Sept. 8, 1970 R. A. PALMER 3,526,946

METHOD FOR MAKING AN ENCASED STEEL BUILDING BLOCK

Filed March 26, 1968 5 Sheets-Sheet 1

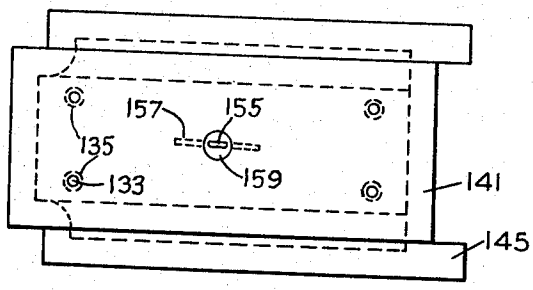


FIG. 1

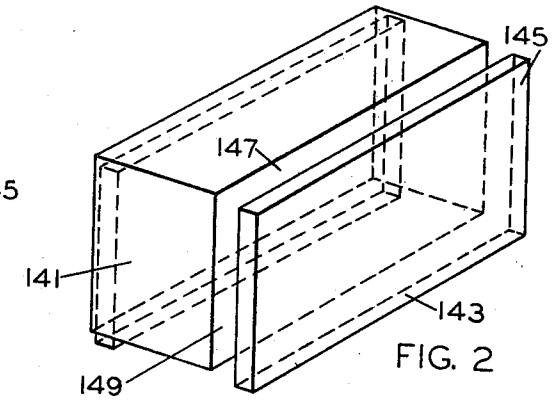


FIG. 2

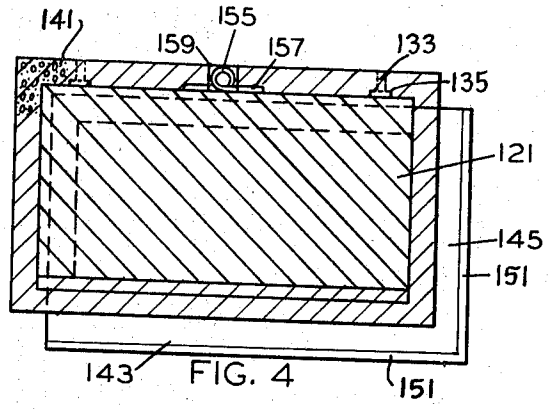


FIG. 4

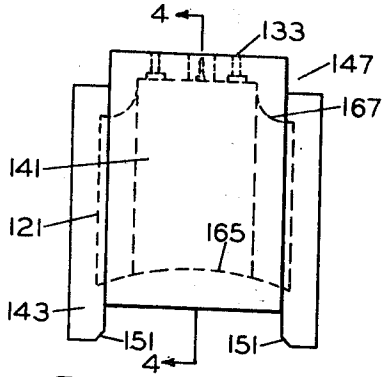


FIG. 3

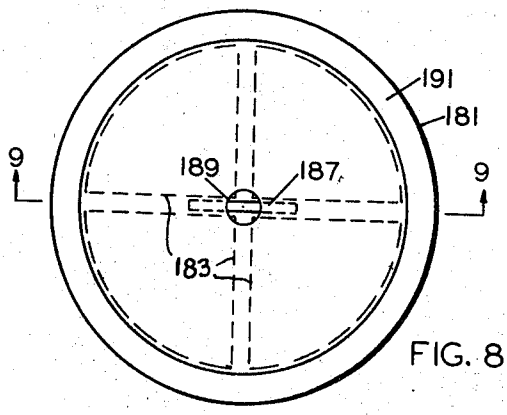


FIG. 8

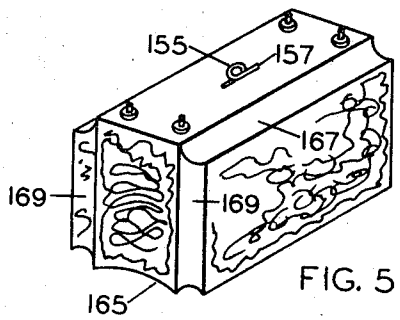


FIG. 5

