June 24, 1952 J. A. KNIGHTON 2,601,532

METHOD OF MAKING FACED BUILDING BLOCKS AND THE LIKE

Filed Aug. 19, 1949 3 Sheets-Sheet 1

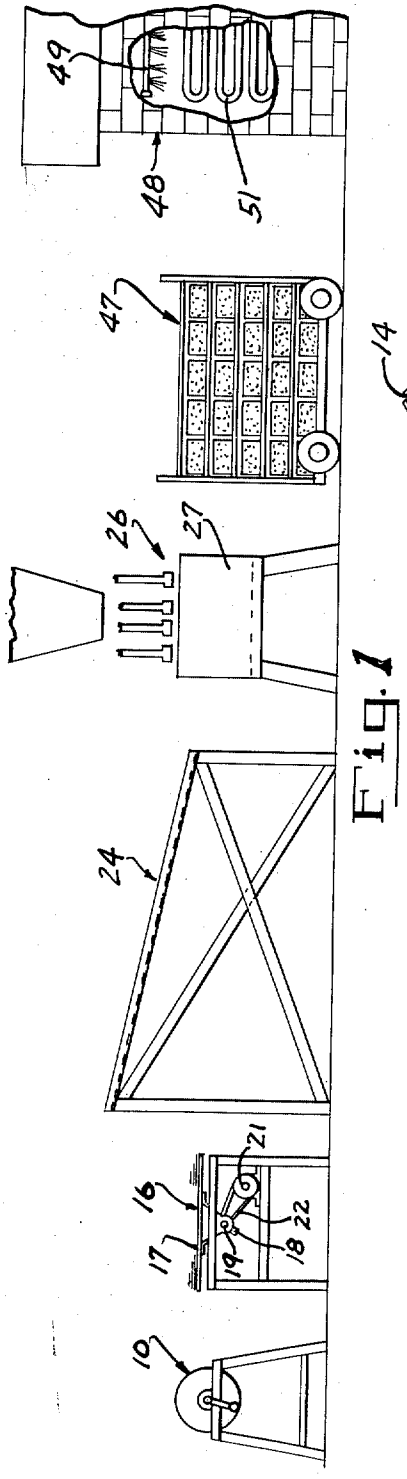

Fig. 1

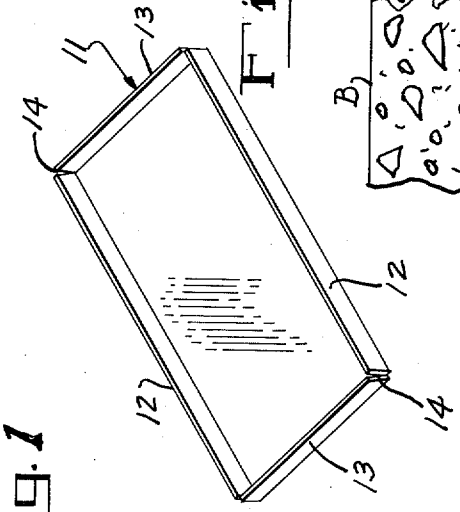

Fig. 3

