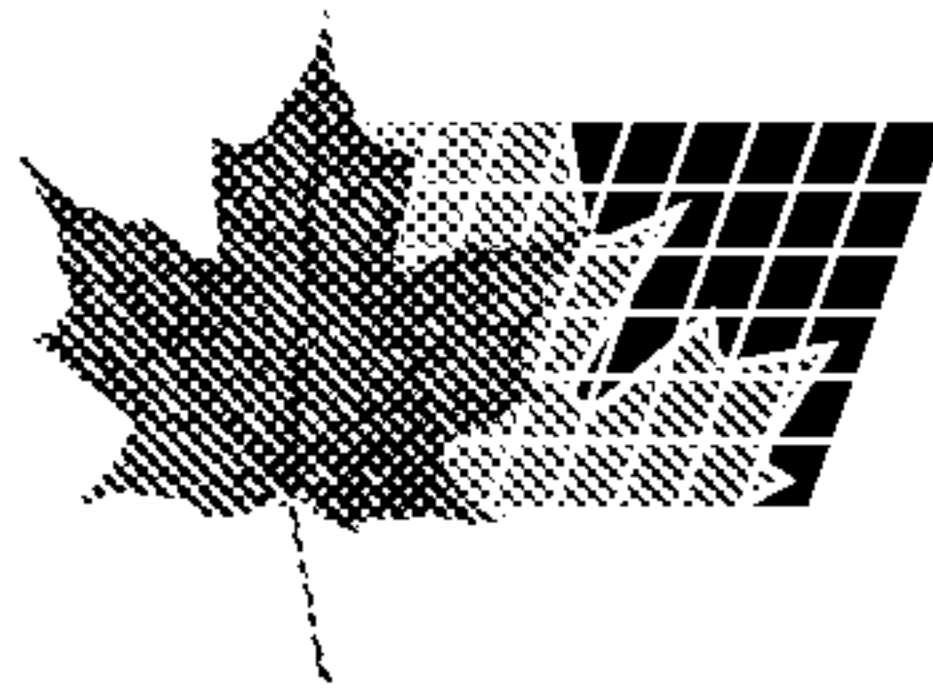




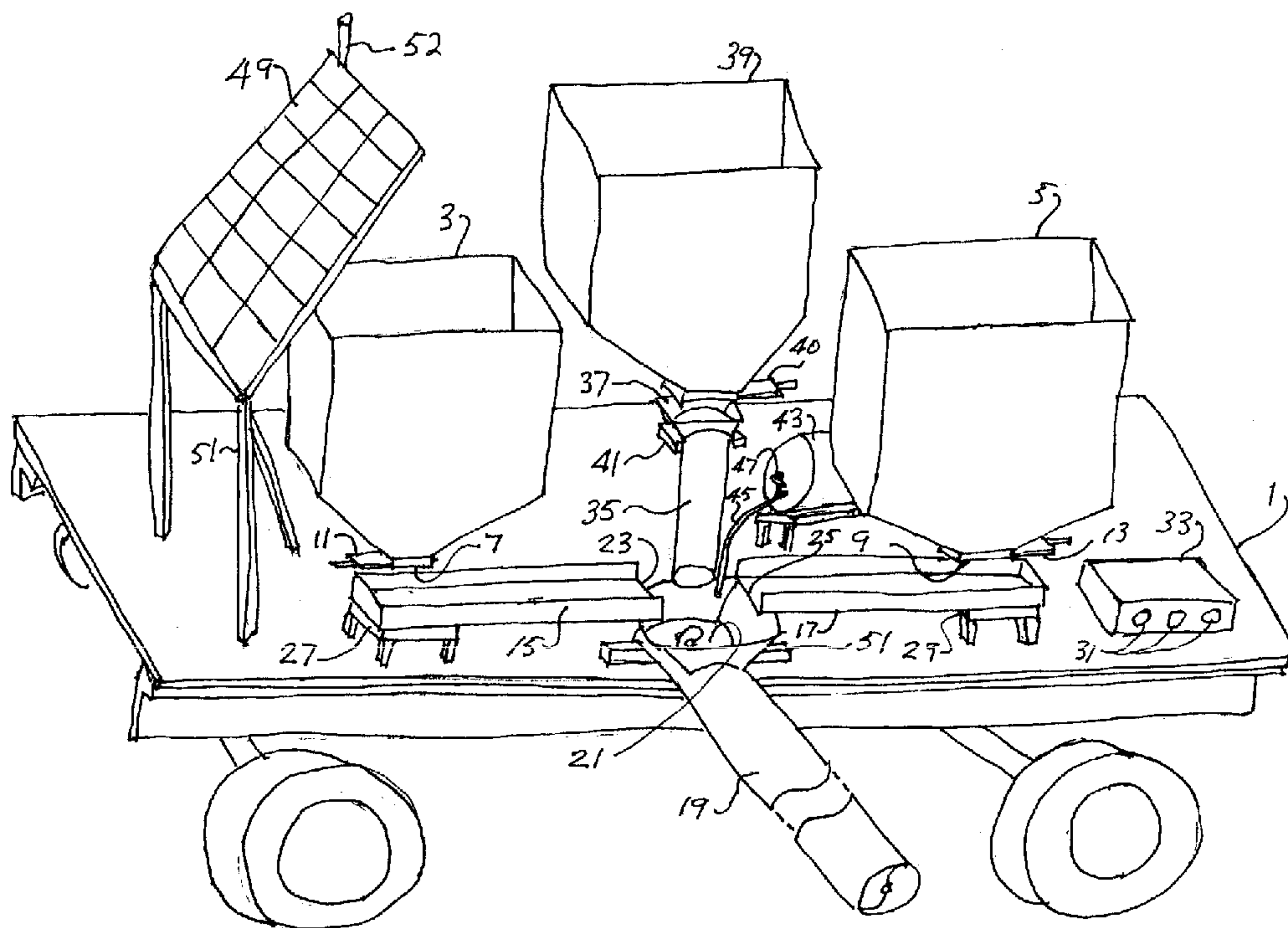
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(54) **MELANGEUR ET MOULE A BETON**

