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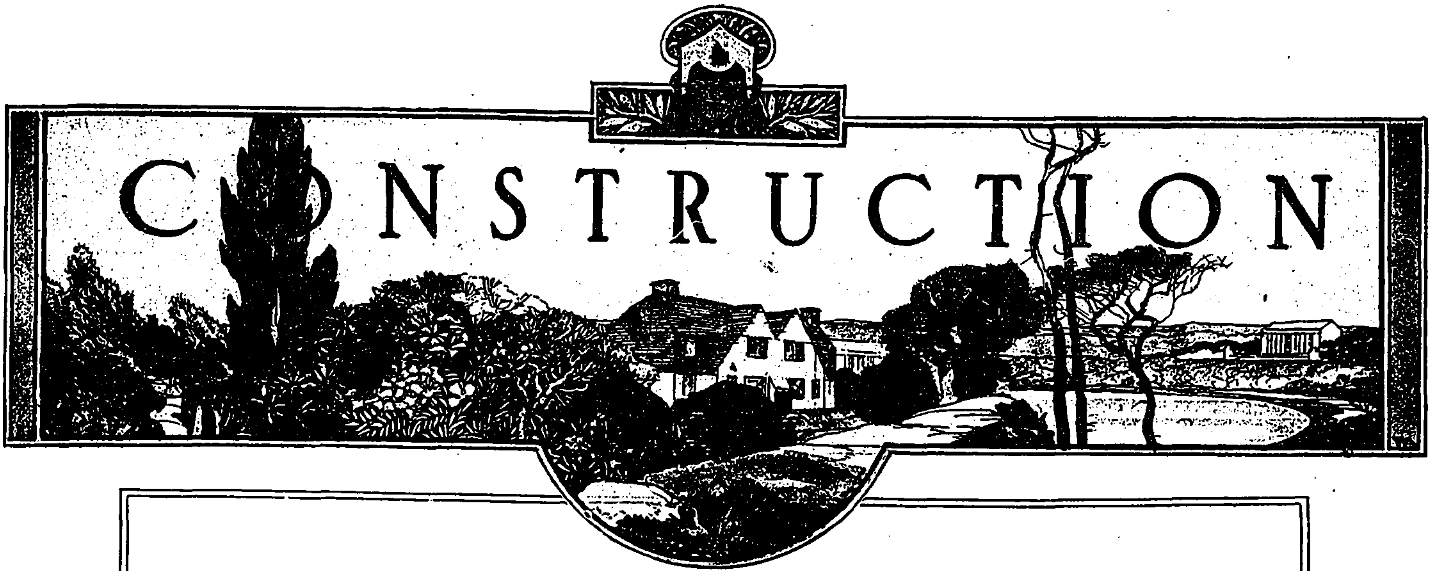

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NORTH TORONTO MILITARY ORTHOPEDIC HOSPITAL, ORIGINALLY ERECTED BY THE SALVATION ARMY AS A TRAINING SCHOOL AND TAKEN OVER BY CANADIAN MILITARY HOSPITALS COMMISSION WHEN THE CALL CAME TO PROVIDE HOSPITAL ACCOMMODATION MORE QUICKLY THAN NEW BUILDINGS COULD BE CONSTRUCTED.

Plans and Construction of Military Hospitals

United States Architect Who Assisted in the Erection of Military Hospitals in France Outlines Plans Adapted to American Requirements

By Charles Butler, in "Architectural Forum."

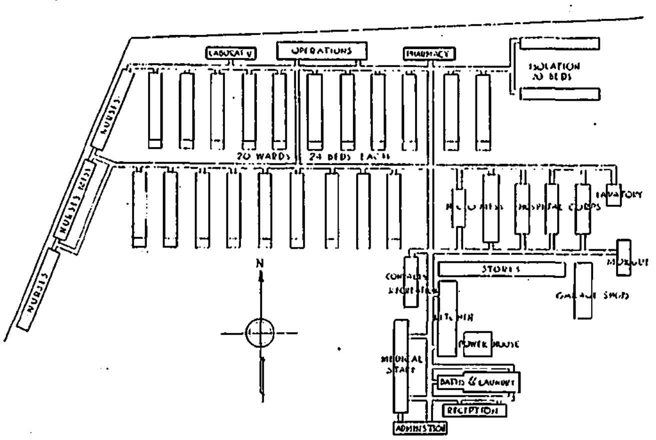
"WAR HOSPITAL" covers a multitude of varying types of building with varying destinations, from the hole in the ground in the front line trench to the great physical re-education centres in the rear, and includes canal boat, railroad train hospitals, hospitals for contagious diseases, rest camps, etc.