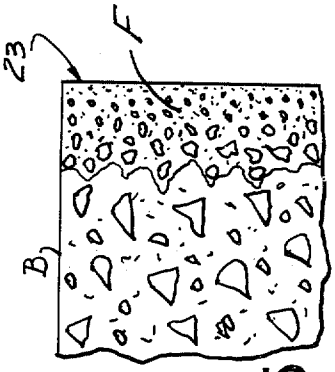

Fig. 5

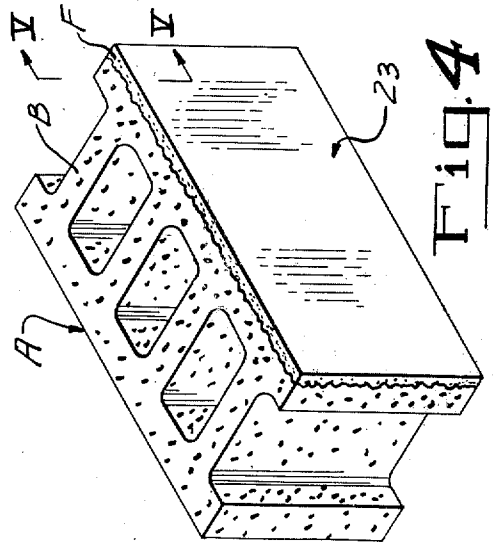

Fig. 4

INVENTOR.
JAMES A. KNIGHTON
BY
Jennings & Carter
ATTORNEYS

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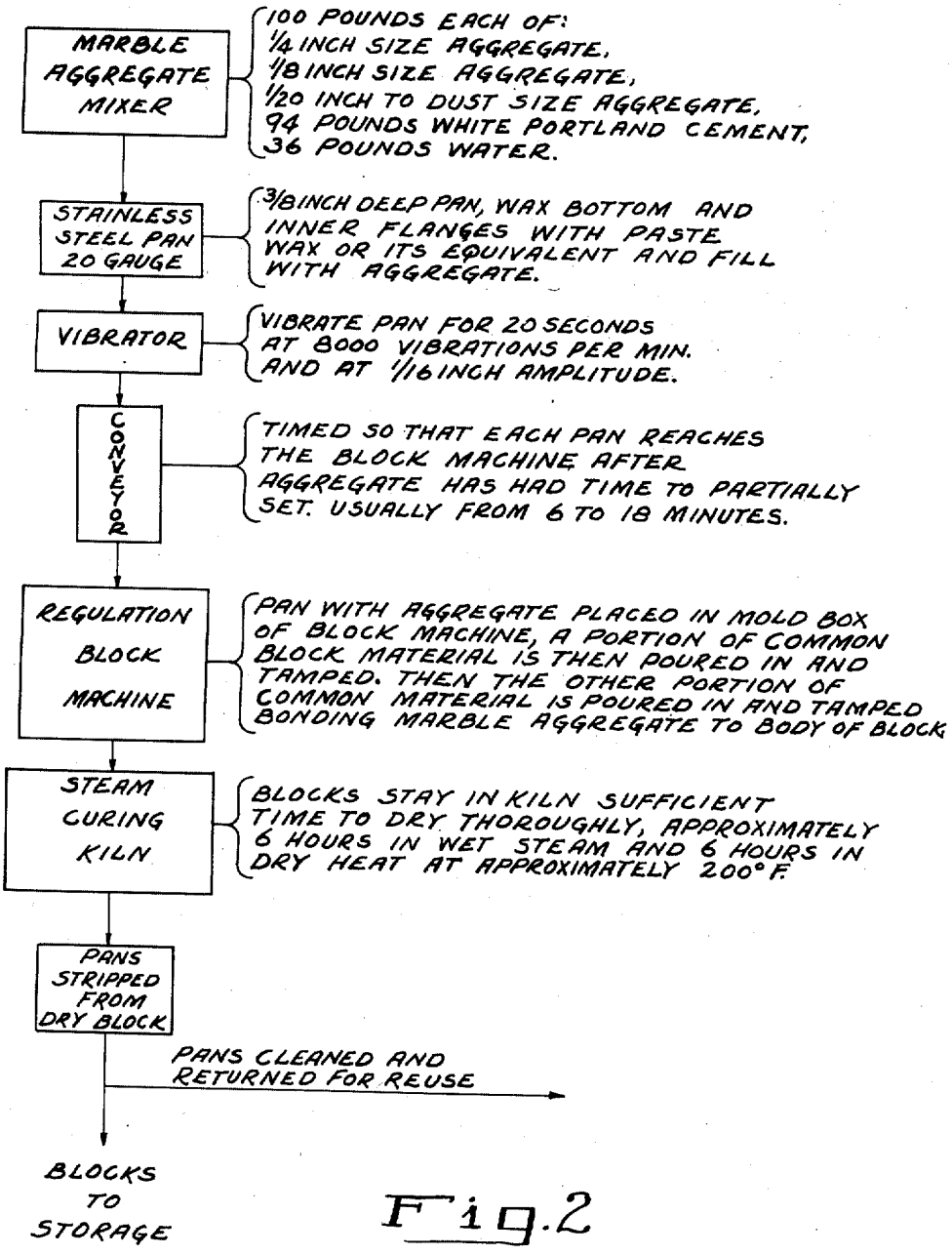


