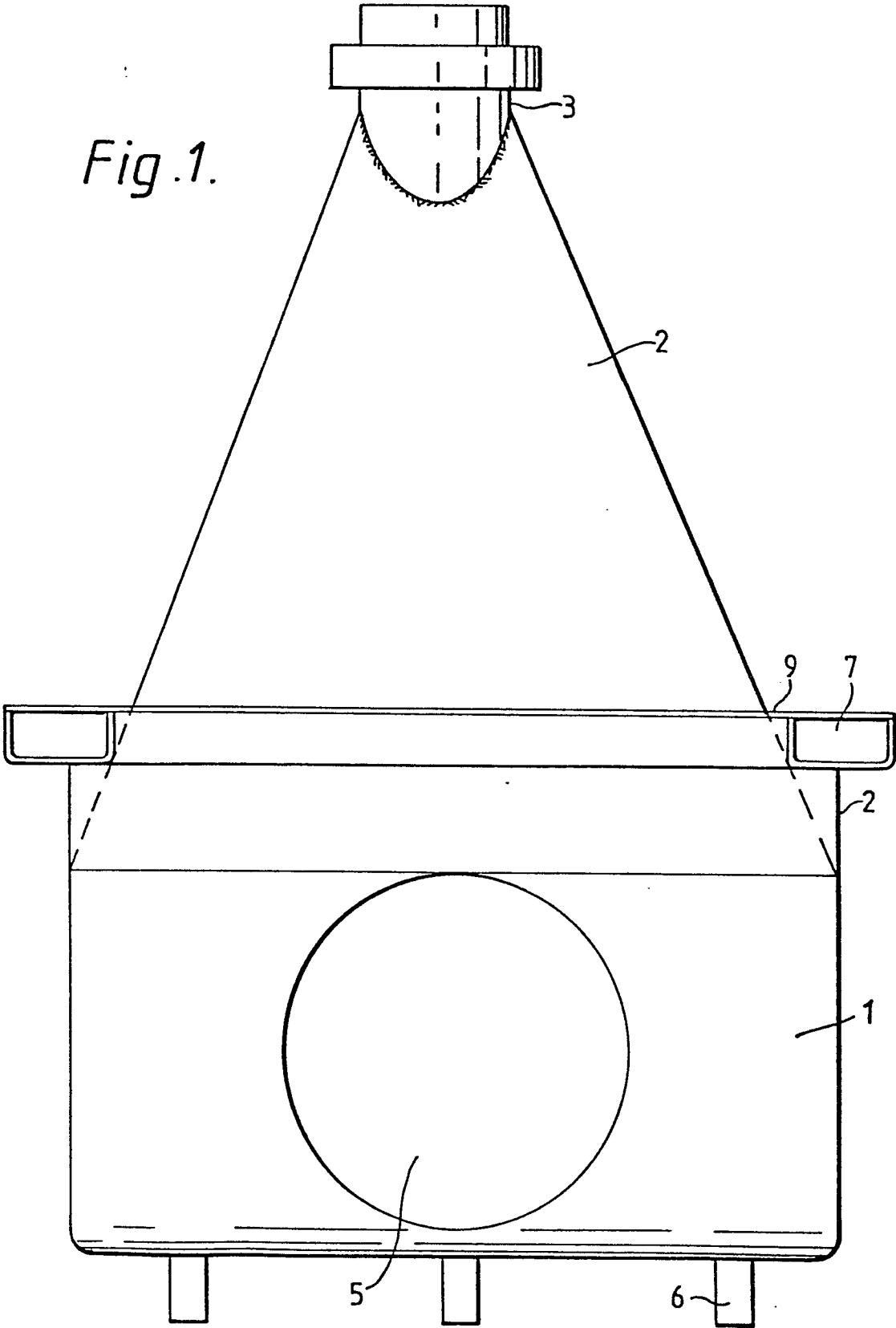
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Fig. 1.



