CRAFTSMAN CONCRETE BUNGALOWS, SHOWING ECONOMY OF CONSTRUCTION: BY THE EDITOR

I AM presenting here two Craftsman bungalows embodying a practical and economical idea in concrete construction. I believe that this new method, which is illustrated with perspective views and working drawings, will mean a reduction in cost and an increase in efficiency over the methods hitherto used, and so will be of interest to architects, builders and all who are considering the problem of building a home.

In order to make this new process of construction clear, it may be well to explain briefly those usually employed. When concrete was first used it was found to be an ideal building material, because indestructible and fireproof. The problem, however, was just how to use it to the best advantage. Solid concrete walls were built at first, but these had a serious disadvantage. Concrete is a good conductor of heat and cold, and is affected by changes of temperature and varying atmospheric conditions. In winter, therefore, the cold air outside the house chilled the solid concrete walls, making the inner surface colder than the air within the rooms; whereupon the warm air within the house, coming in contact with the cool wall, was at once chilled, decreasing its moisture-holding capacity and causing the surplus moisture to condense upon the cool inner surface and run down the walls. This is what is known as sweating, and the dampness produced not only made the rooms chilly and unwholesome, but also stained and discolored the wall coverings and hangings.

Various methods were devised in an attempt to obviate this difficulty, and to construct a solid concrete wall which would not sweat. Furring was used—that is to say, strips of wood were placed at intervals against the inner surface of the solid concrete wall, and lath and plaster were applied, the air spaces left between the concrete and the plaster serving as an insulation and thus preventing sweating.

FIG. 1: ELEVATION OF FRONT OUTER WALL OF LIVING ROOM IN BUNGALOW NO. 131, IN PROCESS OF CONSTRUCTION, SHOWING DOOR AND WINDOW FRAMES SET IN WOODEN FORMS PREPARATORY TO FILLING IN THE CONCRETE.
Concrete walls have also been made so as to include a continuous insulating air space, but these have either been cast in one piece or else expensive interchangeable metal forms have been used, and both methods, though efficient, have rendered the cost of construction high.

The only drawback to this last method being its expense, I have worked upon the theory that the most satisfactory form of concrete wall is one which can be cast with a continuous vertical air space, or other insulation, between two thicknesses of concrete, yet built in such a way as to necessitate only the simplest, fewest and least expensive forms possible. I have decided, therefore, to use wooden forms, which cost much less than the metal ones and can be put up right on the building site by any carpenter; the forms being interchangeable, so that they may be used again and again as the wall is gradually built up, thus minimizing the number of forms required. I have also tried to devise reinforcing ties that would be sufficiently strong and yet as simple and economical as possible.

In designing the two bungalows which illustrate this new process, I have omitted the cellar, because this permits a concrete foundation on which the concrete partitions of the house can be built. The omission of a cellar is a considerable saving of time, labor and materials, and if the bungalows are heated and ventilated by a Craftsman fireplace-furnace the only excavation needed would be for the ashpit. If a different heating system is desired, however, with the furnace located in the cellar, a sufficient space can be excavated for this purpose, in which case, of course, the coal bin would be included in the cellar instead of being on the ground floor. But if the cellar is used the usual wooden partitions would be built instead of the solid concrete partitions shown in these bungalows, as the excavation would prevent the use of the concrete foundation needed as a base for the concrete walls.

CRAFTSMAN CONCRETE BUNGALOW.

This construction, however, besides not being fireproof, involved the extra cost of wood and plaster, much time and labor, and so has never been considered quite satisfactory. Such a structure, moreover, is not ideal from an architectural standpoint, for it represents an attempt to remedy or cover up the defects of an unsatisfactory structure by imposing a superstructure not so durable.