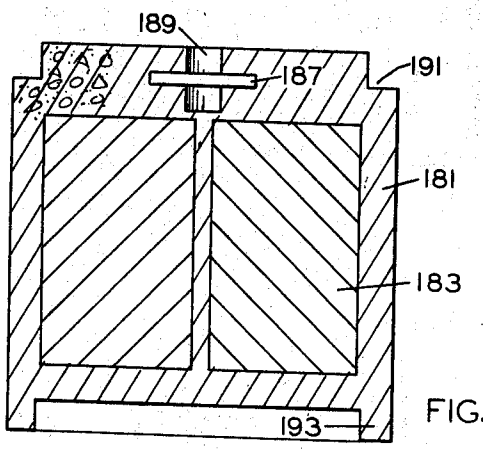


FIG. 9

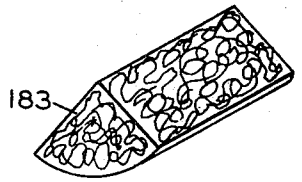


FIG. 10

METHOD FOR MAKING AN ENCASED STEEL BUILDING BLOCK

Filed March 26, 1968 5 Sheets-Sheet 2

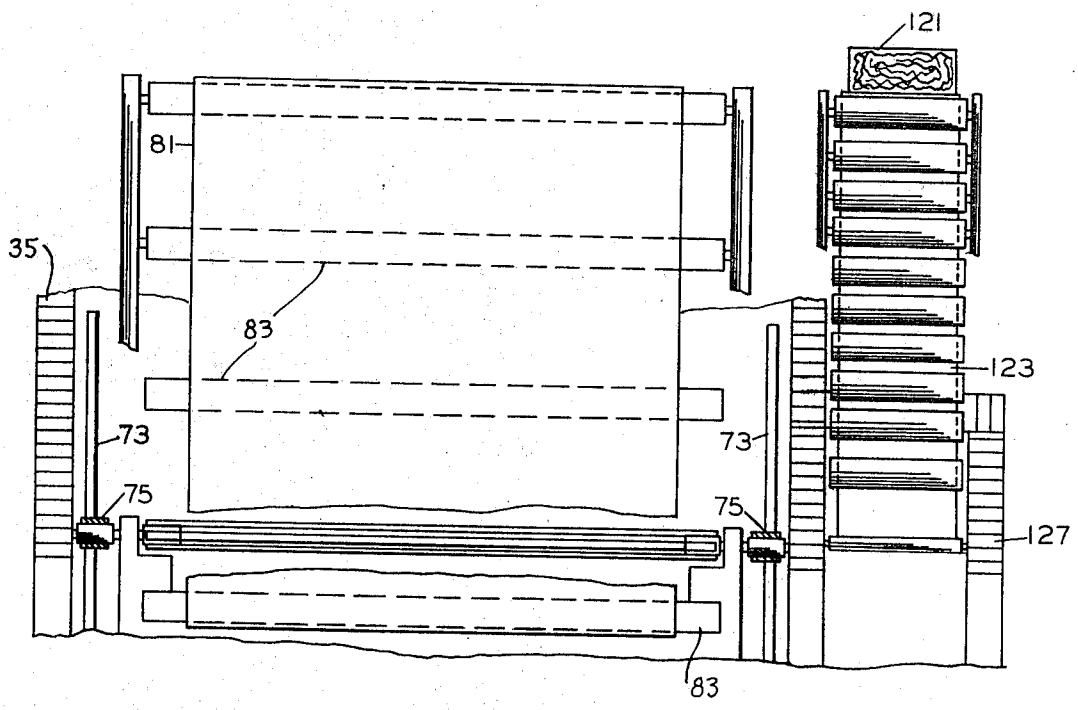


FIG. 15

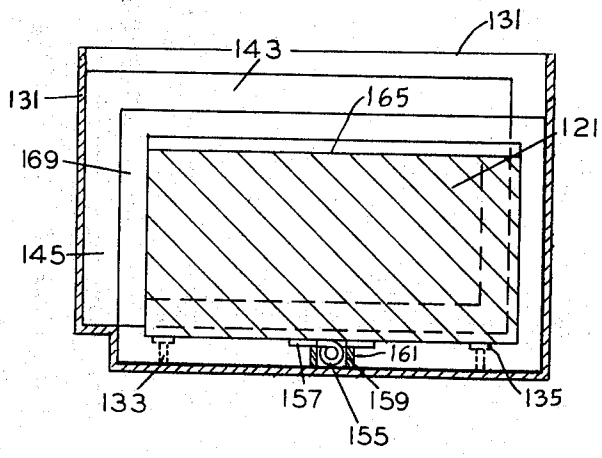


FIG. 6

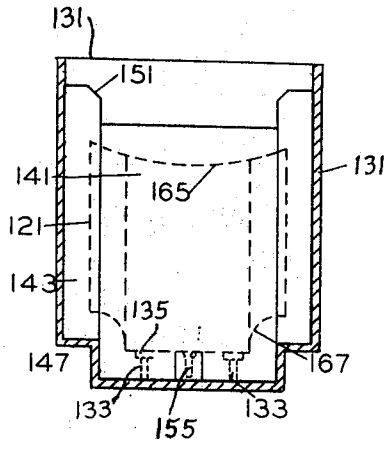


FIG. 7

Sept. 8, 1970 R. A. PALMER 3,526,946

METHOD FOR MAKING AN ENCASED STEEL BUILDING BLOCK

Filed March 26, 1968

5 Sheets-Sheet 3