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Fig. 2.

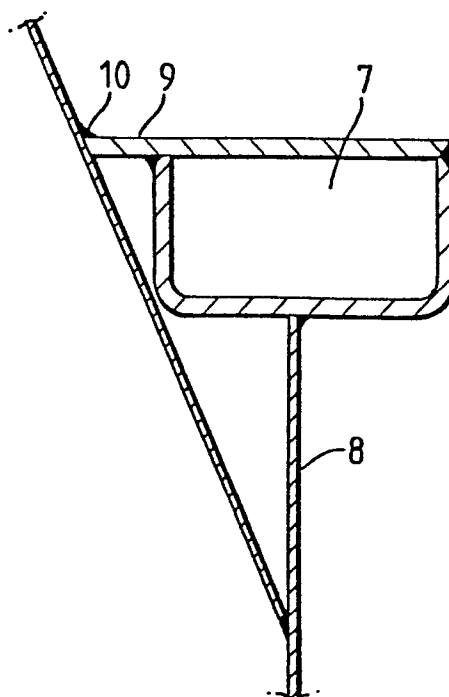
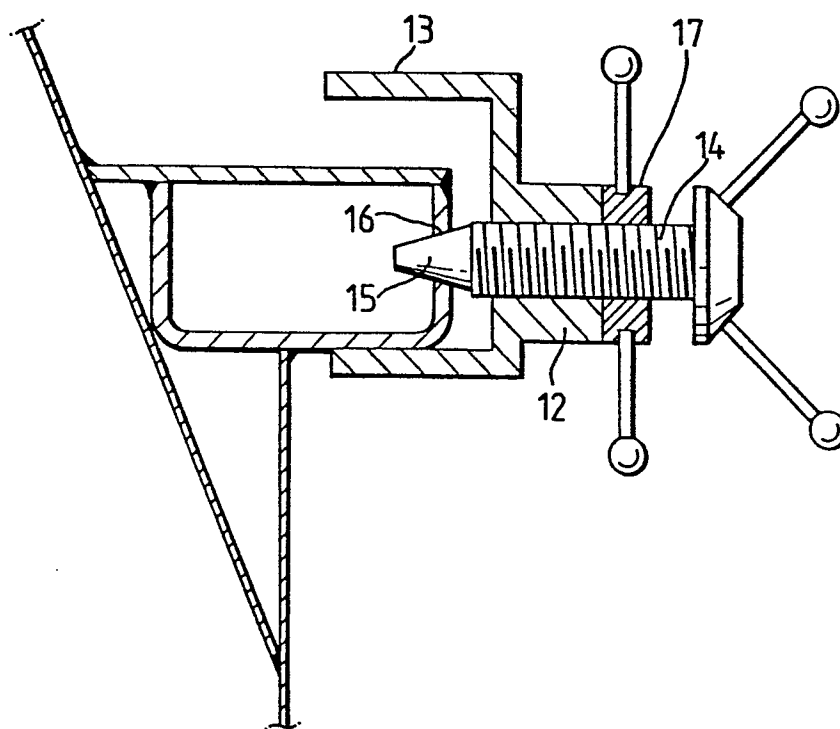


Fig. 3.