The hospitals, however, to which I refer especially in the present article, are those for the general care of wounded and sick, and it may, perhaps, be easiest to classify them by their geographical relation to the front. I speak, I may say, entirely of the French front, as my experience at the British front is extremely limited.

I should perhaps preface my remarks with an explanation of just what my relation to the French army was, and how I happened to have the opportunity to gain some knowledge of French war hospitals.

As a member of the American Relief Clearing House I was at work in Paris in the fall of 1915, when Dr. Carrel, who knew of my having made a special study of hospital planning in America, asked me to prepare for him the plans for a small 100-bed unit, to be erected closer to the front than his hospital at Compiègne, then under shell fire and likely to be evacuated any day.

Administration difficulties in regard to the admission of foreign nurses to the advanced zone of the army prevented the erection of this hospital, and the destruction of the 380 mm. gun which was shelling Compiègne ended the necessity of evacuating, so the project was dropped; but the Deputy Minister of War in charge of the Medical Service (there are three assistant Ministers of War in France for Munitions, Supplies and Medical Service) expressed his interest in the plans and asked me to bring them to him. It turned out that it had been planned to hold a competition for a model portable house type of hospital to be erected near Paris and to serve as a type for future base and home hospitals; but after looking over our plans the minister remarked that a competition did not seem necessary, and I volunteered my services to work out this model plan. A very excellent site was selected just outside the Bois de Vincennes, the great park to the east of Paris corresponding to the Bois de Boulogne on the west. At my request, M. Pellechet, a former fellow student at the Ecole des Beaux Arts, was to his considerable annoyance dug out of his second line trench and brought back to help me on the work. Dr. Dumont, a prominent young civilian surgeon, similarly mobilized for the war, was shortly after added to our combination, and we three working together have since very considerably influenced the design of French war hospitals.



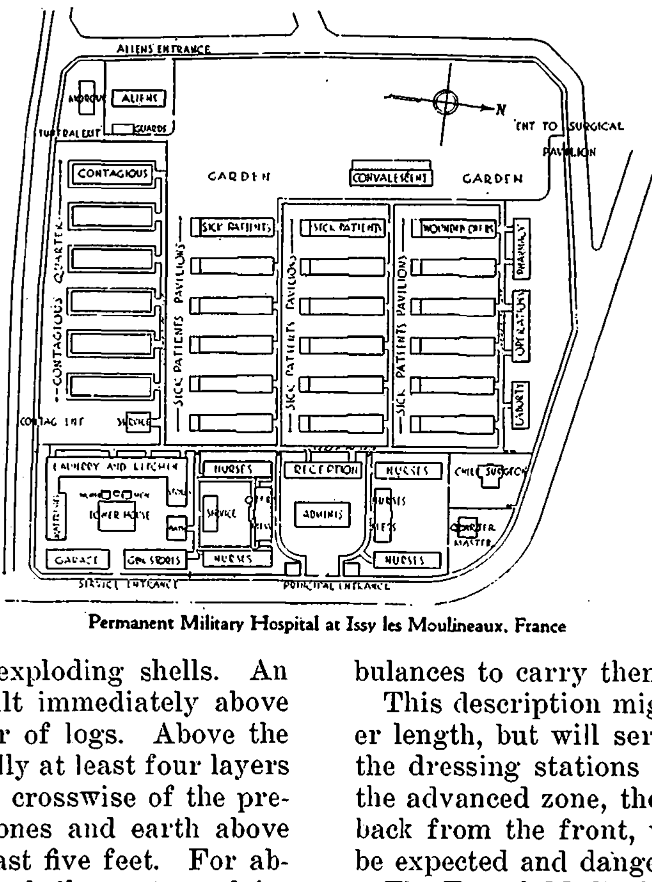
Plan for 500-Bed Base Hospital, Vincennes, Paris, France

All France is divided into two parts, the army zone—and the rest. The zone is a strip, on the average, thirty miles wide, parallel to the front, into which one only penetrates by the permission of the Grand Quartier Général. In this zone lie the front line hospitals, ambulances, dressing stations, etc.