(54) **CONCRETE BLENDER AND MOLD**



(57) A cement mixer for manufacturing cement blocks which uses a minimum of power so that the apparatus can be driven by a portable gasoline generator or by photoelectric converted power. The apparatus is portable and can be transported by trailer to the site where the blocks need to be manufactured. The mixer has trays for carrying the mixture materials to a blender and vibrators attached to the trays to transport the materials to the blender. The blender has an inlet for receiving the materials from the trays and an auger for blending the materials while at the same time transporting the blending and blended materials to a receptacle. Also included in the invention is a mold having the shape of a concrete block. The mold is formed of hard urethane that can mold surfur-based concrete and does not wear as quickly as other materials.

ABSTRACT

A cement mixer for manufacturing cement blocks which uses a minimum of power so that the apparatus can be driven by a portable gasoline generator or by photoelectric converted power. The apparatus is portable and can be transported by trailer to the site where the blocks need to be manufactured. The mixer has trays for carrying the mixture materials to a blender and vibrators attached to the trays to transport the materials to the blender. The blender has an inlet for receiving the materials from the trays and an auger for blending the materials while at the same time transporting the blending and blended materials to a receptacle. Also included in the invention is a mold having the shape of a concrete block. The mold is formed of hard urethane that can mold sulfur-based concrete and does not wear as quickly as other materials.

CONCRETE BLENDER AND MOLDFIELD OF THE INVENTION

5 This invention relates to the field of
manufacture of molded cement articles and in particular
to an efficient portable cement blender which can be
used in territorial regions which have a lack of power
supply, as well as a mold which can utilize reclaimed
sulfur.

10 BACKGROUND TO THE INVENTION

In many regions of the world, the main building
construction material is sand and stone, which dictates
manufacture of buildings and houses from concrete. A
versatile form of the concrete is a cement block, from
15 which many different forms of building structures can be
made.

However in some of such regions, there is a lack
of power to blend the required sand, cement and stone to
make cement blocks, which results in humans being
20 required to perform the blending. This is difficult
work, and often results in manufacture of a minimal
number of blocks, many of which are non-uniform or
inferior. In addition, the molds that are used are
often formed of wood, resulting in poor finish to the
25 blocks and a high wear rate on the molds.

Rapid manufacture of a large number of blocks is
important in regions which have been devastated by
natural disaster, such as hurricanes or earthquakes.
Even if electrical power had previously been available I
30 such regions, the natural disaster would often destroy
its generation and/or distribution. Thus even electric

motor-driven cement mixers which are on-site would not be able to be used. Yet in these regions, rapid manufacture of new housing units is very important, in order to avoid disease or death.

5 SUMMARY OF THE INVENTION

The present invention is an apparatus and a method for manufacture of cement blocks which use a minimum of power which is so low that the apparatus can be driven by a portable gasoline generator or by
10 photoelectric converted power. Thus there is no need for mains power. The apparatus is portable and can be transported by trailer to the site where the blocks need to be manufactured. Thus cement blocks can be easily and quickly made at the places most needed.

15 Instead of blending the cement block ingredients in a rotary mixer, which requires all of the heavy ingredients for a batch of cement to be mixed at the same time, and thus requires a large horsepower motor to drive the mixing chamber, in an embodiment of the
20 present invention each of the ingredients is fed progressively at the required rate into the opening of transporting auger by vibratory feeders. The vibratory feeders utilize very little power.

The process of transporting the ingredients by
25 the auger performs the blending process. The ingredients in the process of blending by means of the transporting auger are passed from the output of the auger into the hopper of a molding machine, which contains a mold having the shaped of a cement block.

30 The mold with its blended ingredients are vibrated for about 6 - 12 seconds to release entrapped

air. The blended ingredients are compressed in the mold, and after less than a minute the block is forced out from the mold in a plastic but self-supporting state for curing.