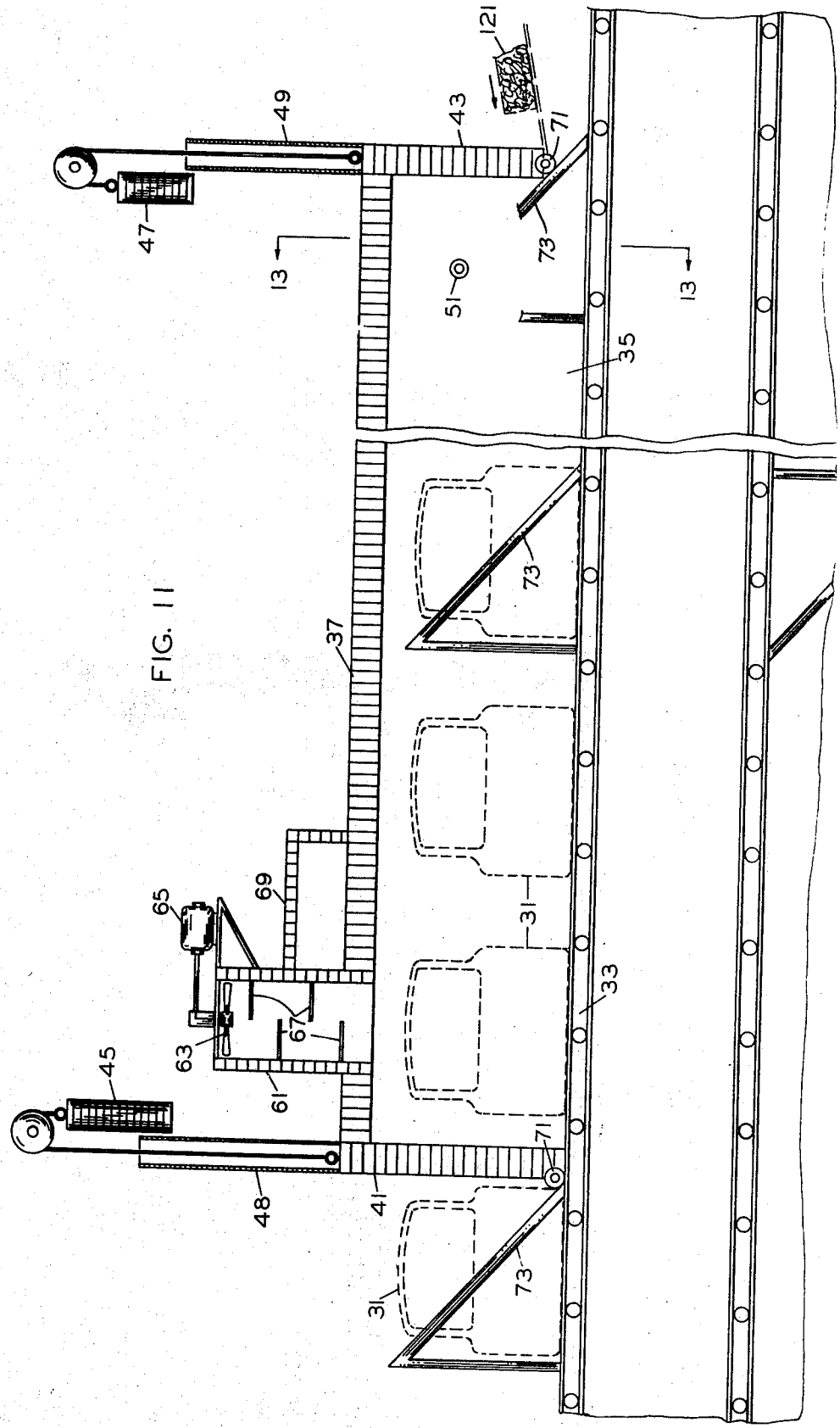


FIG. 11

Sept. 8, 1970 R. A. PALMER 3,526,946

METHOD FOR MAKING AN ENCASED STEEL BUILDING BLOCK

Filed March 26, 1968 5 Sheets-Sheet 4

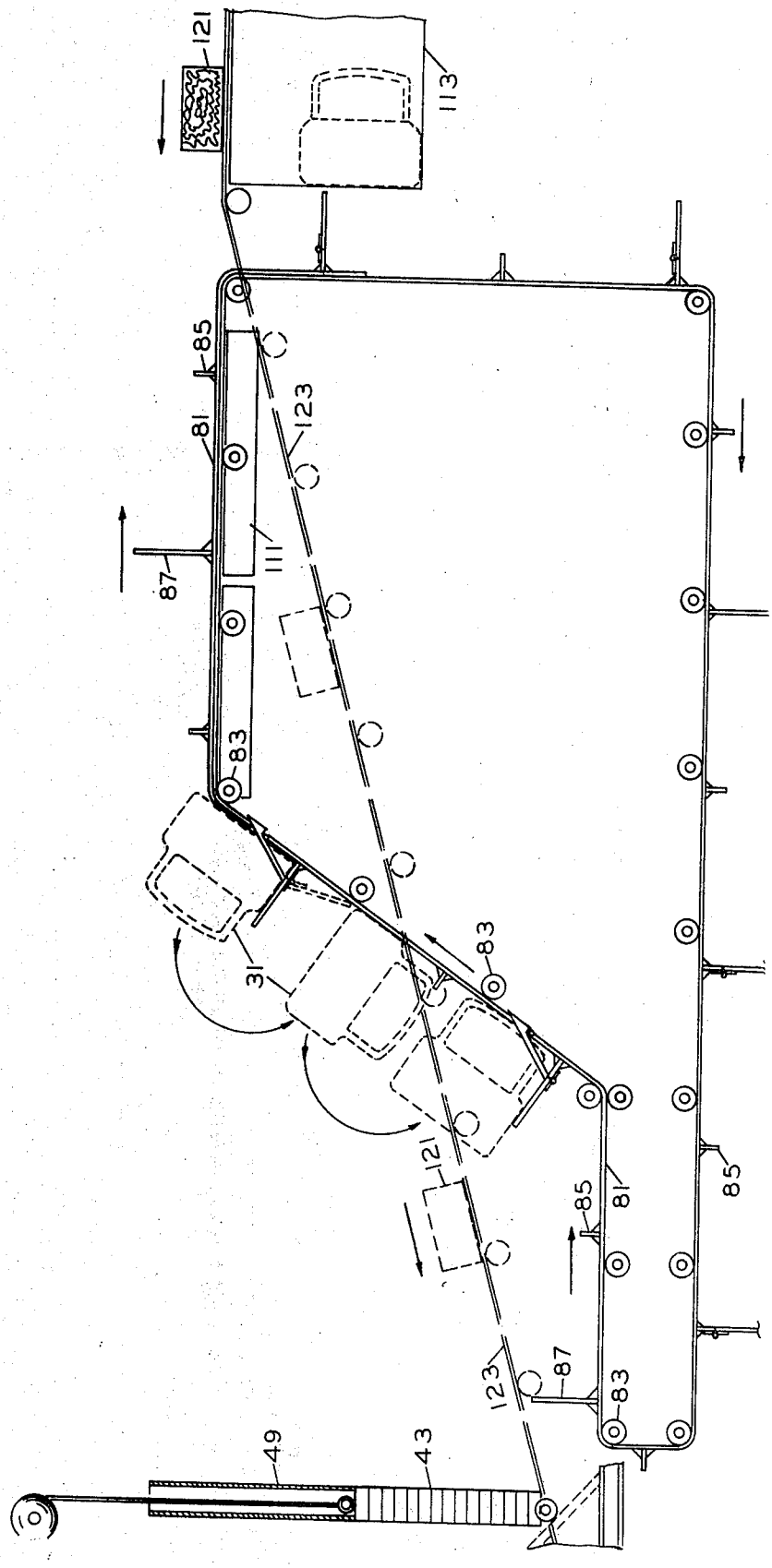


FIG. 12

Sept. 8, 1970 R. A. PALMER 3,526,946

METHOD FOR MAKING AN ENCASED STEEL BUILDING BLOCK

Filed March 26, 1968

5 Sheets-Sheet 5

FIG. 14

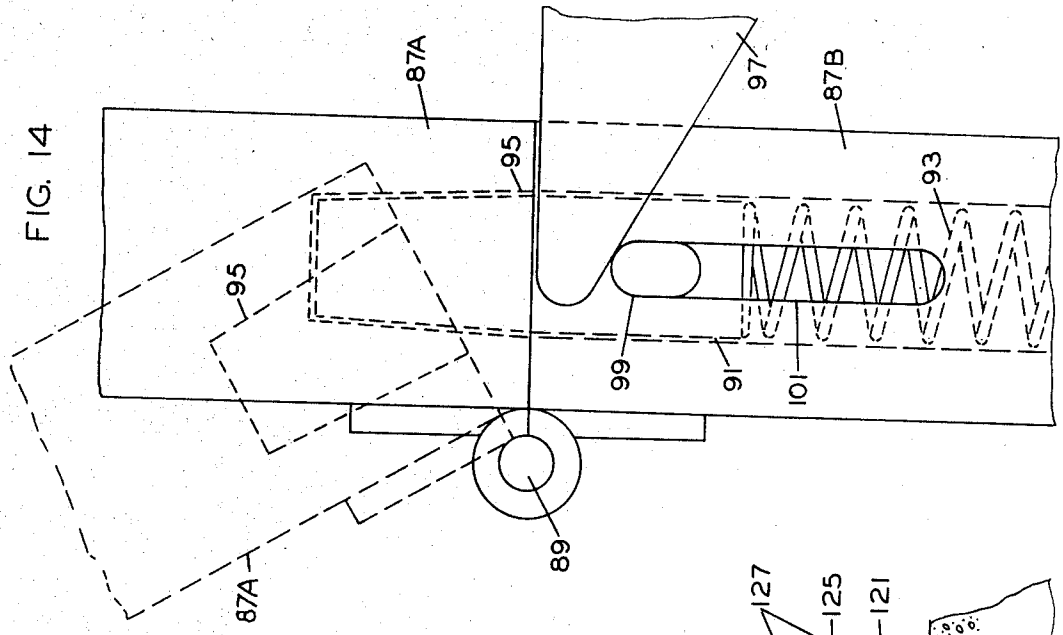
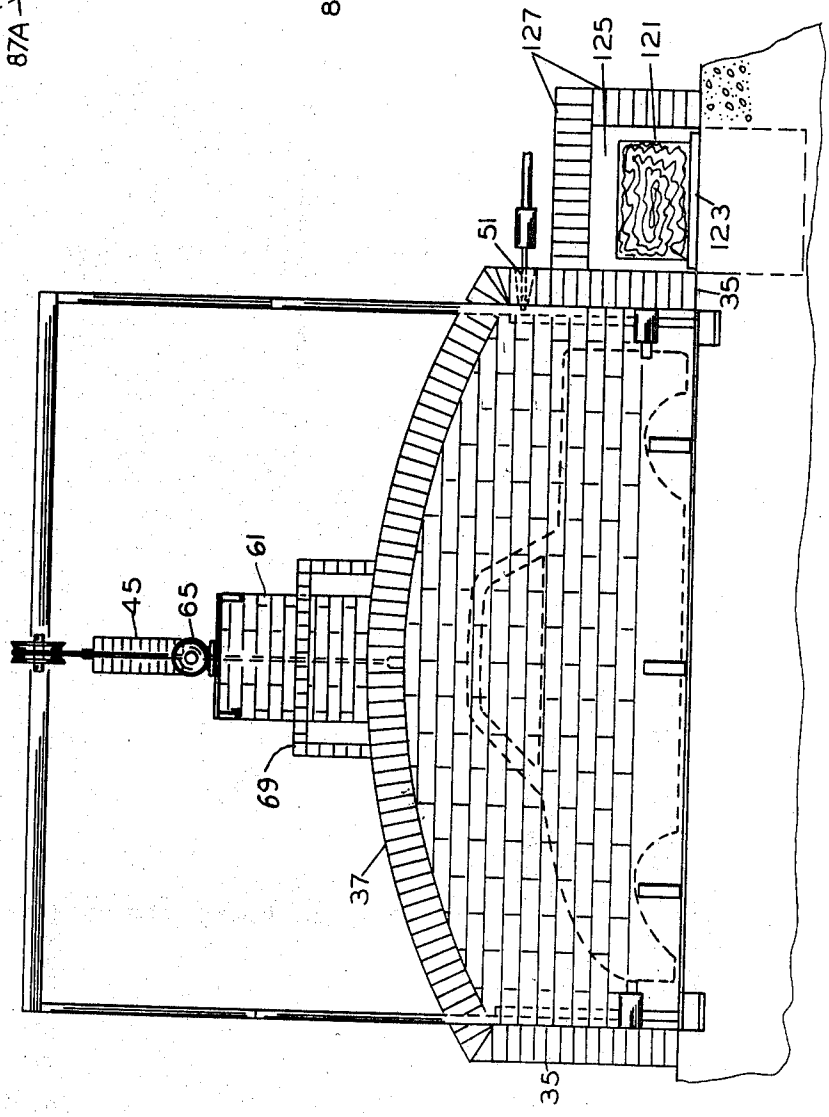