At the present time one of the most widely used and efficient forms of concrete construction is the hollow concrete block. But even in this a serious objection is present, for although the hollow spaces extend vertically through the blocks at close intervals, and thus provide frequent air spaces between the inner and outer surfaces of the completed wall, the sides of the blocks which form the divisions between the holes still serve as a connection between the inner and outer surfaces of the wall, forming an occasional but nevertheless active conductor of heat and cold. The wall is thus only partially insulated, and sweating takes places to some extent wherever this solid connection occurs.
CRAFTSMAN CONCRETE BUNGALOW, NO. 131: THE ECONOMICAL FORM OF CONCRETE CONSTRUCTION USED HERE AND IN BUNGALOW 132 IS EXPLAINED IN THE ACCOMPANYING DESCRIPTION AND WORKING DRAWINGS.
ONE-STORY CRAFTSMAN CONCRETE BUNGALOW, NO. 132, SHOWING PRACTICAL AND DECORATIVE USE OF WOODEN BEAMS FOR PILLARS AND GABLE OF PORCH.
With the form of concrete construction used here, a trench is dug for the base of the outside walls. This trench is made deep enough to carry the walls below frost level, and the foundation walls are built up to the height desired. The ground enclosed by these walls is leveled off, covered with a layer of cinders, and on top of this is poured a layer of concrete. Nailing strips, 2 x 2, to which the wood flooring of the house may be nailed, are placed in this concrete layer while it is still soft, and the concrete which fills the spaces between these strips is leveled off flush with the top of them. This hardens and forms an inexpensive, practical and sanitary foundation. The exterior concrete walls extending below frost level prevent any frost from penetrating beneath the floors of the bungalow, the bed of cinders forms an insulation by taking up any moisture, and the concrete layer beneath the flooring gives the necessary base for the concrete partition walls of the interior.

The walls—which are preferably of cinder concrete—are cast in wooden forms. Each form consists of matched sheathing boards, ⅜ of an inch thick and 5½ inches wide—known as the ordinary 6-inch sheathing boards—three of which are fitted together as shown to make each side of the form, which is thus 16½ inches deep. These three boards are then fastened together by wooden strips or cleats, D, nailed to the form at intervals of about 24 inches as shown in Figure 3, which represents part of two of the forms during the casting operation. Bolts are provided, which extend through the cleats and sides of the form, each bolt head having two projections or pins, and a beveled washer, B, being inserted between the head of the bolt and the inner side of the form, as shown in Figure 2. The outer end of the bolt has the usual washer and nut which may be screwed up to secure the parts rigidly in place.

Three similarly joined boards are held in place opposite the first, to make the other side of the form, the two sides being 8 inches apart, with the central insulating boards, C, between and parallel with them. These are also sheathing boards, the same as those used for the sides of the form. These boards are selected because they are comparatively inexpensive and are always carried in stock, and by having the outside forms and the central insulating boards of corresponding sizes, the work of building up and casting the walls is greatly simplified. Before using these insulating boards they should be soaked in water for twenty-four hours, which will bring them to their maximum swelling point. Thus, when they are embedded in the concrete wall, they will shrink and become somewhat loose, leaving a slight air space on either side and so more completely insulating the concrete surfaces. Three of these boards are fitted together and temporarily fastened by means of wooden laths, and a saw notch is made in the edge of each outside board to receive the metal tie which is to hold the parts together. This reinforcing tie, A, which is 1½ inches wide and ⅜ of an inch thick, is bent in the center, as seen in the drawings, in order to hold the insulating boards in position and prevent any side motion of them during the casting operation. The ends of this tie are bent...
and provided with holes having opposite notches which register with the projections or pins on the heads of the bolts. This allows the bolt heads of each wooden form to be passed through the holes in the ends of the metal tie; whereupon the bolts are given a part turn so that the projections will hold the tie in place, the nuts are screwed up tight and the two sides of the wooden form and the central insulating boards are thus held rigidly in position the required distance apart.

A sufficient number of wooden forms are constructed to allow them to be placed around the foundation of the house, in two rows, one above the other, and the upper row is fitted to the one below by means of the cleats, as shown in Figures 1 and 3, with the central insulating boards and reinforcing ties in place as just described. The mixture of concrete is then poured in from above until it fills the spaces between the sides of the wooden forms and the central boards, and as the mixture is sufficiently liquid to spread and fill all the crevices, a solid wall is obtained.

This is left standing until it has set, after which the lower of the series of wooden forms is removed by simply loosening the nuts that hold the securing bolts, giving each bolt a slight turn to allow its head and projections to be withdrawn through the hole and notches in the bent end of the metal tie, and then pulling away bolts, inside washer and wooden forms from both sides of the concrete wall. This leaves a solid construction consisting of two thicknesses of concrete with the continuous insulating boards in the center, all held together rigidly by the metal reinforcing ties which are left embedded in the wall.