The grouping of these services is about as follows: In the front line trench is what is known as the *Abri du Blessé,* a hole in the side of the trench, where the wounded man is put to get him as much as possible out of danger till he can be moved to the advanced dressing stations which lie fifty yards or so behind the front line trenches. This dressing station, or *poste de secours,* is presided over by an assistant surgeon, probably a medical student when war began. From the dressing station, which is always underground and contains perhaps a dozen bunks, the wounded man is transported, as soon as the firing slackens sufficiently, through the *boyau,* or communication trench (*boyau* means bowel, and the convolutions of the communication trench for the purpose of localizing the effect of bursting shells fully justify the name), back to the battalion dressing station, perhaps a mile away.

You can imagine just how painful is the trip through this mile of winding trench. Various types of stretchers are used, perhaps the most satisfactory being the hammock stretcher hung from a pole carried on the shoulders of the bearers and more easily manœuvred in the winding trench than the ordinary side pole stretcher. There are also chair stretchers for seated cases, etc.; but any way you take it, it is a hard trip for a wounded man. At the battalion dressing station is a full fledged surgeon and there are facilities for operating—as always underground. This dressing station is generally accessible for motor ambulances, at least at night.

The advanced dressing station is located so that one end is in direct communication with the *boyau* through which the wounded are transported. It is underground and fairly heavily protected, and contains beds in two tiers, with a small space at one end for emergency dressings and stores. The wounded reach this post in about six minutes, and from there are carried in ordinary stretchers about a mile to the end of the military road, the farthest point to which ambulances can go.



Permanent Military Hospital at Issy les Moulineaux, France

These subterranean posts are made about ten feet wide at the ceiling, with walls of planks sloping slightly in toward the floor. Log posts support the roof, and are spaced about every five feet.

The lower beds are for the more seriously wounded, the upper ones for slightly wounded. The former are removable for cleaning; the latter hinged at one end to allow swinging for cleaning. The construction of the roof is interesting in showing the provision made for exploding shells. An explosion chamber is built immediately above the ceiling over one layer of logs. Above the chamber there are generally at least four layers of logs, each layer placed crosswise of the preceding one, and large stones and earth above these to a depth of at least five feet. For absolute protection against shells up to and including 220 mm., experience has shown that fifteen feet should be provided. Against 380 mm. and 420 mm. shells, experience has as yet shown no satisfactory method of insuring protection.

The battalion dressing stations are located underground and heavily protected from shell fire. They contain an operating room at one extremity, provided, as always, with two exits. Beds in two tiers accommodate about twenty-four wounded. Living quarters for orderlies, surgeons, etc., are provided above ground. The wounded from the advanced stations arrive here in about one hour from the front.

The next station, called an ambulance, is located about two miles from the front, and comprises a number of buildings underground. The operating room is about eight by seventeen feet, with an arched roof of corrugated steel, the crown of which is about seven feet four inches above the floor. The haunches of the arch are filled with earth up to the level of the crown, above which is a thin layer of cement and a course of tree trunks about eight inches in diameter. Above these is the first explosion chamber, about twenty inches high, again two or three courses of logs, another explosion chamber and additional logs covered with earth and rocks, making a total thickness from crown of arch to the surface of about twelve feet.

The explosion chambers are designed to counteract the effect of the type of high explosive shells which are fitted with a delayed fuse that, ignited by impact, allows the shell to penetrate the earth before exploding.

The operating room is reached by a *boyau* leading from an examination room, also underground, with heavy protection, and placed at the edge of the road by which the ambulances arrive. From the operating room another *boyau* continues to a waiting space, where, after having their wounds dressed, those who are to go to the hospitals can wait in security for the ambulances to carry them away.