FIG. 13



United States Patent Office

3,526,946
Patented Sept. 8, 1970

3,526,946

METHOD FOR MAKING AN ENCASED STEEL BUILDING BLOCK

Robert A. Palmer, Dansville, N.Y., assignor to Korblock Corporation, Hornell, N.Y., a corporation of New York

Continuation-in-part of application Ser. No. 484,005, Aug. 31, 1965. This application Mar. 26, 1968, Ser. No. 716,050

Int. Cl. B23q 17/00

U.S. Cl. 29—403 7 Claims

ABSTRACT OF THE DISCLOSURE

A discarded or junk automobile is stripped down by removing the engine, transmission, differential, axles and other relatively massive metal parts, to provide a body mainly of sheet steel and other relatively light metal parts. This is then heated to burn out upholstery and other combustible ingredients and to melt any remaining glass, is tumbled to remove ash and small fragments, and the entire body or a suitably severed fraction thereof is pressed to form a compact crumpled mass of sheet metal. This mass is then used as a core, covered by cement, to form a large sturdy building block suitable for heavy construction. Burning ovens, conveyors, and tumbling means are provided, as well as a heavy duty press, for mechanizing the operation to a considerable extent.

This appilcation is a continuation-in-part of application Ser. No. 484,005, filed Aug. 31, 1965.

This invention relates to building blocks for building various types of structures, such as walls of buildings, abutments and piers of bridges, retaining walls for earth, or other structures, and relates more particularly to such building blocks mainly of steel encased in suitable enveloping material such as concrete or cement.

An object of the invention is the provision of a generally improved and more satisfactory building block of this nature.

Another object is the provision of a simple and economical process and apparatus for making such building blocks.

Still another object is the provision of a building block so designed and constructed that it serves the dual purpose of providing a durable and sturdy heavy-duty building element for construction purposes, and at the same time an efficient means for using up otherwise unwanted waste material of unattractive appearance, thereby helping to rid the countryside of eyesores.

More specifically, an important object of the invention is the provision of a practical building block in which the main structural element is formed of compressed or crushed automobile bodies suitably encased in cement or concrete or the like, so that the use of these building blocks will help to dispose of junk automobile bodies which are a serious esthetic nuisance in many parts of the country, and at the same time will provide a satisfactory building element for heavy duty construction purposes.

Another object is the provision of a practical and economical method for using up old or junk automobile bodies in the construction of building blocks.

These and other desirable objects may be attained in the manner disclosed as an illustrative embodiment of the invention in the following description and in the accompanying drawings forming a part hereof, in which:

FIG. 1 is a top plan view of a building block in accordance with a preferred embodiment of the present invention;

FIG. 2 is a perspective view of the same;

FIG. 3 is an end view of the same;

FIG. 4 is a vertical section taken approximately on the line 4—4 of FIG. 3;

FIG. 5 is a perspective view of the metallic core of the building block before it is encased in the concrete or other encasing material;

FIG. 6 is a schematic side view of the metallic core in a mold, ready to have the encasing material poured into the mold;

FIG. 7 is an end view of the same;

FIG. 8 is a plan of a different form of building block, cylindrical rather than rectangular, suitable for use in constructing columns;

FIG. 9 is a vertical section taken approximately on the line 9—9 of FIG. 8;

FIG. 10 is a perspective view of a metallic core element used in the construction of the block of FIGS. 8 and 9;

FIG. 11 is a schematic view partly in vertical longitudinal section and partly in side elevation, illustrating a portion of the apparatus used in manufacturing the building blocks of the present invention;

FIG. 12 is a similar view of another portion of the apparatus, constituting in effect a rightward continuation of FIG. 11;

FIG. 13 is a schematic cross section through the apparatus approximately on the line 13—13 of FIG. 11;

FIG. 14 is a detail showing a hinge joint used in the apparatus, and the means for operating it; and

FIG. 15 is a somewhat schematic end elevation of a portion of the apparatus shown in FIG. 12, with parts broken away and parts in vertical section.

The present invention includes the manufacture of building blocks or construction blocks formed basically from a steel core or body of crinkled or crumpled and compressed sheet steel and other light steel sections, encased in and firmly bonded to an outer covering of cementitious material such as concrete, and the invention also includes an economical and efficient method for manufacturing such building blocks, and comparatively simple, efficient, and inexpensive apparatus for manufacturing the blocks and carrying out the method. The invention has a two-fold purpose of, first, providing an extremely rugged and strong building block which can be used for heavy duty construction and which is of sufficient size so that a comparatively few blocks handled by power machinery will serve to complete a given foundation, abutment, pier, retaining wall, or other piece of heavy construction which would otherwise take a great many blocks of the smaller conventional kind; and second, to provide a practical means for using up discarded or junk automobile bodies, thus helping to rid the countryside of the eyesore which now exists in many places where such bodies are stored.

According to the invention, an automobile body is first stripped of the heavy metal parts, such as the engine block and accessories mounted on the engine, the transmission, the differential and other "rear end" parts, and the axles and wheels. This stripping operation is comparatively easy, and the articles removed have some resale value, either as replacement parts for repairing old automobiles of the same model, or as scrap iron in the manufacture of steel. As distinguished from these removed parts, the remainder of the automobile, that is, the body shell itself, has substantially no value as scrap iron unless absolutely all non-steel parts are first removed at prohibitive labor expense, and for that reason there has been, in the past, no financial incentive to make a suitable disposition of the body shell. It is these automobile body shells, lying around open storage fields and junk yards by the thousands, which have produced such an unsightly condition widespread throughout the land, a condition which the present invention aims to alleviate.

According to this phase of the invention, the stripped automobile body, schematically shown at **31** in FIG. 11, is placed on the conveyor schematically shown at **33**. This conveyor travels rightwardly when viewed as in FIG. 11, and the movement of the conveyor moves one body after another successively into one end of a high temperature tunnel oven having walls **35** and a top **37** of refractory brickwork, capable of withstanding great heat. In the specific form shown in FIGS. 11 and 13, the tunnel oven has an arched top **37**, but this is shown merely as a convenient example. The details of construction of the oven, and likewise of the conveyor, are not important for purposes of the present invention, and can be varied as desired by the oven manufacturer, so long as the oven is sufficiently large in cross section to accommodate a typical automobile body as indicated in FIG. 13, and sufficiently long so that several such bodies may be in the oven at the same time, as indicated in FIG. 11.

To conserve heat, the ends of the tunnel oven are closed by an entrance door **41** and an exit door **43**, each movable vertically along guideways and counterweighted by counter weights **45** and **47**, respectively, which balance most of the weight of the door, leaving only a relatively small weight to be lifted when the door is to be opened. The doors, like the other walls of the oven, are made mainly of refractory brick, although any suitable conventional framework of high melting point steel alloy may be used to hold the brick in place and to permit the entire door to be raised and lowered along the guideways **48** and **49**, respectively.

Near the exit end of the oven (the right hand end as shown in FIG. 11) provision is made for introducing suitable fuel through one or more nozzles **51** in one or both of the lateral walls **35**. The fuel may be either gas or oil or a combination of both, in any event being a fuel which will produce an intense hot flame for heating the oven to a very high degree, preferably about 1100 degrees Fahrenheit in the vicinity of the fuel nozzle **51**.