The holes left in the sides of the concrete by the removal of the inside washers are pointed up with a trowel, and any ridges or unevenness caused by the joints or roughness of the boards are smoothed off with a wooden float. This gives an interesting sand finish to the concrete, and if a perfectly smooth finish is desired a steel trowel may be used and a skim coat applied.

Another series of central insulating boards, C, is then fitted above those of the second row, provided with metal reinforcing ties, A, with the bottom row of forms, just removed, fastened on either side of the central insulating boards, the cleats being always arranged in staggered relation as shown in the drawings. The bolts are then tightened and concrete is again poured into the molds around the walls of the house.

This process is repeated, one layer of concrete being cast each day, until the entire outer walls are completed. By estimating the amount of time and labor required for each daily operation, the exact number of men needed can be employed, putting the work on a most economical basis.
One of the most practical features of this construction is the simple way in which the doors and windows are set into the outside walls. In building up the forms and casting the successive layers of concrete around the house, wherever such an opening is needed, the rough frame of a door or window is placed inside the wooden forms, with the sides of the frame at right angles to the sides of the forms: see Figure 1. This frame, which consists of side and top boards, rests on the hardened concrete layer below, and is temporarily fastened to the forms to hold it in place while the wall is being cast. It is provided with vertical grooves, as shown in Figure 4, to insure its being locked firmly in the concrete. As this rough frame is only 4 inches wide and the wall is 8 inches wide, a temporary rough inner frame, 8 inches wide, is fastened to the 4-inch frame, thus closing the door or window opening during the casting operation. The concrete is then poured into the forms on each side, the inner temporary frame preventing the mixture from filling the space required for the door or window. Successive layers of the concrete are cast each day, as previously explained, until the tops of the frames are covered. The removal of the wooden forms and temporary inner frame then reveals the sired opening left in the concrete wall, with the rough frame embedded in the concrete. To this rough frame the door or windows may afterward be fastened, leaving a concrete reveal. When several windows are grouped together, making an extra wide opening in the wall, like those shown in Figure 1, the top of the opening is reinforced to center the load, and the frame is propped in the middle until the mullions are inserted, after which the prop may be removed.

From this description and the drawings it will be seen that the walls are cast in successive layers all around the house, unhindered by the door and window openings, which are thus provided for at the same time.

The interior or partition walls of the bungalow are somewhat different in construction, for the temperature on either side of them will be practically the same, no moisture will condense, and so no central insulation will be needed. For these partitions, therefore, solid concrete can be
used. Each partition is 4 inches thick and is made by placing the wooden forms used for the exterior in the desired position, 4 inches apart, and connecting them by means of metal reinforcing ties. The ties, in this instance, will of course be only three inches long, without any central bend, but with the ends bent and perforated for the reception of the bolt heads just as in the construction of the exterior walls. The partitions are cast and built up in successive layers as previously described, the concrete floor serving as a solid base.

In order to insure a perfect union at the junction of the exterior walls and the partitions, during the casting of the former, a 2 x 2 furring strip is placed upright on the inner side, within the wooden form, at the point from which the partition wall is to extend. When the forms are removed this furring strip is also pulled away, leaving a vertical groove on the inner side of the concrete wall. Afterward, when the partition is being cast, the concrete poured into the wooden forms fills this vertical groove, hardens, and ties the outside and inside walls of the house firmly together. Thus when the whole has been cast, foundation, walls and partitions will form practically an integral construction.

Usually, in building a house, the interior trimming is one of the most expensive items, often representing one-fourth of the total building cost, for it involves both expensive
materials and skilled carpentering. With the method of construction used here, however, this expense is reduced to a minimum.

In constructing the partitions of these bungalows, openings are left in the 4-inch concrete walls by inserting rough wooden frames within the wooden forms and casting the wall around them just as in the case of the exterior walls, the rough wooden frames serving as a foundation to which the door jambs are afterward fastened. In this instance, however, no temporary inner frame is needed, the walls and rough frames being the same width. This construction will be seen clearly by reference to Figure 5, which shows, in horizontal section, the concrete partition with baseboards on either side, the rough frame embedded in the concrete, the door jamb fastened to the rough frame and rabbeted to receive the finishing moldings, the rabbet being sufficiently deep to prevent any crack showing if the wood shrinks, and tight enough to insure a close fit between jamb and moldings. The door stop is fastened to the jamb and the door is hung in the usual way. The edges of the rough frame will serve as "grounds" for the plasterer.