5 In accordance with an embodiment of the invention, a concrete mixer comprises:

- (a) plural horizontal trays for carrying respective mixture materials to an inlet of a blender,
- (b) vibrators fixed to the trays for causing the
10 trays to transport the materials along the trays to the inlet of the blender,
- (c) the blender having an inlet for receiving the materials from the trays and an auger for blending the materials while at the same time transporting the
15 blending and blended materials to a concrete receptacle, and
- (d) apparatus for controlling the volume of each of the materials transported to the inlet of the blender.

20 In accordance with another embodiment, a mold for molding concrete articles is formed of hard urethane. This provides advantages which allows otherwise discarded filler material (e.g. sulfur reclaimed from smokestack cleaners) to be used in the concrete block, speeding set-up of the concrete and
25 reducing the cost of the blocks.

 Preferably the hard urethane is D-75 urethane.

 In accordance with another embodiment, a method of making molded concrete articles comprises:

- (a) transporting each of the materials required to
30 form the concrete article by vibration of respective materials transporting trays to an inlet of an auger,

(b) blending the materials while at the same time transporting the blending and blended materials by means of the auger to a concrete receptacle, and

(c) molding a concrete article using blended materials contained in the cement receptacle.

BRIEF INTRODUCTION TO THE DRAWINGS

A better understanding of the invention may be obtained by reading the detailed description of the invention below, in conjunction with the following drawings, in which:

Figure 1 is an isometric view of a blender in accordance with an embodiment of the invention, and

Figure 2 is a schematic diagram of a system for producing concrete blocks,

Figure 3A is an isometric view of a mold in accordance with another embodiment of the invention, and

Figure 3B is a block made in accordance with an embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Preferably the blender is mounted on the bed of a trailer 1, for easy transport to a block manufacturing site. Bins 3 and 5 are mounted on the trailer. The bins have sloped sides for gravity feeding their contents (respectively sand and gravel), have open slots or ports 7 and 9 at their bottom sides to allow their contents to drop below them at controllable rates. These rates can be controlled by means of shutters 11 and 13, which can be manually moved between and along opposing channels disposed along opposite edges of the respective ports 7 and 9 (not shown) to open or close the ports 7 and 9.

The contents of the bins drop onto elongated trays 15 and 17 respectively, which trays are disposed each with one end region under a respective port 7 and 9. The other end region of each tray 15 and 17 is disposed above the open end 21 of an auger 19. The auger 19 contained in a tube has one end 21 open and flared, into which the material transported on the trays drops. The trays 15 and 17 have upwardly extending sides around three sides, and are open at their ends 23 and 25.

Controllable vibrators 27 and 29 are fixed in contact with the underside of the respective trays 15 and 17, preferably under the locations where the sand and gravel drop from bins 3 and 5 to the trays. The vibrators can be controlled by respective rheostats 31 or the equivalent mounted in a control box 33. The vibrators can be type Eriez 45A pan feeders which are sold by Eriez of Canada Limited, Mississauga, Ontario, Canada. The vibrator variable control can be type FT115, sold by the same company. In a successful embodiment, the trays were made of mild steel, 36" long by 8" wide.

It has been found that each of the above tray and vibrator structures can feed, by means of vibration, between 12 oz. and 12 tons per hour of sand and stone along the tray 15 or 17, all controllable by control 31 (which is clearly a very broad range).

It is preferred that cement should be added to the mixture for blending by means of a round cross section 8" diameter pipe 35, which has its outlet above the inlet 21 to the auger 19. An inlet 37 to the pipe 35 is flared upwardly, and is disposed under a bin 39

which contains the cement. A shutter 40 is disposed across the outlet to the bin 39, similar to shutters 11 and 13. A vibrator 41 is fixed preferably to the bottom of the pipe 35 under the inlet. The vibration amplitude (i.e. the feed rate) of vibrator 41 is also controlled by means of a control rheostat 31.

A water tank 43 is also mounted on the trailer 1, at a height which is above the opening 21 to the auger 19. A hose 45 from the tank 43 feeds water into the opening 21 at a rate that is controlled by a valve 47. The valve 47 can alternatively be located adjacent the tank 43 as shown or adjacent the opening 21 to the auger 19; the latter location may be more convenient when the operation is set up, since it is closer to the controls 31 where an operator may be located.

In operation, the shutters 11, 13 and 40 and valve 47 are closed. Cement is loaded into bin 39, sand is loaded into one of bins 3 or 5 (say bin 3), and stone (e.g. gravel) is loaded into the other bin. Water is loaded into tank 43.

The shutters 11, 13 and 41 and valve 47 are opened partway, and auger 19, driven by an electric motor (not shown) is started. The vibrators 27 and 29 are turned on by means of a power switch (not shown) and the feed rates of the trays are adjusted by means of controls 31.

At this time it is preferred that the exit of the auger 19 should cause its effluent to pass into a sampling bin. Blending of the mixture occurs in the auger itself.

The quantity of each of the sand, stone and

cement is controlled by controlling the corresponding vibrator feed rate using rheostats 31 and by the amount which the shutters 11, 13 and 40 are opened, and the amount of water in the mixture is controlled by the degree to which the valve 47 is open.