Near the entrance end of the oven (the left hand end when viewed as in FIG. 11) the tunnel has a duct **61**, equipped with a high speed exhaust fan **63** driven by an electric motor **65**. Baffles **67** in the duct **61** help to prevent the direct heat from coming in contact with and damaging the fan **63**, without interfering appreciably with the flow of the hot air and hot gasses. This duct **61** with the exhaust fan may be placed in any desired location, extending laterally from one of the side walls of the oven, or upwardly from the roof, the latter location being illustrated in FIGS. 11 and 13 merely as an example. The motor **65** is preferably off-set from the duct **61** to a sufficient distance to minimize any damage to the motor from the hot gasses flowing through the duct **61**. If the duct extends upwardly from the roof, a supplementary baffle **69** of refractory brick or other refractory material is placed above the roof **37** of the oven and below the motor **65**, to reduce the possibility that radiant heat from the roof of the oven will adversely affect the motor.

The doors **41** and **43** are raised as required, in order to permit the automobile bodies to enter and leave the oven. The raising of the doors can be done in any convenient way, the details of which are not important for purposes of the present invention. For example, each door may have, at its bottom corners (at each side of the oven) a roller **71**, engaged by respective cam members **73** (one at each side of the oven) which may be placed on the same conveyor **33** on which the automobile bodies are placed, or, more conveniently, on separate conveyors **75** (FIG. 15) one located at each side of the main conveyor **33**. The advantage of this is that the conveyors **75** for operating the cams **73** for opening the doors may be driven and controlled independently from the main conveyor **33**. For example, when one automobile body reaches a position just in front of the entrance door **41**, as seen near the left end of FIG. 11, the main conveyor **33** carrying the automobile bodies may be temporarily stopped, and the conveyors **75** carrying the door opening cams **73** may be driven forward so that the cams **73** will lift the rollers **71** at the bottom corners of the entrance door **41**, thereby lifting the door to the required height. Then the cam conveyor may be stopped and the main conveyor **33** may be driven forwardly to pass the automobile body into the oven, after which a slight additional forward movement of the cam conveyor **75** advances the cams **73** so that the rollers **71** drop off these cams and the door closes downwardly, by gravity. A similar operation takes place when the door **43** at the exit end of the oven is to be opened. Preferably the cams **73** are so spaced with respect to each other that they operate approximately simultaneously on both doors, so that both doors are opened at substantially the same time, then the main conveyor **33** is operated to move the last body out of the oven and a fresh body into the opposite end of the oven, and both doors are closed again.

The described mechanism for operating the doors of the oven is disclosed only as a convenient example, since the details of oven door operation are not important to the rest of the invention, and may be widely varied. For example, the oven doors may be operated by electric motors, controlled by manual switches, or by automatic switches operated by suitable cams on the conveyors.

As above mentioned, the temperature produced by the fuel in the oven is preferably in the neighborhood of 1100 degrees Fahrenheit, and the operation of the exhaust fan **63** will pull the hot gasses leftwardly toward the entrance end of the oven, so that substantially the entire length of the oven is heated to the high heat mentioned, there being only a slight drop in temperature from the exit end toward the entrance end of the tunnel oven. Ventilation openings are maintained near the exit end, to allow flow of air inwardly when the exhaust fan is in operation, to produce a flow of the heated gasses. This may be done by providing special air inlet openings, or preferably by having the exit door **43** open a few inches at its bottom, as shown in FIG. 11, even when it is in "closed" position.

Because of the resulting flow of hot gases, all of the bodies within the oven at any given time (preferably about four or five automobile bodies) are heated to the high temperature mentioned. This burns out of the bodies all of the combustible materials, such as any upholstery, and any dust, scraps of wood or other foreign substances, and leaves nothing but the metal from which the body was made, by the time the body reaches the exit end of the tunnel. The time that any given body is within the tunnel may be varied as desired, depending on the length of the tunnel and the rate at which fresh bodies are introduced into the inlet end. Ordinarily it is found that a time within the tunnel of about one half hour, at the temperature above

indicated, is sufficient for burning out all upholstery and other non-metallic materials, leaving only the burned out metal parts. These metal parts will be mainly of sheet steel, with possibly some other steel parts of relatively light cross section, such as angle braces, small channels, rods, angle irons, etc., it being remembered that the heavy metal parts such as engine, transmission, rear end elements, etc., having already been removed as above mentioned, before the body was placed on the conveyor **33** to go into the oven. The body may include some chromium plated or nickel plated parts, and minor parts of brass or other non-ferrous metals, which are of no disadvantage for purposes of the present invention but would be fatal to the satisfactory use of the body as scrap iron in the manufacture of steel.

When the burned out body comes out of the oven, the main conveyor **33** transfers it to another conveyor **81** of somewhat different construction, as seen in FIG. 12. This conveyor **81**, formed for example of chains passing over suitable guide rollers **83**, has a series of low lugs **85**, and a series of higher lugs **87** interspersed with the lower lugs **85**. The lugs **87** may conveniently be of two sections hinged as shown more particularly in FIG. 14, having an upper part **87***a* and a lower part **87***b* connected to each other by a hinge **89**. A heavy duty pin **91** mounted for upward and downward longitudinal sliding motion in the lower lug part **87**, and pressed upwardly by a spring **93**, enters a cavity **95** in the upper lug section **87***a*. When it is seated in the cavity **95**, this pin holds the two lug portions **87***a* and **87***b* rigidly in line with each other. However, when the pin **91** is withdrawn downwardly against the force of the spring **93**, the upper lug section **87***a* may then swing backwardly on its hinge **89**, as shown in dotted lines in FIG. 14. To withdraw the pin, there may be a cam **97** operating on a lateral projection **99** projecting from the pin **91** through a slot **101** at the side of the lower lug portion **87***b*, so that when the forward motion of the conveyor brings the lug **87** past the cam **97**, the cam withdraws the pin **91** and permits the upper part **87***a* of the lug to swing back relative to the lower part **87***b*.

The cam **97** is located near the top of the steep inclined part of the conveyor **81**, so that when the burned-out body is near the top of the incline, the pin **91** is withdrawn, allowing the upper section **87***a* of the retainer lug to swing back, while the fixed lower section **87***b* prevents the vehicle body from sliding down the incline. Since this section **87***b* is quite low, way below the center of gravity of the body, the vehicle body rolls over the fixed retainer or lug **87***b*. If the body attempts to slide down the incline after clearing the lug **87***b*, it engages the next low fixed lug **85**, which once more prevents sliding and requires the body to tip over. Any desired number of such fixed lugs **85** (that is, lugs fixed to but moving along with the conveyor) may be used between successive jointed or hinged retaining lugs, and of course the steeply inclined part of the conveyor may be made of any desired length. Finally, near the bottom of the steep incline, after the vehicle body has rolled over at least once and preferably two or three times, it comes to rest against another upright lug or retainer, which this time carries the vehicle body all the way to the top of the incline and onto the horizontal part of the conveyor, as shown near the top of FIG. 12. Meanwhile, however, the vehicle body has rolled over at least once and preferably more than once, and this tumbling action serves to shake out any residue of ash from the components which were burned in the oven, and any small fragments or pieces of non-combustible material which may be loose within the body.