Fig. 2

INVENTOR.
JAMES A. KNIGHTON
BY Jennings & Carter
ATTORNEYS

June 24, 1952 J. A. KNIGHTON 2,601,532

METHOD OF MAKING FACED BUILDING BLOCKS AND THE LIKE

Filed Aug. 19, 1949 3 Sheets-Sheet 3

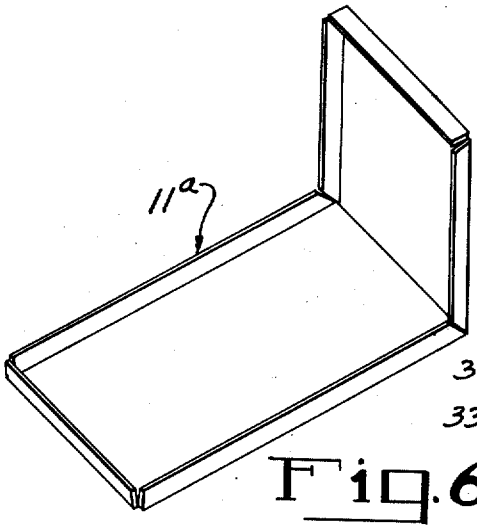


Fig. 6

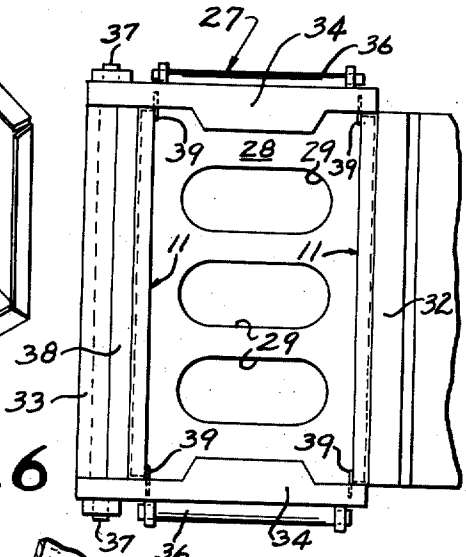
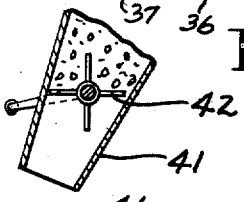