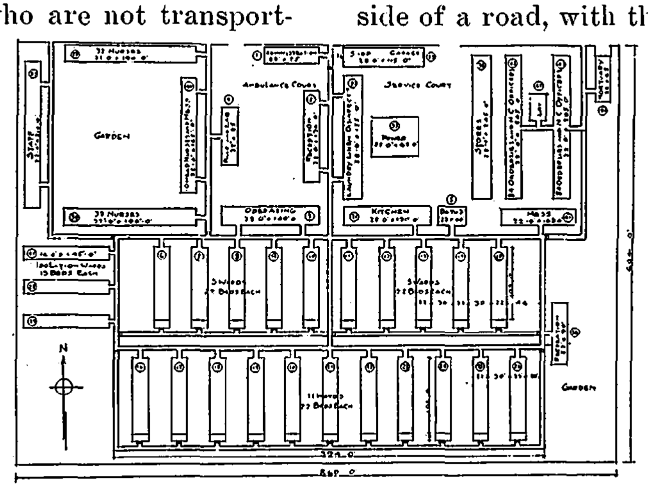
This description might be extended to greater length, but will serve to give a fair idea of the dressing stations and ambulances lying in the advanced zone, the first two or three miles back from the front, where shells may always be expected and danger is at all times present.

The French Medical Corps has devised a most ingenious unit for use in connection with these ambulances—what is known as the Ambulance Chirurgicale Automobile. This consists of a unit construction portable building, comprising a waiting room about ten by sixteen feet, a sterilizing room about the same size, and an operating room about twenty by sixteen feet, all of which can be packed on two motor trucks. Another truck contains a very complete sterilizing outfit, a fourth the X-ray equipment with electric generator, while the fifth serves for general supplies and transport of personnel. These buildings are now being erected with double walls and steam heat, and can be quickly transported to the point on the front where they are most needed.

We now come to the field hospitals lying a little farther back, and in which men can be cared for who need a few days' treatment before being sent on to the rear. They are a cross between the ambulances and the base hospitals, and are either in existing buildings, in tents, or in portable barrack buildings, but more and more in barracks, and with more and more of the conveniences and comforts of the base hospital.

Back of the field hospitals lie the great centres, such as Revigny and Bar le Duc to the rear of Verdun, Belfort in Alsace, Bray and Amiens in the Somme, where the wounded are counted by thousands instead of by hundreds, and where the final sorting out is done.

At Bray, which I visited in October, the group contains three thousand five hundred beds, divided into a hospital of one thousand beds for the seriously wounded who are not transportable, a *depot d'éclopés* of one thousand beds for the slightly wounded and slightly ill, and an evacuation hospital of one thousand five hundred beds for those who are to continue to the rear on hospital trains. The hospital proper is of the unit construction, portable house type, equipped for giving first-class surgical treatment.



General Plan for Base Hospital Adapted to American Conditions
Butler & Rodman, Architects

It was a hospital of this type which I was asked to design to be erected as a model just outside of the gates of Paris.

This plan will serve to show the special requirements of war hospital planning. They are in relative importance as follows:

1. Reduction of road building to minimum.
2. Complete intercommunication between buildings by wheeled cars. Patients, food, linen and supplies of all sorts are carried on wheels, and all buildings must be connected by galleries uninterrupted by steps.
3. Grouping of wards for easy service and with proper north-south orientation, and south end unobstructed.
4. Grouping of administration, technical and general services for easy communication and supervision.
5. Grouping of dwellings for staff, nurses and orderlies for convenience and supervision, and with sufficient separation from patients' quarters.

Although, as a result of certain governmental changes, the plan for the hospital at Vincennes was never executed, it has served as the basis for the plans of many other hospitals to be built all over France, which were submitted for criticism to our committee.

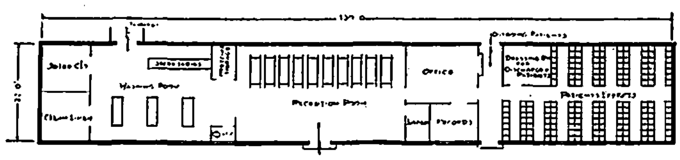
An interesting development of the work of our committee is the plan for the permanent military hospital at Issy les Moulineaux. For this hospital complete plans had been prepared and approved just before war broke out; but as a result of the modifications caused by war experience, we were asked to completely replan the hospital, which in its general scheme of arrangement follows the war hospitals, but is executed in permanent materials.