The desired result of releasing the body near the top of the steep incline, for the rolling or tumbling action, at one time, and yet not releasing it when it subsequently comes up the incline, may be produced in various ways. For example, all of the high retaining lugs (sufficiently high to prevent the body from rolling over) may be of the hinged kind shown in FIG. 14, but the cam **97** which releases the hinge may be moved to an ineffective position whenever the operator finds that the vehicle has had enough tumbling action and should now continue its journey up to the horizontal part of the conveyor. Or again, hinged or jointed retainers of the kind described in connection with FIG. 14, can alternate with fixed retainers sufficiently high to prevent the body from rolling. These would be in addition to the intermediate low lugs **85** which are to catch the body and cause it to roll over rather than to slide down the incline. Thus, for example, a vehicle body may travel up the steep incline while resting against one of the hinged retainers **87**, which hinged retainer is released as the vehicle reaches the top of the incline. Then the vehicle body rolls down the incline, hitting each of the low lugs **85** as it goes, until it comes to rest against high retaining lugs similar to **87** but which are not hinged or jointed, and which are always in an upright position (fixed to and traveling with the conveyor) sufficiently high to prevent the body from rolling any further. These carry the body all the way up the incline and onto the flat top part. Then the next body on the conveyor is held by a high jointed retainer **87** released at the top of the incline, and rolls back to the next non-jointed high retainer, and so on, one after another.

On the upper horizontal part of the conveyor **81**, is a weighing platform indicated schematically at **111**, where the burned-out body can be weighed while the conveyor is temporarily stopped, or the weighing platform may be at one side of the conveyor and the auto body may be pulled or shoved laterally off of the conveyor onto the weighing platform and the flat working platform around the weighing scale. For making the crushed steel core for a given size and style of building block, it is desirable to use an approximately uniform weight of steel to be crushed. Since a supply of junk automobile bodies used in an operation of this kind will represent bodies of different styles, sizes, and weights, it is desirable to bring the mass of steel to an approximately uniform weight required for the particular core to be made, before the pressing operation. Moreover, most auto bodies are too large to make the core for a single building block, and must be sectioned or cut apart to make two, three, or four large sections (depending on the size of the auto body) each suitable for crumpling and compressing to a single core unit. This is why the body is weighed at this point. Attendants with cutting torches, or power driven metal saws, or both, will be stationed at the weighing location, and when the body is weighed, it can be determined into how many sections or large pieces the body should be cut. Then each of these sections is weighed again, and if too heavy, some of the most accessible parts will be cut off and laid aside, to bring the section down to approximately the required weight. On the other hand, if the section is lighter than desired, some of the spare metal cut off of other sections is thrown in, to bring it up to the desired weight. According to the invention, each metallic core used in the building block will be made from approximately one-half to one-quarter of a complete burned-out automobile body, but with some parts possibly cut off or some metal possibly added, as above explained, after the initial sectioning of the auto body, to bring the mass to an approximately uniform weight.

When the necessary weight adjustment has been made at or in the vicinity of the weighing scale **111**, each adjusted section is advanced by a hydraulic ram or other suitable power mechanism to a pit type of heavy duty press, the top of which is at preferably the same elevation as the top horizontal part of the conveyor **81** and the working platform around the weighing scale. The pit of the press is indicated schematically at **113**. Heavy duty pit presses capable of crushing an entire automobile body or a large section thereof into a relatively small compact mass of metal, are well known in the metal working field.

Any conventional press of this kind may be used, the details of which are not important for purposes of the present invention, so are not here illustrated. Likewise conventional equipment, not here illustrated, may be used for handling the vehicle body and each section thereof, placing it in the pit press, and removing the resulting crumpled compressed block or mass from the press when the pressing operation is completed. By the time a body reaches the weighing scale **111** and the working platform near the scale, it will have cooled considerably from the temperature which it had when leaving the burn-out oven, but will still be quite hot, and modern metal-handling equipment of conventional kind is comparable of handling the hot metal parts without difficulty.

As a result of the pressing operation, the vehicle body or individual section thereof is reduced to a compact mass, mainly of sheet steel which may be described as crumpled, crimped, or crinkled. The general shape of the compact mass or block is rectangular, but with certain variations from the shape of a strict rectangular parallelepiped as mentioned below. The exact shape produced will depend on the shape of the pressing dies used in the press, and these are shaped to produce a block or mass having the shape characteristics further mentioned below. But regardless of the general exterior shape, each of the outer faces of the compressed mass will have minor irregularities and will have a multiplicity of crevices, cracks, or small openings, much like the outer surface of a ball of paper which has been crumpled or crinkled in the hands.

The compacted crinkled mass mainly of sheet steel, indicated at **121**, then travels down a conveyor **123** to the elevation of the burn-out oven, and the conveyor then goes along a tunnel **125** made of refractory walls **127**, along one side of the oven. Enough heat radiates from the hot walls of the oven to keep the interior of the tunnel **125** at an elevated temperature so that, at the time the crumpled mass of metal is delivered to the coating apparatus, it has a temperature in the neighborhood of 130 degrees Fahrenheit.

The tunnel **125** continues along the side of the burn-out oven to a point near the entrance end of the oven, where the hot mass **121** is delivered to apparatus for applying a coating of cement around all sides of the metal mass, to encase the metal mass and provide a building block of definite predetermined external dimensions notwithstanding any slight variations in dimensions of the crumpled metal core. When speaking of a cement coating, the word cement is intended in a broad generic sense, as including a coating of plain or "near" portland cement or similar material, or a coating made of a mixture of such cement with a fine aggregate such as sand, or with a coarse aggregate such as gravel or crushed stone, with or without fine aggregate. Such a mixture of portland cement and aggregate is often referred to as concrete, but is here intended to be included under the broad generic word cement.

In order to apply the cement coating, the metallic core **121** is placed in a mold open at the top but closed at sides and bottom, the mold being of the internal dimensions required to produce a building block of the desired external shape and size. The metal mass is, of course, spaced from the bottom and sides of the mold, to allow space for forming the cement coating of the required thickness. One form of such a mold is shown at **131** in FIGS. 6 and 7. The metal mass **121** therein is placed so that it is spaced from the side walls of the mold, as shown, and is elevated above the bottom wall of the mold by temporary legs or stilts **133** which may conveniently be screwed into socket members **135** which have a sufficient area so that the weight of the metal core resting on the members **135** will prevent them from tipping over.

The cement mixture, in plastic or semi-plastic condition, is then poured into the mold **131** around the metallic core **121**, and tamped down sufficiently so that it flows under the metal core and fills the space beneath it, as well as filling the spaces at the sides of the metal core. Also, sufficient cement is put in to cover the top of the metal core, and suitable movable mold parts (not shown) may be employed to produce upstanding flanges of cement along the upper lateral edges of the molded block and along the vertical edges at one end thereof, to produce the preferred shape further described below. These flanges, originally molded at the top, will be at the bottom of the completed building block when it is ready for use, since the block is preferably molded in an upsidedown position, although of course it may be formed in any other position desired.

Because of the plastic nature of the cement at the time it is first applied to the crumped metal core, the cement will penetrate into and interlock thoroughly with the crevices which exist on all faces of the metal core, as a result of the crumpling or crinkling action produced by the press. The cement will also accommodate itself to and interlock with the minor irregularities on the surfaces of the metal core, of course. Thus a particularly strong bond between the cement coating and the metal core is achieved, especially because of the multitude of irregular crevices in the metal.