Fig. 8



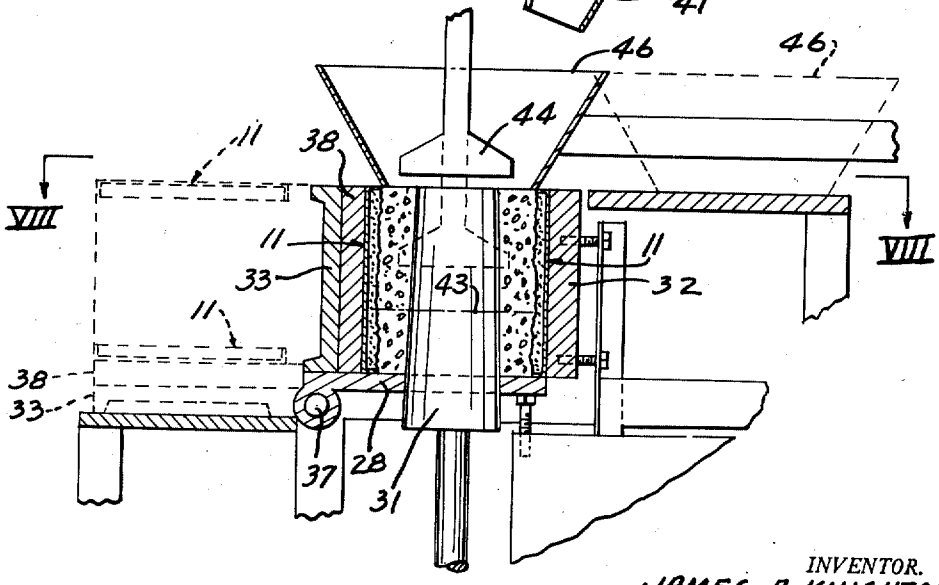


Fig. 7

INVENTOR.
JAMES A. KNIGHTON
BY
Jennings & Carter
ATTORNEYS

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UNITED STATES PATENT OFFICE

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METHOD OF MAKING FACED BUILDING BLOCKS AND THE LIKE

James A. Knighton, Birmingham, Ala.

Application August 19, 1949, Serial No. 111,242

5 Claims. (Cl. 18—60)

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The present application is a continuation-in-part of my co-pending application Serial No. 661,700, filed April 12, 1946, subject, Method of Making Concrete Building Blocks, which application is now abandoned.

My present invention relates to a method for making faced building blocks and the like, and while not limited thereto contemplates the provision of a method of the character designated by means of which blocks formed principally of ordinary concrete material shall have securely bonded to one or more faces a relatively thin layer of material such for instance as a cement-marble aggregate mixture, thus providing a block having one or more water-proof surfaces which are smooth and attractive in appearance, and a block which lends itself to economical, mass production.

It is the prime object of my invention therefore to overcome the above difficulties and to provide a method for making faced concrete building blocks and the like in which facing material in plastic condition is first placed in a shallow pan formed of material having the strength, anti-corrosion properties and smoothness of stainless steel, the pan and its contents being vibrated at a given frequency and amplitude for a given period of time, being permitted to set for a given time, and then being placed in the mold box of a concrete block machine where the common cement-aggregate mixture for the body of the block is packed onto the facing material and bonded intimately therewith.

Another object is to provide a method of making such blocks in which a definite proportion of cement, aggregate and water forming the facing material is perfectly bonded to the block body material by feeding a portion of the body material into the mold box in contact with the facing material, the pan preferably being placed on edge in the mold box, tamping this portion of the body material and then feeding and tamping the remainder of the body material to complete the block.

A suitable form of apparatus for carrying out my improved method is shown in the accompanying drawings forming a part of this application in which:

Fig. 1 is a diagrammatic side elevational view of the apparatus for filling, vibrating and conveying the pans filled with facing material and the block making machine and kiln;

Fig. 2 is a flow sheet illustrating the steps in the process;

Fig. 3 is an isometric view of the improved form of shallow pan for the plastic facing material;

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Fig. 4 is an isometric view of a block made in accordance with my improved method and with my improved apparatus;

Fig. 5 is an enlarged detail sectional view taken along line V—V of Fig. 4;

Fig. 6 is an isometric view of an L-shaped pan especially adapted to form a block faced on one side and one end;

Fig. 7 is a view of the mold box of the block machine with a pair of pans in place therein and filled with common cement-aggregate mix for forming the body of the block; and,

Fig. 8 is a plan view of the mold box taken generally along line VIII—VIII of Fig. 7.