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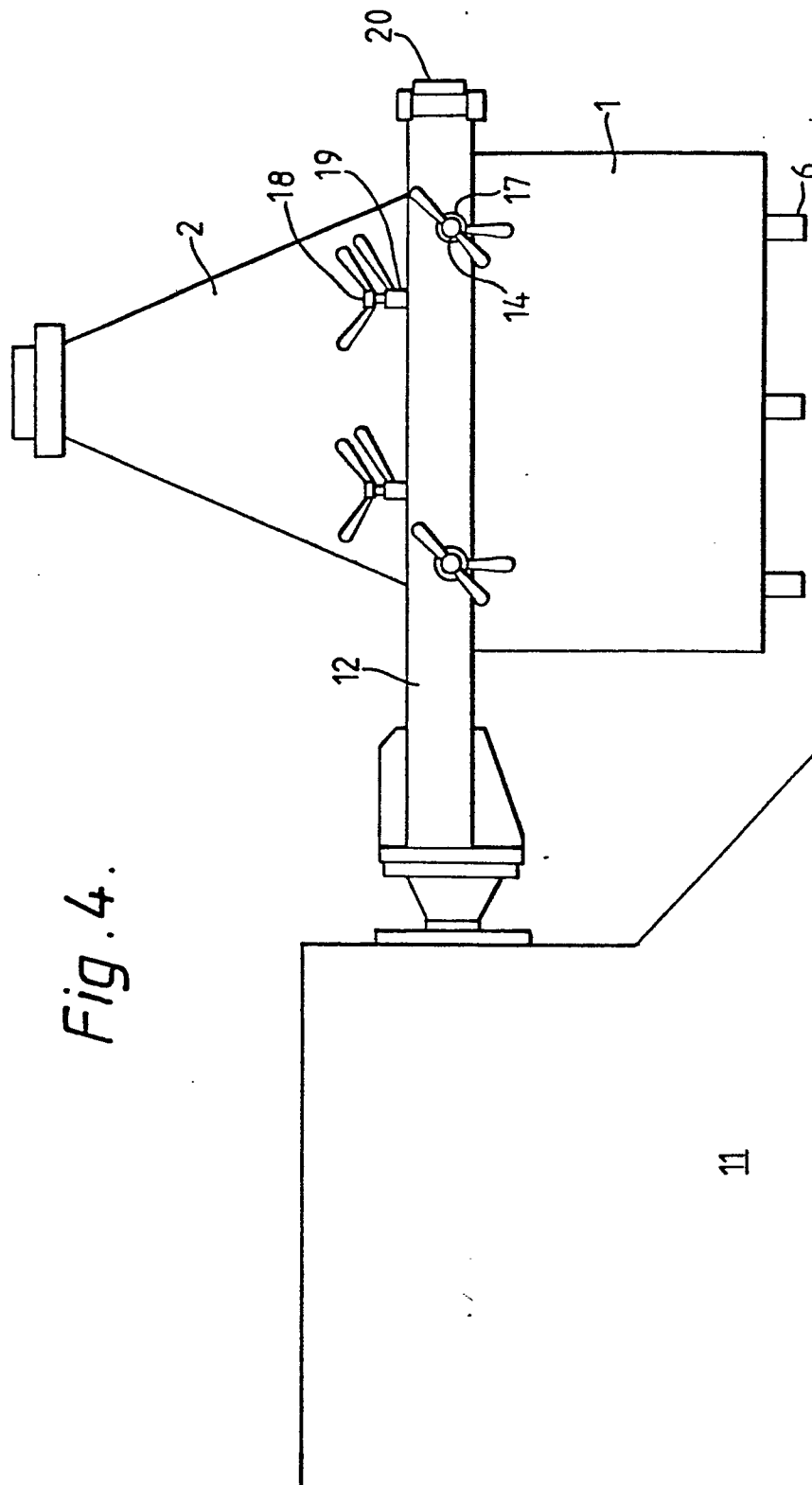
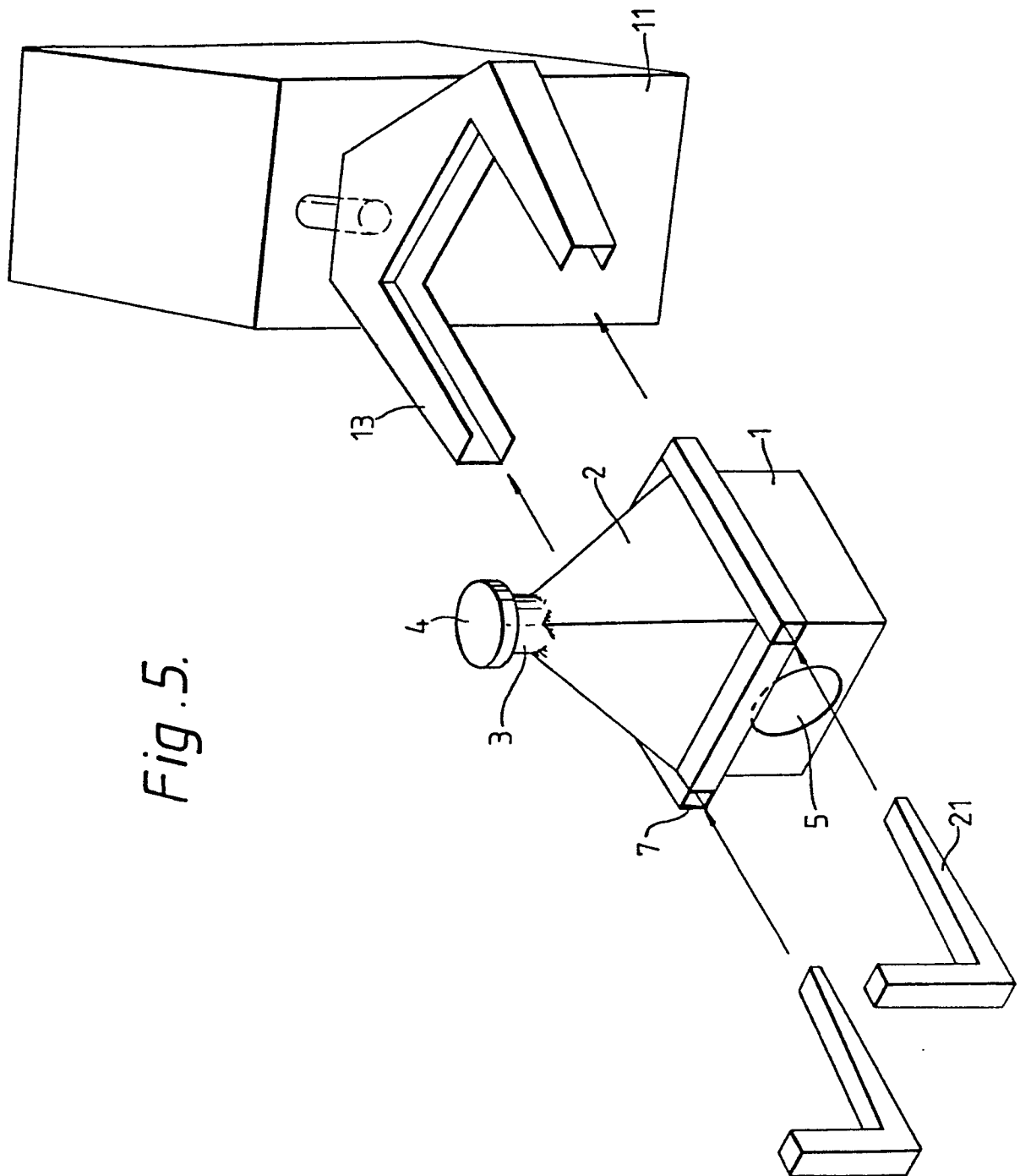


Fig. 4.

*Fig. 5.*



European Patent
Office

EUROPEAN SEARCH REPORT

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Application number

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DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	EXHIBITION: ACHEMA 79, 19th Chemical Engineering Exhibition - Congress, 17th - 23rd June 1979, Frankfurt-am-Main, DE. "The batch mixer was here exhibited" -----	1-9	B 01 F 9/02 A 47 J 43/04
			TECHNICAL FIELDS SEARCHED (Int. Cl.3)
			—
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family, corresponding document
X	The present search report has been drawn up for all claims		
Place of search		Date of completion of the search	Examiner
The Hague		28-11-1980	SALA