By sampling the effluent of auger 19 and adjusting the feed rates of the three dry ingredients using controls 31, and by adjusting the water valve 47, the correct proportions of ingredients are blended by the auger. Once the correct proportions have been noted, the location of the discharge end of auger 19 is moved to the opening of a hopper for a cement block molding machine. Water is used with manufacture of blocks using ordinary cement, but is not used when blocks containing sulfur instead of cement are manufactured.

By the use of vibratory feeders, the amount of electric power required to operate the blender is minimized, thus increasing its efficiency. Indeed, a three vibrator system as described above has been found to require only 2 HP to continuously turn out about 18 to 20 cubic yards per hour of concrete, blended with cement, sand, stone and water as described above. It is believed that this could not previously be done with such little power.

The amount of power is so low, that it can be provided by means of one or more banks of solar cells 49. The solar cells can be mounted on a base which is hinged at one side to a support 51, and manually or by motor rotated about the hinge and fixed to a rod 52 to obtain an optimum angle to the sun as the day

progresses. The output power of the solar cells 49 can be converted to the voltage and a.c. frequency required by the vibrators in a well known manner, e.g. by an inverter. This allows the blender to be totally self-contained in the field.

Alternatively, a fossil fueled electric generator can be used to provide the requisite power, and can be mounted on the trailer 1. It should be noted that due to the low horsepower required to operate this blender, inexpensive and readily available generator can be used.

It is preferred that the auger 19 should be hinged or rotatably pinned under its open end 21, to a support 51, so that during transport the discharge end of the auger can be swung upwardly to be fastened approximately vertically, swung to the side or swung inwardly of the trailer, for easy transport.

Alternatively, the open end 21 of the auger can be unfastened and the auger removed for transport in a cradle or other fixing apparatus on the trailer 1.

Figure 2 illustrates a schematic side view of certain elements of the structure, feeding a molding machine. The concrete mixture blended in the auger 19 is lifted up and discharges into a hopper 53. A concrete block mold 55 is disposed with its upper opening below and if necessary to one side of the hopper 53. A side of the hopper above the opening to the mold 55 has a door or port 57 which can be opened manually or more preferably pneumatically. The bottom of the mold is fixed to a vibrator 59.

When the blended effluent (concrete mix) of the

auger 19 drops into the hopper 53, it gradually fills it. Once enough concrete mix is contained in the hopper, an operator opens port 57, allowing the concrete mix to drop into the mold 55. Once the mold has been
5 filled, or slightly overfilled, the operator closes port 57. The operator then causes vibrator 59 to begin operation, e.g. for about 6 to 12 seconds, which causes the concrete mix to release any entrapped air or other gases. The operator then causes the top of the mold to
10 close (not shown), and the molding machine to compress the concrete mix in the mold to preferably about 2200 pounds per square inch (which is more than twice the ASTM standard of 1000 pounds per square inch).

After a predetermined compression time (e.g.
15 about 10 seconds), the cement mix has been rendered into a plastic state, and the top of the mold is removed. The bottom of the mold is pushed upwardly, pushing the set-up block upwardly. Once it clears the upper sides of the mold, a pusher plate can push the plastic
20 concrete block to one side, to a curing table.

While manual operation or control of the block making apparatus has been described, operation is preferably pneumatically controlled, and control of the pneumatic sequence can be automated by a mechanical or
25 electro-mechanical or other controller.

Another embodiment of this invention relates to the structure of the mold itself. Previous molds were typically made of steel. Such molds have been found to wear very quickly when used repetitively to form
30 concrete blocks, thus increasing the cost of a production line.

A block which utilizes waste and poor quality sulfur had previously been invented, e.g. sulfur recovered from smokestack cleaners. Blocks can be made using, by volume, about 51% sand, about 29% stone and 12% cement or 8% - 9% sulfur, the sulfur being heated to 230° F.

Materials for sulfur-based concrete blocks is described, for example, in Canadian patent 1,279,661 issued January 29, 1991, invented by Garry L. Tucker.

While that sulfur can be used in the manufacture of concrete blocks, it has not been able to be used in a practical manner for the reason that the heated sulfur was found to freeze immediately on contact with the steel of the molds, thus precipitating out of the mixture and ruining at least the surface of the blocks.

I have discovered that I can make concrete blocks using the mixture that includes sulfur by forming the mold out of dense, very hard D-75 urethane. I have discovered that the sulfur does not freeze on contact with the urethane. Therefore the poor quality sulfur reclaimed from smokestack cleaners can be recycled into useful concrete blocks which can be used as construction materials.

In addition, I have discovered that the mold made of hard urethane does not wear as quickly as steel, and experiments have shown that it outlasts a steel mold for the described application 5:1. A mold 61, formed of such urethane, which can be used as mold 55 in Figure 2, is shown in Figure 3A to make a cement block such as that shown in Figure 3B. Indeed, with the system described above, and with the ingredients described

above including the reclaimed sulfur, allows manufacture of the blocks at low cost.