Referring now more particularly to Figs. 1 and 2 of the drawing, I show diagrammatically the method, materials and apparatus used in making my improved block, the block itself being indicated at A, Fig. 4. The body of the block comprises common cement-aggregate mix of the ordinary kind used for making concrete blocks, and bonded to one or more faces thereof as will be explained is a relatively thin layer of facing material F. As is understood some of the aggregate in the body material may be larger than the largest aggregate in the facing material. While the facing material may comprise other components, I prefer to make the same of a water-white portland cement mixture with some form of natural stone, for instance marble particles, as the aggregate. More specifically, I have discovered that the desirable qualities of water proofness, density, and smoothness may be obtained through the use of the following mixture for the facing material in the proportions set out:

100 pounds of ¼ inch size marble aggregate
100 pounds of ⅛ inch size marble aggregate
100 pounds of 1/20 inch to dust size marble aggregate
94 pounds of white portland cement
36 pounds of water

The materials just mentioned are placed in a rotary mixer 10 where they are intimately mixed together in the manner well understood.

In order to provide the thin slab or layer of the facing material which may be handled while sufficiently plastic to adhere to the common cement material of the block body, I employ a metal pan or pallet indicated generally by the numeral 11, Fig. 3. As shown, the pan is of a shape in plan to conform to the shape of the

surface of the block to be faced. Thus, in making the standard 8 x 8 x 16 inch block the pan would be 8 inches wide and 16 inches long. In practice I have discovered that stainless steel is an admirably suitable material for such pan. In making the 8 x 8 x 16 blocks I have found that stainless steel of 20 gauge is sufficiently rigid and entirely practical.

The pan may be formed of a sheet of stainless steel with integrally formed, upstanding side and end walls **12** and **13**. For the usual block forming operation the walls should be approximately ⅜ of an inch high. The corners of the walls are left unjoined as indicated at **14**, and the walls preferably are disposed at an obtuse angle to the bottom, preferably including with the bottom an angle of approximately 95°, thus providing a slight amount of draft for a purpose later to appear.

In commencing the process, the bottom and inner surfaces of the walls of the pan first are preferably given a thin coat of fast drying paste wax of the ordinary household type. After this wax is dry, a sufficient quantity of the plastic material from the mixer **10** to substantially fill the pan is placed therein. In actual practice I fill the pan to within approximately $\frac{1}{16}$ inch of the top.

At **16** I indicate diagrammatically a vibrating table. This table comprises a level bed **17** which may be a sheet of steel, and is vibrated by means of a weight **18** eccentrically mounted on a shaft **19**. The shaft is driven by means of a motor **21** through the medium of a belt **22**, and the direction of the vibration comprises essentially vertical components. I have discovered that both the frequency and amplitude of the vibration are important factors in providing a thin, dense, smooth outer surface on the layer of facing material. When using the specific mix for the facing material above given I have found that the shaft **19** should be rotated approximately 4,000 revolutions per minute, thus making the frequency of vibration approximately 8,000 cycles per minute. The table should be so set that the amplitude of this vibration is on the order of $\frac{1}{16}$ of an inch.

After the pan is filled with plastic material I place the same on the table and the vibrator is operated at the above frequency and amplitude for approximately 20 seconds. I have further found that this time element is important in producing the desired density and smoothness of the facing material. This has the effect of causing the marble particles to stratify or at least for the same to move upwardly in the pan. As shown more particularly in Fig. 5 of the drawing the larger particles in the plastic facing material F move upwardly in the pan while it is being vibrated whereas the smaller particles and a large part of the cement remain in the bottom of the pan, which as will later appear becomes the outer face **23** of the block. I have discovered that vibration at the above frequency and amplitude for the length of time given produces an extremely dense, smooth outer surface **23**. Further, by causing the smaller particles to move toward the bottom of the pan, the whole mass adheres more strongly to the bottom and sides than would be the case if the larger particles were distributed uniformly throughout the material. This is of particular advantage in that a pan filled and vibrated as above given may be quite readily inverted or placed on edge without the material shifting or falling therefrom.