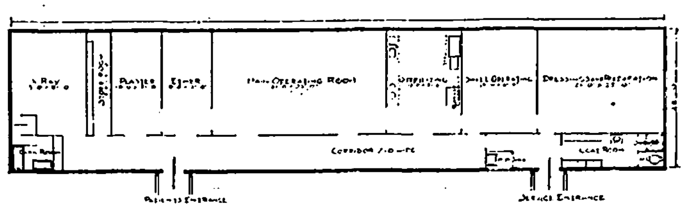
On my return to the United States last winter I was asked to assist the Committee of Directors of Red Cross Base Hospital Units of New York, and the following plans for typical base hospitals show the result of our work in France as adapted to American requirements.

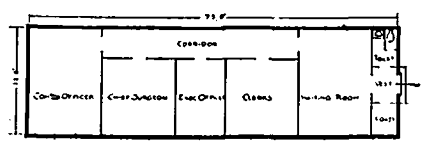
The site selected is assumed to be on the south side of a road, with the ground sloping slightly toward the south. The grouping of administrative and technical services around the ambulance court and the general services around the service court are to be noted, with the orderlies' quarters at the east and the nurses' and doctors' quarters at the west. The only road building required is in the two courts, while the wards lying to the south are connected to the administrative and service buildings and dwellings by covered wooden walks.

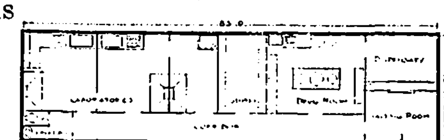
The wooden slatted walkway, covered or uncovered, is as much of a necessity in a war hospital as it is in a trench, as mud is the bane of the front, and the slat walk which permits of its elimination, so far as the interior of the hospital is concerned, is invaluable, and as all differences of level are taken up by ramps in place of steps, every part of the group may be reached by food trucks, wheel stretchers, and chairs.

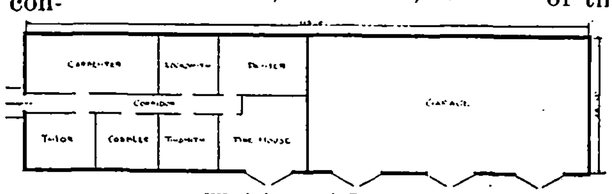
The details of the plans follow in general the ordinary practice, with the necessary modifications to fit military needs. The reception building in its present form is, however, a very definite product of the war. As it must be assumed that every wounded man is filthy, even though not necessarily vermin infested, it is essential that he be thoroughly cleaned before being admitted to the ward. The need of storage rooms for men's uniforms, boots, underwear, etc., and the necessary space for clean linen, surgeons' and clerks' offices, has led to the plan shown. In the center is the receiving room into which the ambulances discharge their loads. In this room the surgeon on duty makes a hasty examination, picking out those most needing prompt transport to the wards. They are then taken in order into the wash room, where their pedigrees are taken, their valuables checked and where after receiving the ward assignments they are cleaned in the table baths, put in clean hospital clothes, and wheeled away to bed, while their soiled clothes go to the disinfecting plant.