These parts and similar parts for the windows can be got out in the mill and sent to the job already stained and finished, so that all which is needed is for the carpenter to miter the pieces at the corners and put them in place. In this way the whole
interior can be trimmed with little labor and expense compared with that usually incurred.

The gables of both bungalows are shingled, the roofs are of Ruberoid, and the chimneys, though shown of concrete, would be equally or possibly more satisfactory if of brick. In each case the rooms are all on one floor, as compact as possible and yet with a hospitable sense of openness in the arrangement of living and dining rooms, inglenook and porch spaces.

In bungalow No. 131 the entrance door leads from the recessed corner porch, with its concrete pillars, parapets and flower-boxes, directly into the spacious living room, made cheerful by three pleasant window groups and by the welcome vista of the inglenook at the farther end. From the dining room, through another wide opening, a glimpse also had of this pleasant nook, with its open hearth, built-in bookshelves and fireside seats, so that both rooms share its comfort and friendliness. An interesting feature of the left-hand fireside seat is the fact that it may serve as a storage place for coal, which may be put in from the kitchen and taken out in the nook as needed for the fire.

From the dining room a door leads to the corner porch at the rear where meals can be served in warm weather. Doors also lead from the dining room and porch to a small square passageway communicating with the kitchen and pantry. The kitchen in turn opens upon a recessed porch which will serve as an outside kitchen or laundry. Off one side of this porch is the coal bin and a door to the maid's room, which is provided with a lavatory. Two bedrooms, bathroom and ample closets occupy the rest of the floor plan, being shut off from the living room by a small hallway.

In bungalow No. 132 a somewhat different arrangement is shown. The large living room and dining room are planned with only a slight division between, so that upon entering from the front porch one has a vista through both rooms to the dining-room windows in the rear which overlook the enclosed porch. The inglenook occupies the whole right-hand end of the living room, and on each side of the chimney-piece are built-in bookcases and seats. A large closet is also provided, and a smaller closet is placed at the left of the entrance door, for umbrellas, wraps, etc. A fireplace is also built in the dining room. In one corner of the plan are pantry, kitchen, maid's room and lavatory, with ample closet space and shelves. The kitchen communicates with the enclosed porch at the rear, which will serve as an open-air dining and living room, and on the opposite side of which is a place for fuel. Three bedrooms and bathrooms are provided on this side of the bungalow, with plenty of closets both in the rooms and in the small hallways between them.

**CONCRETE AND COLOR**

The neutral gray of a concrete house is the best possible background for the display of a one-color garden scheme. In the first place, the concrete itself can be slightly tinted when it is being mixed, so that it will be a cool bluish gray, a warm red or a deep cream. It can be made to imitate the local rocks in color—sandstone, limestone, granite or any of the infinite modifications of soft and warm or hard and cold gray rocks. It is needless to say that the concrete must not be in any sense a pronounced shade, but only merge toward the tone of gray that will be the most harmonious with the surrounding country and with the flowers that are to be grown near it.

Unless the concrete be mixed to a definite tone, it will be, when finished, a cold, unsympathetic, trying gray, and for a house of this type the predominating color of the flowers should be yellow, for yellow, like the sunlight, will warm the coldest slate tones into cheeriness. Any of the yellow climbing roses or the orchidlike canary vine, trained over a porch or pergola, or allowed to climb in and out through a lattice against the walls or around a window, will warm and mellow the whole house no matter how cold the tone of the concrete may be or how severe the lines of the building. Forsythia, tulips, poppies, asters, daffodils, nasturtiums, bush roses and many other yellow flowers shine their brightest when planted near the foot of a concrete wall. Flowers of the shades of blue or purple, such as heliotrope, asters, Canterbury bells, delphinium, stock, cosmos, wisteria, clematis, are particularly effective against a light greenish gray wall. White flowers, such as daisies, chrysanthemums, candy tuft, climbing roses, can be planted with good effect with the shades of violet.