After vibrating the pan and its contents I let the same stand for a period of from 6 to 18 minutes. To obtain this setting time in continuous production I may provide an inclined slide **24** having its highest end adjacent the vibrator **16** and its lower end adjacent a block machine indicated generally by the numeral **26** in which the composite block is to be formed. The slide is of a length to permit the pans to set for the desired time before the first one placed thereon is removed and placed in the block machine.

I have discovered that the time of setting should be controlled at least within 1 to 3 minutes in order to produce the best results. If the plastic facing material **23** while in the pan sets too long, upon forming the block as will be described a poor bond will be obtained. If it does not set long enough it will be found that the common cement material forming the body of the block will, during the tamping while in the mold box, flow through the layer of material F, thus spoiling the outer surface **23**. This setting time is important in causing the material to stay in place in the pan. The precise time of setting varies somewhat in accordance with the temperature and humidity of the surrounding atmosphere. I have found that under average humidity conditions if the temperature of the surrounding atmosphere is in the neighborhood of 75 to 90° F., the optimum setting period is approximately 6 minutes; if 60 to 75° F. the optimum setting period is approximately 12 minutes; if 40 to 60° F. the optimum setting period is approximately 18 minutes. By observing these setting times as a step in the process being disclosed I have found that the common cement material for the body of the block intimately bonds with the facing material without the liability of its forcing its way to the bottom of the pan **11**. I thus eliminate the majority of culls due to faulty bonding along the line of juncture between the body of the block and the facing material and culls resulting from damage to the surface **23** of the facing material F.

After the material in the pan has set for the time indicated I place the same in the mold box **27** of a concrete block machine. As shown more clearly in Figs. 7 and 8, such a mold box comprises generally a bottom **28** having openings **29** therein through which slidably pass the usual cores **31**. In the form of machine which I preferably use, the rear wall **32** of the mold box proper is stationary and is provided with a front **33** and end walls **34**. The end walls **34** preferably are hinged as indicated at **36** to the bottom **28** whereby they may swing outwardly thus to strip the block from the box. A form of machine which is entirely suitable for carrying out my process is that manufactured by the Miles Manufacturing Company of Jackson, Michigan. In this particular machine, the entire mold box embodying the bottom **28**, the front wall **33** and the end walls **34** is pivoted as at **37**. The entire mold box may thus be moved from the dotted line position indicated in Fig. 7 to the full line position.

With the mold box as indicated revolved counterclockwise 90° about the point **37** as shown in dotted lines, Fig. 7, I first place on the front wall **33** a wooden pallet **38**. On top of this wooden pallet, in upright position, I place a pan **11** filled with the plastic facing material which has been vibrated and set as indicated. The end walls of the mold box are provided with two sets of clip members **39** into which the ends of the pan **11** fit. When making double faced blocks, a second pan **11** is inverted and placed with its end over-

lying the other set of clips 39 on the end walls 34. The entire mold box is now rotated clockwise 90° to the full line position shown in Fig. 7, and the cores 31 are moved upwardly into the position shown. Locking means, not shown, are provided for holding the end walls closed while the mold box is in the full line position of Fig. 7. The common concrete material for forming the body of the block is now fed from a suitable supply hopper 41 under control of a manually operable valve 42. Initially, only a small quantity of the material from the hopper 41 is placed in the mold box, say for instance up to the dot dash line 43. With this quantity of concrete in the mold box the tampers 44 are lowered and this quantity of the material is packed in place. Next, and while the tampers still are operating I fill the remainder of the mold box between the surfaces of the facing material in the pans 11 with sufficient common concrete material to completely form the block body. After tamping for a length of time sufficient to further pack and settle the common material, the shuttle hopper 46 is moved to the dotted line position indicated bringing into position on top of the mold box a strike-off plate, not shown. The tamping is continued to completely pack the block and the mold box is again revolved 90° counterclockwise about its pivot point 37. The mold box is now opened up by swinging the end walls 34 outwardly. The block is now lifted from the mold box, the wooden pallet 38 serving as its support and is placed on a racked kiln car indicated generally at 47, Fig. 1. The blocks now go into a kiln indicated at 48 which is provided with means for supplying live steam through suitable pipes 49, and also is provided with coils for dry heating indicated at 51. The blocks remain in the kiln approximately 6 hours under the two kinds of heat, that is 6 hours under wet heat and 6 hours under dry heat at a temperature of about 200° F.