Also, the fact that the metal core is hot at the time the cement is applied thereto, at a temperature of approximately 130 degrees Fahrenheit, helps the quick drying and hardening of the portions of the cement coating which are next to the metal core. The application of the mass of wet cement, at room temperature, to the heated metal core, will immediately tend to lower the temperature of the surface portions of the metal core, but the heat from the interior portions of the metal core immediately begins to flow toward the outer surfaces thereof and warms them up again. Thus the cement sets or hardens around the metal core in a very satisfactory manner, and is intimately and firmly bonded thereto. With the metal at about 130 degrees, the cement sets solidly and very satisfactorily, without the cracks which would develop if the metal were much hotter than 130 degrees at the time the cement is applied.

It should be noted that minor variations in the dimensions of the metal core as it comes from the press, are taken up by slight variations in thickness of the cement coating, the outside finished dimensions of the cement being, however, standardized so as to be of predetermined exact dimensions in the completed article. But in any event, regardless of such minor variations in size of the core, the finished block in all cases is made mainly of the crumpled metal core, and the thickness of the cement coating on any face of the core, in a direction perpendicular to the face of the core, is considerably less than the thickness of the core itself in the same direction.

As already indicated, the finished building blocks may be of any desired shape and size. The most convenient shape for general utility construction (for making piers, abutments, retaining walls, and heavy-duty walls of buildings) is in the general shape of a rectangular parallelepiped the main body of which is shown at **141** in FIGS. 1–3, but which preferably has flanges **143** projecting beyond the bottom edge and **145** projecting beyond one end edge of the block, on each of two opposite sides or faces thereof, with rabbet grooves **147** and **149**, respectively, along the opposite edges of the same face. These rabbet grooves are matched in size to the projecting flanges **143** and **145**, so that when a series of similar blocks are laid to form a wall, the projecting flanges **145** at one end of a block will fit reasonably snugly, but with some play, into the rabbet grooves **149** of the next adjacent block, in the same horizontal row, and the downwardly projecting flanges **143** will fit reasonably snugly, but with some play, into the rabbet grooves **147** at the top edges of the blocks in the course or row immediately below. Preferably a strong adhesive, such as epoxy resin, is spread in the rabbet grooves of one block before the next adjacent block is laid, so that the epoxy resin practically unites the various blocks to each other to form

a coherent unified mass. If desired, the inner edges of the projecting flanges **143** and **145** may be slightly chamfered as shown at **151** in FIG. 3, to assist in guiding one block against the next adjacent block already laid. Because the joints between adjacent blocks are sealed by epoxy resin rather than by cement mortar, a wall or other structure of pre-formed blocks of this kind can be built safely in sub-freezing weather without special heating precautions as required when doing cement or concrete construction in cold weather.

Although the blocks may be of any desired size, it is contemplated that in general the blocks will be considerably larger and heavier than common conventional building blocks such as the usual concrete building blocks. They will ordinarily need to be handled by mechanical handling means, such as small cranes or hoists. Tongs of the kind often used for handling large pieces of stone can be employed for grabbing the building blocks and hoisting them into place. It is convenient, however, to provide a special lifting element on each block which may be engaged by a hook on a hoist, thus eliminating the need for tongs.

The lifting element is conveniently provided by having a cavity in the cement coating of the top face of the building block, and burying a metallic handling element with its ends in the cement coating, and with a central portion accessible in the cavity, so that it may be hooked onto a lifting hook. The metallic lifting element may be either straight or of any other desired shape. In the form shown in FIGS. 1, 4, 5, and 6, the lifting element is a metal rod bent into a loop **155** and having ends **157** extending straight and approximately tangentially to the loop **155**. The ends **157** are buried in the cement coating on the top of the block, while there is a cavity **159** around the loop **155**, so that the loop is exposed and can be engaged by a lifting hook. The cavity is conveniently formed by placing a tube **161** in the mold **131**, as seen in FIG. 6, and resting the lifting element **155**, **157** on the top of this tube before the crumpled metal core **121** is placed in the mold **131**. Then when the cement coating is inserted in the mold, it will flow around the outside of the tube **161**, which will cause a cavity to be left in the coating at this point.

After the cement has solidified enough so that the block may be handled and taken out of the mold, the members **133** which served as legs to hold the metal core away from the bottom of the mold are unscrewed from the plates or heads **135** in which they are screwed, leaving the latter within the cement coating. Then the holes left by unscrewing the legs **133** are filled with cement. There may be wrench sockets in the exposed ends of the legs **133**, to facilitate the unscrewing.

While the core **121** may be of any desired shape according to the broad aspect of the invention, a specific aspect of the invention deals with the preferred shape. One feature is that the lower face of the metal core mass **121** is shaped to be slightly concave in transverse cross section, across the thickness of the block, as seen at **165** in FIGS. 3, 5, and 7 (the latter view showing the inverted position of the block during the coating operation). The purpose of this slight concave shape is to concentrate vertical pressure forces somewhat inwardly toward the center of the block, thus making the blocks stronger and capable of supporting heavier loads without tending to spread the block laterally and perhaps crack off the cement coating on the lateral faces of the block.

Another feature in the preferred form of block is the concave grooves **167** running along the corners of the metal core where the rabbet grooves **147** are located in the final block, and the concave grooves **169** running vertically along the corners of the core where the rabbet grooves **149** are located in the final block. The purpose of these grooves is to allow space for the desired minimum thickness of cement coating in the vicinity of the rabbet grooves **147** and **149**. It will be seen especially from FIGS. 3 and 7 that the thickness of the crumpled metal core **121** is greater than the thickness of the finished block between the projecting flanges **143** and **145**, and the top edge of the metal core **121** is at an elevation a little above the bottom faces of the rabbet grooves **147**. In other words, the finished building block is mainly of compressed and crumpled metal, and the cement coatings on the faces of the metal core are comparatively thin. Consequently the grooves **167** and **169** must be formed in the metal core, in the locations where the rabbet grooves **147** and **149** are to appear in the finished article, to allow space for the desired minimum thickness of about 2½ inches of cement coating in these locations.

While the preferred building block is in the general shape of a rectangular parallelepiped, other shapes may be used for special situations, and a cylindrical shape is particularly useful for making supporting columns for bridges or other structures. Referring to FIGS. 8–10, a typical cylindrical building block is shown in general at **181**. In this case the metal core could be a single piece of compacted crumpled sheet metal of approximately cylindrical shape, but preferably is in the form of four separate segments each in the shape of a quarter of a cylinder, as shown at **183**. Such a shape is easier to form in a pit press than a completely cylindrical shape. The segments **183** are placed in the mold, slightly separated from each other as shown, and the cement forms a slight separating layer between the individual segments, as well as forming a coating around the outside of the segments, as plainly seen in FIGS. 8 and 9. These segments, just like the main metal core of the rectangular block, are of crinkled or crumpled metal having a multiplicity of small crevices all over their exposed faces, so that the cement interlocks firmly with each of the metal core pieces.

For ease of lifting, the cylindrical building block preferably has a lifting element **187** with its ends embedded in the cement material at the top, and the central portion of the element **187** accessible in a central cavity **189** formed in the top face of the block. Also, the peripheral or circumferential edge of the block at the upper end preferably has a rabbet groove **191** extending all the way around the circumference, and there is a hollow cylindrical flange **193** of corresponding size projecting downwardly around the margin of the lower face of the block, so that when one block is placed on top of another to construct a column, the flange **193** of the top block extends reasonably snugly, with some play, into the groove **191** of the block immediately below. As before, the blocks are preferably cemented to each other by epoxy resin.