5 In order to add the sulfur, the sand can be heated to 230° F. or above to (to allow for cooling during processing) and the powdered sulfur added to the sand. When the sulfur touches the sand it is heated up to substantially the same temperature. Heating the sand also drives off the moisture from the sand. All of the surfaces which touch the sand (and therefore the sulfur, 10 such as the hopper surface, the transporting tray, the auger and the inside of the pipe in which the auger is housed) are coated, e.g. by spraying, with hard urethane, so that the sulfur will be protected from freezing. The mixture should be kept flowing through 15 the auger so that it will not solidify prior to entering the mold.

While a block made of ordinary cement typically has a strength of about 1,000 - 1,200 psi, a block made of sulfur in place of cement as described above have 20 been tested to have strength of about 12,000 psi. While a block made of ordinary cement is eaten away within a few months when exposed to sulfuric acid (as may be contained in acid rain) a block made of sulfur in place of cement as described above has been shown to be 25 virtually unaffected by the sulfuric acid over several years. It has also been shown not to disintegrate when immersed in salt water or when covered in pig urine.

Clearly, with low cost per block, the low levels of power required to operate the apparatus, the ability 30 to supply the low power levels from a portable generator or by power conversion from the sunlight, and the

portability of the entire apparatus, it is ideally suited to produce concrete blocks for housing units and buildings in disaster areas and in underdeveloped regions. Since the apparatus is so simple to use,
5 relatively uneducated workers can be readily trained to manufacture the blocks.

A person understanding the above-described invention may now conceive of alternative designs, using the principles described herein. All such designs which
10 fall within the scope of the claims appended hereto are considered to be part of the present invention.

I claim:

1. A cement mixer comprising:

(a) plural horizontal trays for carrying
respective mixture materials to an inlet of a blender,
(b) vibrators fixed to the trays for causing the
5 trays to transport the materials along the trays to the
inlet of the blender,

(c) the blender having an inlet for receiving
the materials from the trays and an auger for blending
the materials while at the same time transporting the
10 blending and blended materials to a cement receptacle,
and

(d) means for controlling the volume of each of
the materials transported to the inlet of the blender.

2. A blender as defined in claim 1 in which the
controlling means is comprised of a control for varying
at least one of the vibration rate and amplitude of
vibration of each of the trays.

3. A blender as defined in claim 2 in which the
vibrators are fixed to the bottom of the trays at
materials receiving portions thereof.

4. A blender as defined in claim 2 further
including hoppers for storing each of the respective
materials, the controlling means further comprising a
materials egress port in each hopper having a
5 controllable area, through which the materials may pass
and drop to a tray at a materials receiving portion

thereof.

5. A blender as defined in claim 2 in which at least one of the trays is substantially enclosed, in the form of a pipe.

6. A blender as defined in claim 1 further including a tank for containing water disposed higher than the inlet of the blender, a tube for carrying the water to the inlet of the blender, and a valve for
5 controlling the volume of water passed from the tank to the inlet of the blender.

7. A blender as defined in claim 4 further including a tank for containing water disposed higher than the inlet of the blender, a tube for carrying the water to the inlet of the blender, and a valve for
5 controlling the volume of water passed from the tank to the inlet of the blender.

8. A blender as defined in claim 1 including a power supply for powering the vibrators, comprising solar cells.

9. A blender as defined in claim including a power supply for powering the vibrators, comprising a fossil fuelled electric generator.

10. A blender as defined in claim 1 in which the inlet end of the auger is hinged or pinned so as to be able to be swiveled into a storage position.

11. A blender as defined in claim 6 in which the cement receptacle is a hopper of a cement block making machine, the cement block making machine containing a mold for receiving cement from the hopper
5 of the cement block making machine, walls of the mold being formed of hard urethane.

12. A blender as defined in claim 11 in which the hard urethane is D-75 urethane.

13. A mold for molding concrete articles in which the mold is formed of D-75 urethane.

14. A mold for molding concrete articles in which the mold is formed of hard urethane.

15. A mold as defined in claim 14 in which a bottom of the mold is moveable upwardly into the mold so as to eject a set-up article molded therein.

16. A mold as defined in claim 15 in which a top of the mold is adapted to exert pressure against materials contained in the mold of approximately 2200 pounds per square inch during a molding process.

17. A cement block made in the mold of claim 14 containing by volume about 51% sand, 29% stone and 12% cement or 8% - 9% sulfur, the sulfur having been heated to about 230° F.

18. A cement block made in the mold of claim 16 containing by volume about 51% sand, 29% stone and 12% cement or 8% - 9% sulfur, the sulfur having been heated to about 230° F.

19. A method of making molded concrete articles comprising:

(a) transporting each of the materials required to form the concrete article by vibration of respective materials transporting trays to an inlet of an auger,

(b) blending the materials while at the same time transporting the blending and blended materials by means of the auger to a concrete receptacle, and

(c) molding a concrete article using blended materials contained in the cement receptacle.

20. A method as defined in claim 19 including molding the concrete article using a mold formed of hard urethane.

21. A method as defined in claim 20 in which the hard urethane is D-75 urethane.

22. A method as defined in claim 19 including storing each of cement or sulfur, sand and stone in a respective hopper, and dropping the cement or sulfur, sand and stone onto a corresponding tray at a controllable rate.