Referring particularly to Fig. 6 of the drawing, I show an L-shaped pan 11*a* having one section longer than the other which may be used for facing blocks on one end and one side. This pan is constructed of a sheet of stainless steel similarly to pan 11 the walls are flared outwardly of the bottom and the corners are left unconnected as already explained.

In using the pan 11*a*, I first fill the longer section with plastic facing material from mixer 10. I then vibrate the pan with the longer side flat on the table 17 of the vibrator 16. I next allow this vibrated material to stand for a length of time sufficient for the same to harden slightly, usually from approximately one third the length of time given above for the setting of the flat pans at the temperature set forth. The shorter side is now filed with pastic facing material and holding the pan carefully with the short side flat on the table 17 and with a slightly reduced amplitude of vibration, I vibrate this section of the pan. While offhand it would appear that this later vibration would dislodge the material in the then vertically disposed section of the pan, I have found in practice that this is not the case, and the material in both sections of the pan may thus be vibrated sufficiently for the purposes indicated. The pan is now permitted to stand for a short time and may then be placed on edge in the mold box and the block formed in the manner explained.

After the blocks are dried and cured it will be found that the walls 12 and 13 of the pans 11 and 11*a* may be disengaged quite easily from the surfaces by means of a suitable tool such as a screw driver, the sides being sprung slightly to release the pans. The slight amount of draft due to the angularity of the sides with respect to the bottom aids in this removal operation.

From the foregoing it will be apparent that I have devised an improved method for making faced concrete blocks and the like. In actual operation I have found that my improved process is effective in every way. Further, by the use of the L-shaped pan 11*a* shown in Fig. 6 I am enabled to make concrete blocks or the like which are faced on one side and one end. Also, it will be apparent that I may, through suitable modifications of the mold box arrangement, face the block either on one end or one side. I have found that the stainless steel pan is ideal for the purpose intended since this material resists corrosion, does not permit air to enter between the wet facing material and bottom, is rigid, and is capable of being formed to the shape desired. My improved blocks are entirely waterproof and when erected with a waterproof cement between the joints thereof provide a building which is extremely durable and which needs no further waterproofing. In my experience with blocks made in accordance with my process I have had practically no difficulty with separation at the interface between the common and facing materials. I attribute this intimate bonding of these materials to close adherence to the several steps in the process as herein set forth, and to a somewhat lesser extent, the specific composition of the facing material, together with the use of the stainless steel pan or pallet 11 or 11*a*. I thus am enabled to provide in mass production concrete blocks in which the face is of material of one type and the body of the block of material of another type. For the common cement-aggregate mixture for the block body I prefer to use a mixture in which at least some of the aggregate is larger than the largest aggregate in the facing material. Sufficient water is used in the body material to make a mix having approximately the plasticity of the same when making ordinary cement blocks. That is, the body-material is sufficiently dry that the block is self-sustaining immediately after it is formed as illustrated in Fig. 1.