Merely for the sake of typical examples of suitable dimensions, and not as a limitation upon the invention, it may be said that at present it is preferred to make the rectangular style of block with a thickness (side to side when viewed as in FIG. 3) of two feet, and a length (end to end in the direction of FIG. 4) of four feet not counting the projecting flanges **145**, or four feet three inches including the projecting flanges, and with a height, top to bottom of three feet not counting the bottom projecting flanges **143**, or three feet three inches including such projecting flanges. The rabbet grooves **147** and **149** are preferably a width (in a direction through the thickness of the block) of 2½ inches, the other dimension (in the direction of the length of the block or the height of the block, as the case may be) being about 3¼ inches. With these dimensions, the flanges on one block will fit reasonably well into the grooves of the next block, but not making a perfectly tight fit therewith, as there will be a slight crack or space between the projecting flange of one block and the bottom of the groove of the next adjacent block. Therefore the pressure, both vertical and longitudinal, will come on the main body of the building block itself, not on the projecting flange, and there will be no tendency to break the flanges off.

Typical dimensions of the compressed crumpled sheet metal core, for a block having the finished outside dimen-

sions above mentioned, are sufficiently smaller than the outside dimensions of the finished block so that the cement coating on each face of the metal core is about 2½ inches thick. The concave bottom **165** may have a radius of about 24 inches. The concave grooves **167** and **169** may each have a radius of about 2½ inches.

These typical dimensions, given as an example, have the advantage that one typical conventional sedan automobile body, stripped-down and burned out as above indicated, will provide the metal to be compressed in the pit press to form two or three metal core elements each suitable for making one building block. An unusually large auto body may be sectioned into as many as four sections, each suitable for compressing into a single core element. Of course a little metal may have to be taken away or a little added to each body section, before the pressing operation, as already indicated above. The dies used in the pit press are, of course, of the proper shape to form the metallic core into the desired shape for use in the building block.

It should be emphasized that the building blocks of the present invention are suitable for very heavy duty construction and capable of withstanding very heavy compressive loads. The pit press, wherein the auto body sections are compressed to form the individual crumpled core elements, preferably exerts a force of about 850 tons in each direction. When this is divided by the area of the largest face of the metallic core element, something less than 12 square feet, it is seen that the final compressive force exerted against this face of the core is about 70 tons per square foot, in a direction through the thickness of the core element. The area of the top and bottom faces of the core area is something less than 8 square feet; therefore the final pressure exerted by the press on the core element in the direction which will be the vertical direction of the finished block, is somewhat more than 100 tons per square foot. This is more than the crushing strength of the concrete or other cement coating on the metal core, thus showing that the metal core itself can safely withstand all of the compressive load that can be applied to the cement coating, and showing that the finished block is suitable for heavy duty loads. As already mentioned, the concave shape of the lower face of the metal core tends to concentrate the vertical compressive load toward the center of the thickness of the material immediately below it, thus minimizing any tendency of the compressive load to spread the bottom cement facing on the block or to spread the underlying block in a direction through its thickness and to spall or crack off the lateral cement facings from the underlying block. Also, the finished building block maintains its strength indefinitely. Although the metal core is formed mainly of thin sheet steel which would gradually rust away if exposed to air, the complete encasement of the sheet steel in the cement coating serves to prevent rusting or oxidation of the metal.

It is seen from the foregoing disclosure that the objects and purposes of the invention are well fulfilled. It is to be understood that the foregoing disclosure is given by way of illustrative example only, rather than by way of limitation, and that without departing from the invention, the details may be varied within the scope of the appended claims.

It has been suggested, in Lambert Pat. 1,382,095, to compress empty metal cans to form a compact core which is then covered with cement to form a structural unit such as a post, pavement member, etc. As distinguished from this, the present invention makes the metallic core at least mainly if not entirely by crumpling a single piece or integrally interconnected parts of a single automobile body. Of course the parts of the automobile body which form the core of a single building block may originally have been separate pieces when the automobile was built, but usually they are integrally interconnected with each other, by welding or riveting or other fastening means, prior to and at the time that the automobile body is junked and used for making the building block core of the present invention. Thus at least the major part of the core according to the present invention is formed from rigidly connected metal parts, so that in its compressed and crumpled state it tends strongly to resist deformation or slipping of one metal part relative to another, so that the metal core is stronger and more rigid than if it were made up of compressing dozens or hundreds of separate or discrete metal pieces constituted by many separate discrete small metal cans or receptacles.

What is claimed is:

1. The method of disposing of old automobile bodies and manufacturing building blocks which includes the steps of

(a) removing the engine, transmission, differential, axles, and other relatively massive metal parts from an automobile to provide a stripped-down body mainly of sheet steel and other relatively light metal parts,

(b) subjecting the stripped-down body while still uncompacted to heat of sufficient intensity and duration to burn out any upholstery and other combustible ingredients and to melt any glass to fluidity,

(c) tumbling the burned-out uncompacted body to remove ash and small fragments therefrom,

(d) compressing the burned-out body into a compact metallic mass formed mainly of crumpled sheet metal with each exterior face of the metallic mass having a multiplicity of crevices and minor irregularities, and

(e) applying cement to all exterior faces of said crumpled metallic mass to encase said mass in cement, said cement being applied while sufficiently plastic to penetrate partially into said crevices and to interlock, when hardened, with said crevices and irregularities, said crumpled metallic mass being at a temperature of approximately 130 degrees Fahrenheit at the time that the encasing cement is applied to it,

(f) said cement being applied in such quantity that the cement coating on any face of said metallic mass is of substantially less thickness, in a direction perpendicular to the face of the metallic mass, than the thickness of the metallic mass itself in the same direction,

(g) thereby to provide a sturdy building block for heavy construction purposes, composed primarily of a central body of crumpled sheet metal surrounded by an encasing coating of cement.

2. The method as defined in claim **1**, wherein said stripped-down body is burned out at a temperature of approximately 1100 degrees Fahrenheit.

3. The method as defined in claim **1**, further including the step of weighing the burned-out body prior to compressing it, and removing part of the metal thereof before compression or adding additional metal before compression, as the case may be, to bring the weight of metal to be compressed approximately to a predetermined weight needed to produce a compacted metallic mass of the proper size for the building block which is to be made.

4. The method as defined in claim **1**, wherein the step of tumbling the burned-out body includes moving the burned-out body to an elevated position on a steep incline and releasing the burned-out body and allowing it to roll down the steep incline in such manner as to roll over through at least one complete revolution.

5. The method as defined in claim **1** wherein the burned-out body is moved up a steep incline while maintaining the body in a substantially constant position of orientation until it reaches a point near the top of the incline, and wherein the body is then released when it reaches a point near the top of the incline so that the released body may roll back down the incline through at least one complete revolution.

6. The method as defined in claim 5, wherein the body, during its travel up the incline, is maintained in a position with its longitudinal axis crosswise of the direction of travel up the incline.

7. The method as defined in claim 6, wherein the body, during a portion of its travel up the incline, is engaged by an upstanding holding member at a sufficiently high point to prevent roll-over of the body during such portion of its travel, and wherein the holding member is released when the body reaches a point near the top of the incline, to permit roll-over of the body to remove ash and small fragments therefrom.

References Cited

UNITED STATES PATENTS

1,382,095	6/1921	Lambert	52—725
2,943,930	7/1960	Proler	75—63 X
3,320,051	5/1967	Lieberman	75—63 X

JOHN E. CAMPBELL, Primary Examiner

D. C. REILEY, Assistant Examiner

U.S. Cl. X.R.

52—576; 75—63