23. A method as defined in claim 22 including providing water to the inlet of the auger at a

10 controllable rate in the event of use of cement instead
 of sulfur.

 24. A method as defined in claim 19 including
 controlling a transportation rate of each of the
 materials along each of the trays so as to control the
 volume per unit time of deposit of each of the materials
5 into the auger.

 25. A method as defined in claim 23 including
 controlling a transportation rate of each of the
 materials along each of the trays so as to control the
 volume per unit time of deposit of each of the materials
5 into the auger.

 26. A method as defined in claim 22 including
 heating the sand to a temperature of 230° F. or above
 prior to it being dropped onto its corresponding tray,
 in the event that sulfur is used instead of cement, in
5 which the transporting tray for the sulfur is covered
 with hard urethane, and in which the transporting step
 is conducted via an auger in which all surfaces which
 can come into contact with the sulfur are covered with
 hard urethane.

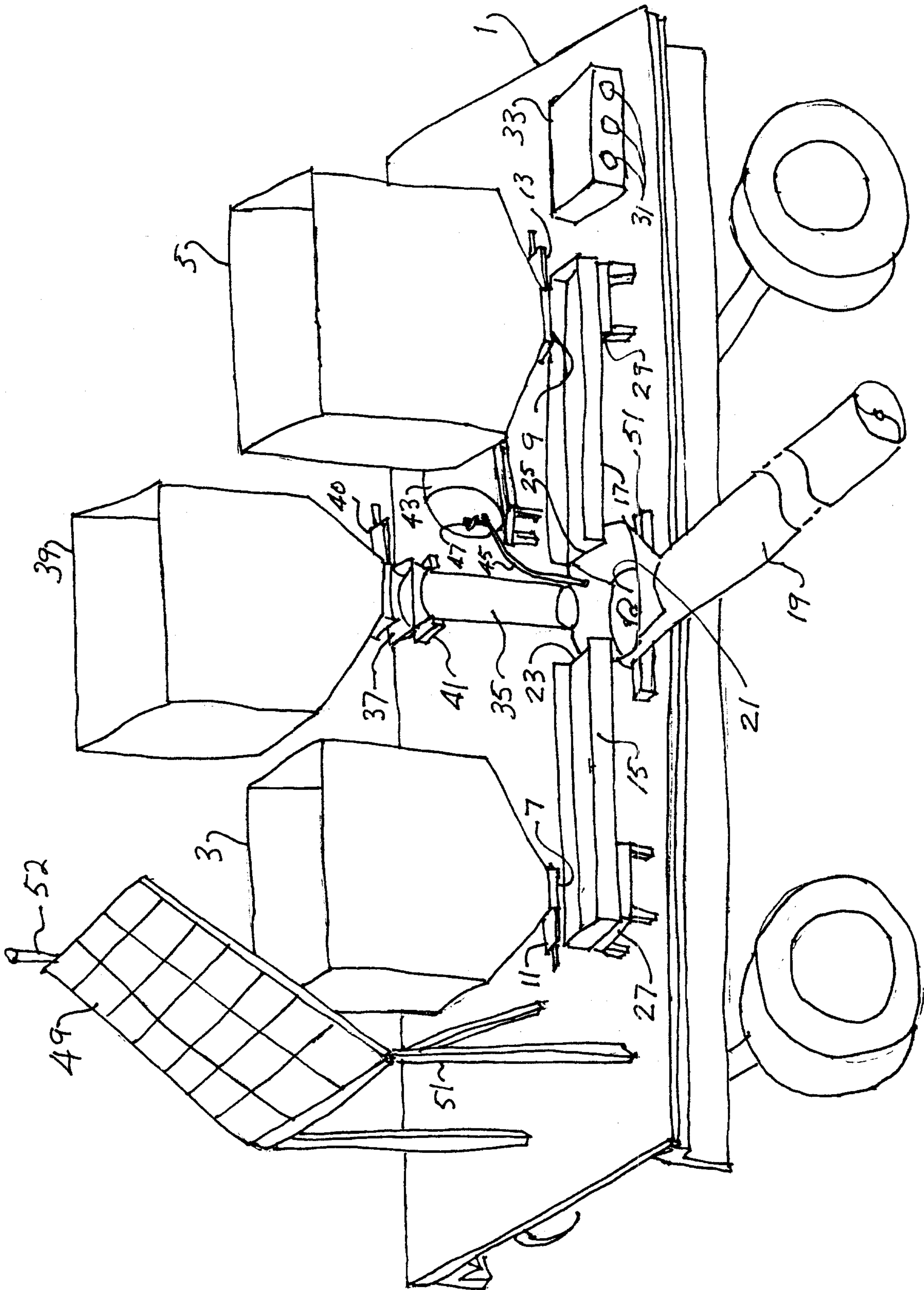


FIG. 1

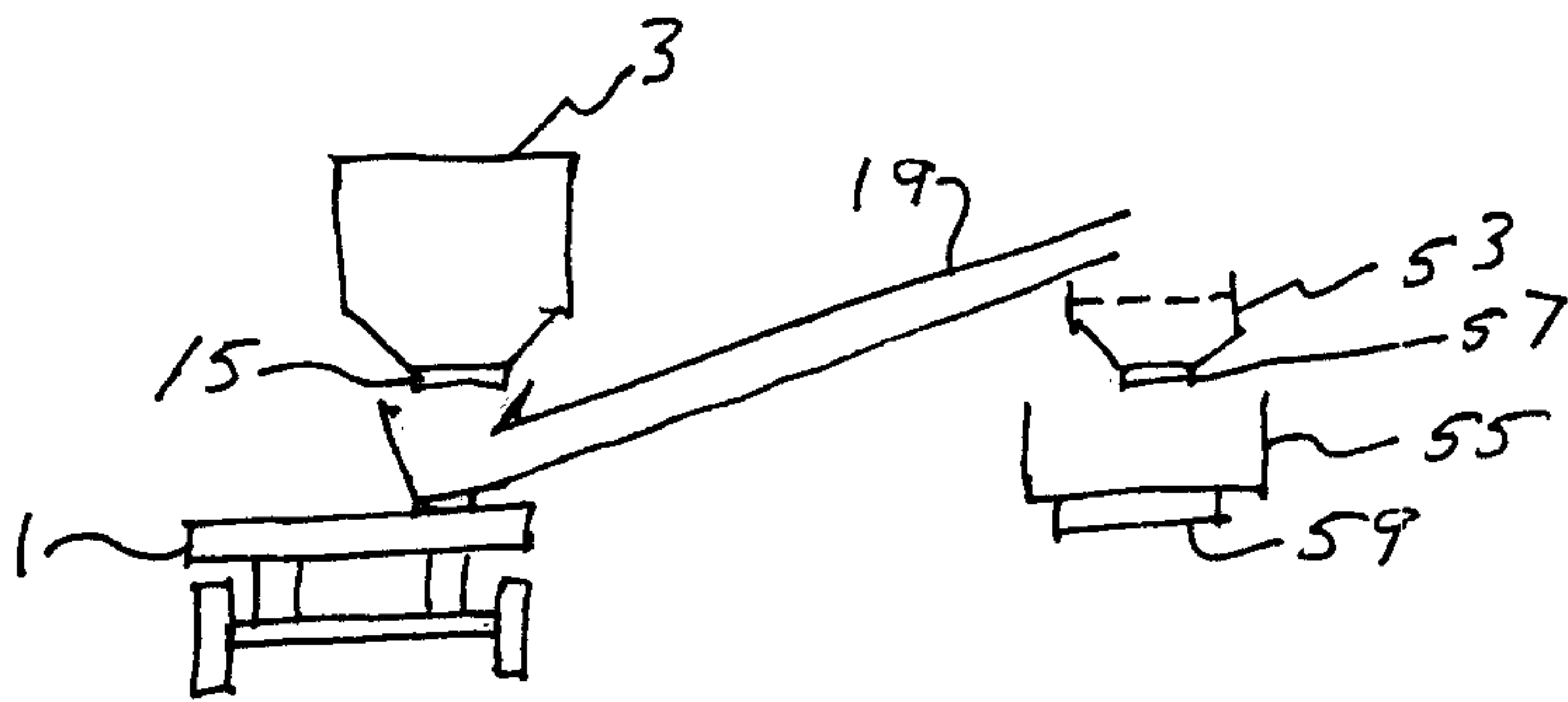


FIG. 2

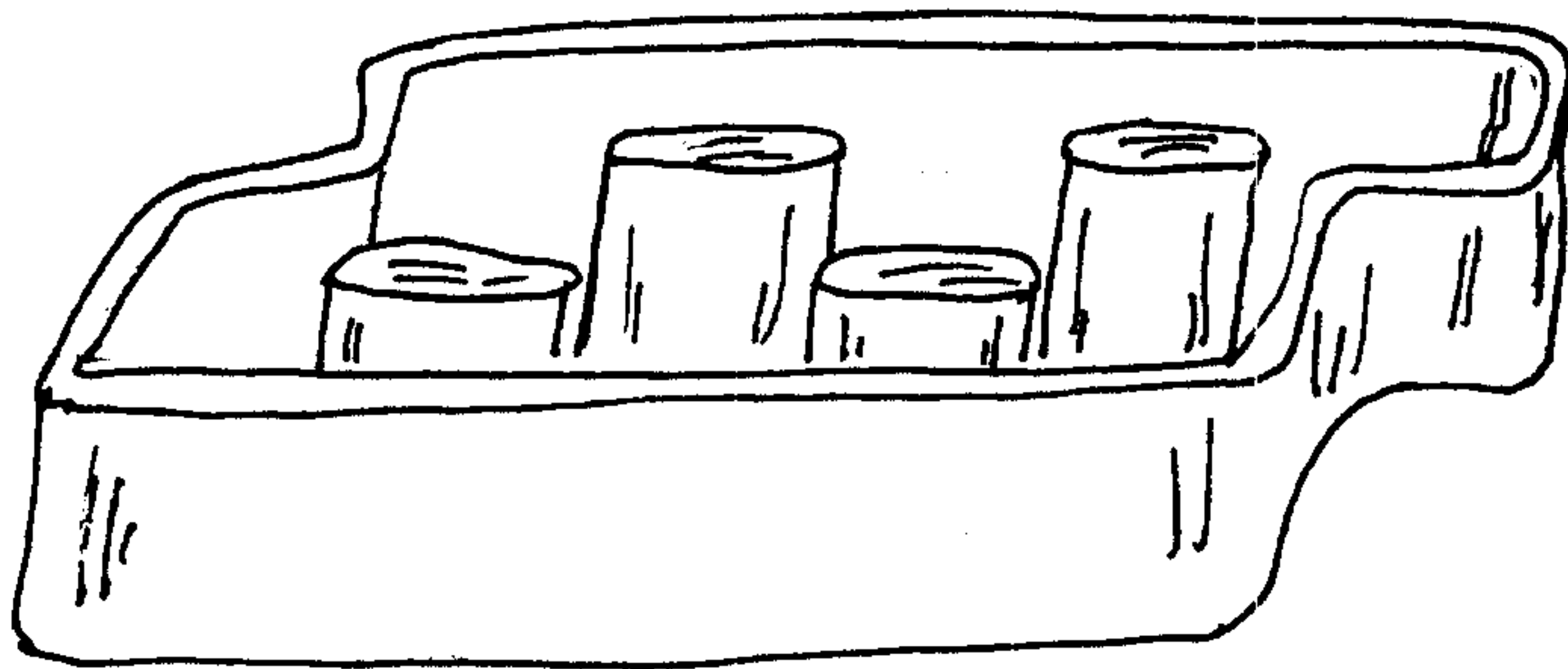


FIG 3A

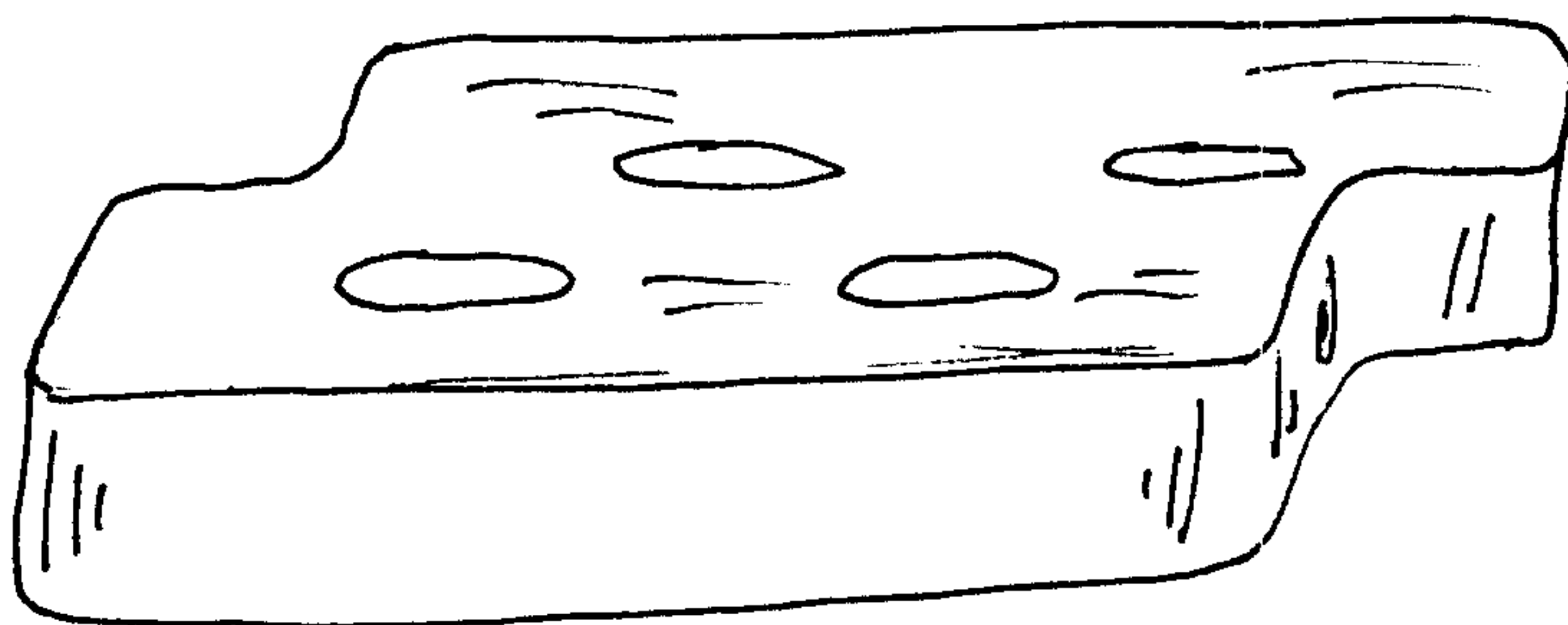


FIG 3B