While I have shown my invention in but two forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications, without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In the manufacture of faced concrete building blocks wherein the facing material comprises one type of plastic cement-aggregate mixture in which the aggregate is of different sizes and the block body material comprises a plastic cement-aggregate mixture of different type dry enough to be self sustaining immediately after the block is formed, the method comprising the steps of placing a quantity of said facing material in plastic condition in a shallow metallic pan, vibrating the pan and contents for a length of time to cause the larger sizes of the aggregate thereof to move out of contact with the bottom of the pan, permitting the vibrated contents to stand in the pan for a period of time sufficient only for the same to partially set to the extent that the contents of the pan will remain in the

pan without substantial flow when it is held substantially vertically on edge, standing the pan on edge with the bottom thereof substantially vertical, bringing the block body material in plastic condition into direct contact with the surface of the facing material in the pan, and tamping the plastic body material to cause intimate bonding of the same with the facing material.

2. In the manufacture of faced concrete blocks wherein the facing material comprises one type of plastic cement-aggregate mixture and the block body material comprises a plastic cement-aggregate mixture of different type dry enough to be self-sustaining immediately after the block is formed, the method comprising the steps of substantially filling a shallow metallic pan with said facing material in plastic condition, subjecting the pan and its contents to vibration composed of motion which embodies essentially vertical components and for a length of time for the principal part of the aggregate in said facing material carried in the pan to move out of contact with the bottom of the pan, permitting the facing material in the pan to stand until partially set only to the extent that the material remains in the pan without substantial flow when the pan is placed vertically on edge, bringing the body block material while in plastic condition into direct contact with the surface of the material in the pan, tamping said plastic body material in a direction substantially parallel with the surface of the facing material in the pan, permitting the faced block thus formed to set with the pan in place, and in then removing said pan.

3. In the manufacture of faced concrete building blocks and the like in which the facing material comprises a mixture of natural stone particles some of which are of different size from the others and all of which are of fractional inch size mixed with cement and water and in which the material for forming the body of the block comprises a common cement-aggregate-water mixture dry enough to be self sustaining immediately after the block is formed, the method which comprises substantially filling a shallow metallic pan with a facing material in plastic condition, vibrating the filled pan for a period of time sufficient to cause the majority of the stone particles of larger size to move out of contact with the bottom of the pan, allowing the facing material to stand in the pan for a period of time sufficient only for the mixture therein to partially set to the extent that the material in the pan remains therein without substantial flow when the pan is held vertical, placing the pan on edge in the mold box of a concrete block machine with the surface of the facing material therein facing inwardly of the mold box, placing a portion of the total amount of the plastic material required for the block body in the mold box in direct contact with the lower portion of the surface of the facing material, tamping the said portion of the plastic material, supplying the mold box with the remainder of the plastic body material and tamping the same, removing the composite block so formed with the pan in place thereon, permitting the block to fully set with the pan in place, and in then removing the pan from the said block.

4. The method as set forth in claim 3 in which the said remainder of the plastic body material is supplied to the mold box concomitantly with the tamping operation.

5. In the art of making faced building blocks in which the facing material comprises a cement-water mixture containing natural stone particles from approximately ¼ inch size to dust size and the body of the block comprises a cement-water-aggregate mixture in which the aggregate comprises solids at least some of which are larger than ¼ inch in size and which is dry enough to be self sustaining after the block is formed, the method of intimately bonding a layer of said facing material of approximately ⅜ inch thickness to a surface of said block during the manufacture thereof which comprises placing a layer of said facing material in plastic condition in a metallic pan having side and end walls approximately ⅜ inch high, vibrating the pan and its contents for a length of time sufficient to cause the majority of the larger sizes of aggregate in the facing material to move out of contact with the bottom of the pan, allowing the facing material to stand at rest in the pan until the same partially sets only to the extent that the contents remain in the pan when the same is held substantially vertically on edge, placing the pan and its contents on edge in the mold box of a concrete block forming apparatus, partially filling the mold box with the material for forming the body of the block while in plastic condition, tamping the body material in the partially filled mold box, subsequently completing the filling of the mold box with plastic body material, continuing the tamping operation until the body and facing material bond directly together along the meeting surfaces thereof, removing the block thus formed from the mold box with the pan in place, and removing the pan after the block has set.

JAMES A. KNIGHTON.

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