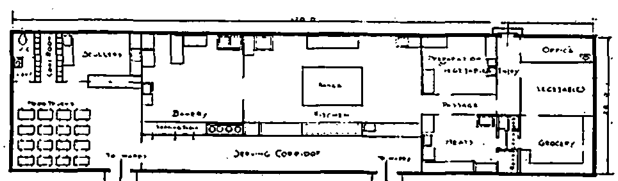

Reception Pavilion

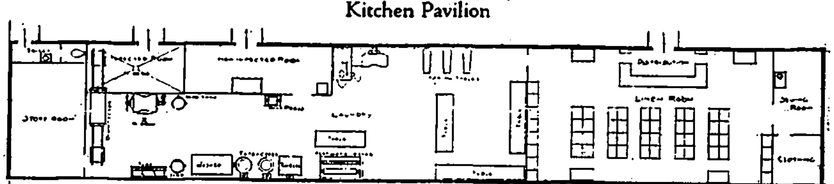

Operating Pavilion

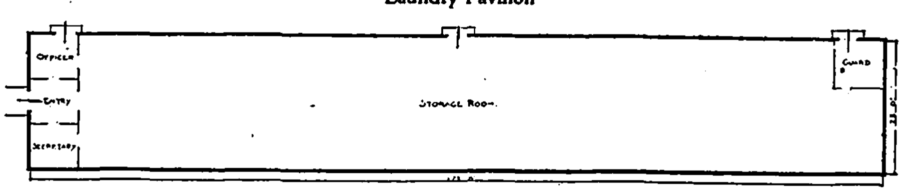

Administration Pavilion


Pharmacy and Laboratory


Workshop and Garage


Kitchen Pavilion


Laundry Pavilion


Storage Pavilion

After being washed, disinfected, and repaired, their effects return to the building for storage, where their records and valuables are also kept. When the wounded man is finally convalescent, and ready to be discharged, he comes back to this building, turns in his check, and receives his uniform and personal possessions and, after signing off, is discharged. The advantage of concentrating in one building the receiving and discharging of patients, together with the filing of their records and the storage of their effects, is obvious.

The administration building contains the usual general waiting room and offices, but is considerably less important than the corresponding service in a civil hospital.

The operating pavilion is naturally of especial interest in a war hospital. The plan shows two entrances—one being reserved for patients, while the other permits the orderlies to reach the dressing preparation room and secure their provision of sterilized dressings for the wards, without penetrating into the rest of the building. Other points to be noted are the two operating rooms, the larger planned to accommodate three tables if necessary and the smaller reserved for uninfected cases.

Easy access is afforded to the plaster and X-ray rooms by the corridor seven feet wide. It is to be noted that for the operating pavilion, the twenty or twenty-four foot unit, used for most of the buildings, is insufficient, and the twenty-eight foot unit has therefore been adopted for this building, as well as for kitchen and laundry.

The pharmacy and laboratory building presents no peculiar features.

The plan of the kitchen is of interest, with its space reserved for the food cars adjacent to the scullery, all dishes being kept in the building between meals and the cars being loaded at a counter which extends the full length of the bakery and kitchen proper and serves as a barrier to prevent the orderlies from entering either room. The main entrance for supplies is on the court side of the building, with an office for the receiving clerk and vegetable and grocery storage, refrigerators, meat room, and vegetable preparation room.

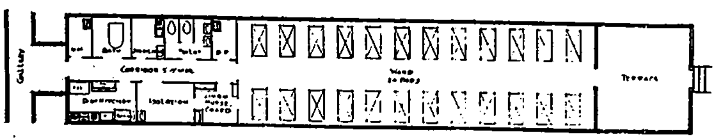
In view of the fact that much of the linen and clothing is contaminated, the laundry has two receiving rooms—one for ordinary soiled linen and one for linen, clothing, mattresses, etc., requiring sterilization; these pass either through the sterilizing washer or the steam and formaldehyde sterilizer into the laundry proper, where they join the other linen and are thenceforth treated no differently from the rest.

The storage space for mattresses and pillows and for clothing awaiting condemnation should also be noted, and the size of the repair room and general storage rooms, also the distribution counter in this last room, which prevents orderlies coming with their requisitions for clean linen from entering the storeroom.

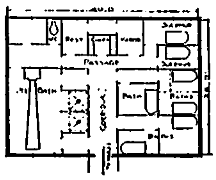
The ward buildings, containing each twenty-four beds in the open ward and one in an isolation room, show the consistent development of the war hospital toward the standards of civil practice.

Base hospitals are being planned more and more with sewage disposal systems, and in the case in point complete service is provided with toilets, bed pan and housemaids' sinks, lavatories, kitchen sinks, etc. As relatively few wounded can be bathed in the ordinary tub, there are no bath tubs in the ward buildings, but instead a small central bathhouse is provided, thus materially reducing the expense. An isolation room is provided in each ward unit, also a surgical dressing room, diet kitchen, and nurses' office and linen closet.

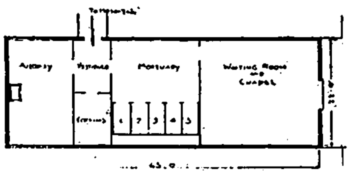
Following the custom of civil hospitals the wards are oriented north and south, and the south end is composed entirely of windows so as to permit the greatest possible amount of sunlight to enter. At this south end is placed, on a level with the ward, a terrace, on to



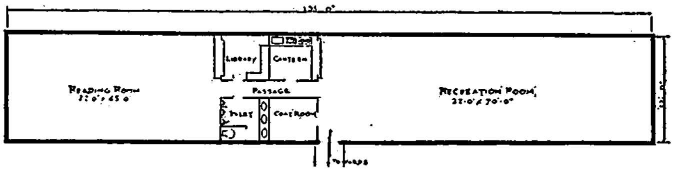
Ward Pavilion



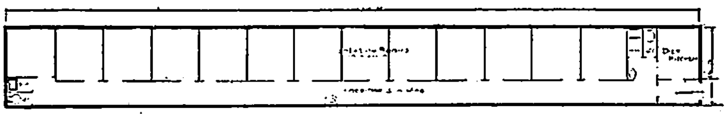
Bath Pavilion



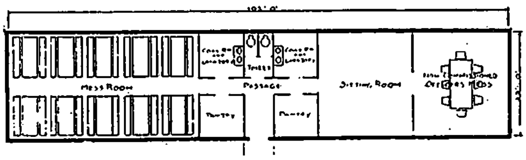
Mortuary Pavilion



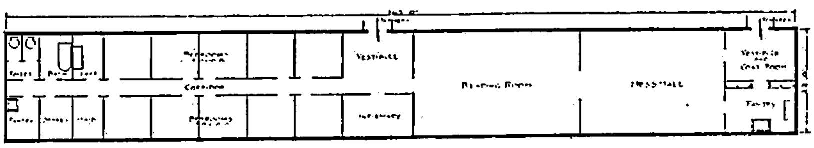
Recreation Pavilion



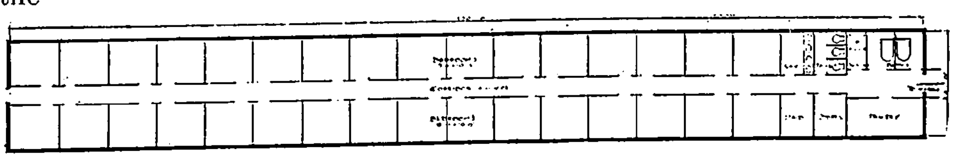
Isolation Pavilion



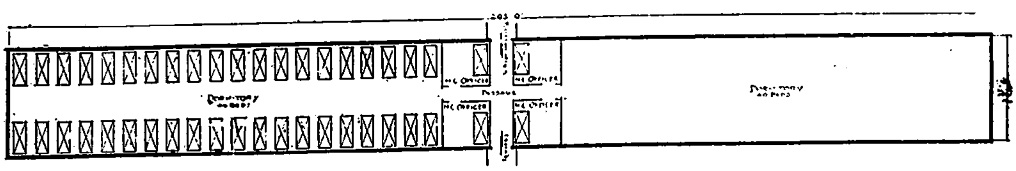
Orderlies' and Non-Commissioned Officers' Mess



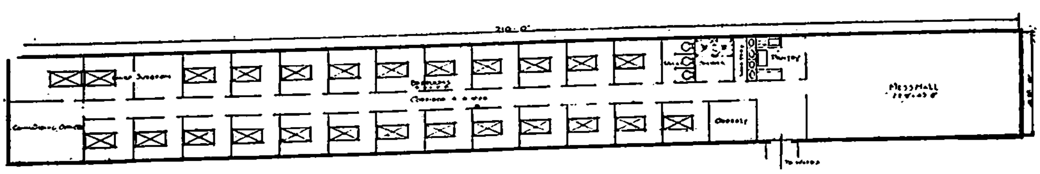
Head Nurses' and Mess Hall Pavilion



Nurses' Dormitory Pavilion



Dormitory for Orderlies and Non-Commissioned Officers



Staff Pavilion

which the beds may be wheeled in clear weather, for experience has shown that fresh air and sunlight are as good for wounded as for tubercular patients. The beds must therefore be provided with large rubber tired casters to permit easy rolling.

A large recreation building is provided, which may also serve as convalescent mess—it must be borne in mind that in the average war hospital there are many men who except for a local wound are quite well and active, who would be difficult to handle if provision were not made for their distraction in a building specially set apart for this work, usually divided into reading room and room for games.

The French authorities have solved the problem of drinking by providing a canteen, at which each convalescent patient may buy drinks to the extent of one drink per day—a simple method when there is but one source of supply. No treating is allowed.

The isolation buildings are designed merely to care for contagious cases which may develop in the hospital, until such time as they may be evacuated to the contagious hospitals.

Individual rooms or cubicles are provided for the medical staff and for the nurses, while the orderlies are grouped in dormitories.

Almost as important

as the planning of a base or field hospital is the choice of materials and type of construction, and here we have much to learn from the experience of our Allies. On the British and French fronts portable house unit type construction is employed almost to the exclusion of other types, the theory being that these buildings will pretty certainly be moved at some stage of their career; there is also the thought that the unit construction building may be of service after the war for temporary use in the regions so completely devastated in France and Belgium. Portable house construction is not used with the idea that hospitals will be taken down and re-erected in three or four hours, as some manufacturers claim for these buildings; but it does seem advisable to use a type of building which may be transported and re-erected if desired.

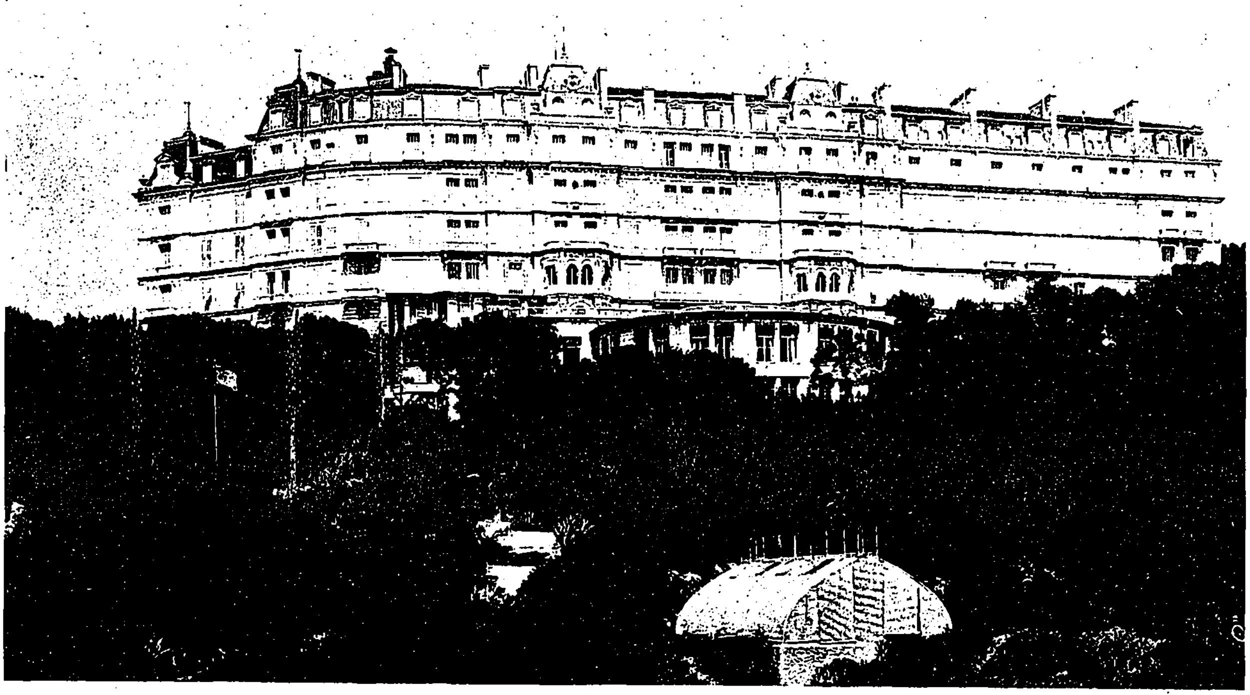
The English, French, and Belgians have all worked out types of buildings which are far superior in their practical workableness to any of our types; this is natural, in view of the fact that these countries are erecting buildings of this type not by hundreds, but by thousands, but it would be well if we could learn from their experience and avoid their mistakes. A very striking characteristic of the types used abroad is the small size of structural timbers. Europe has never had the immense timber supply which we have been for years wasting, and has always been economical; and the further fact has been realized that it was not necessary to design buildings which should have a life of a generation—on the contrary, all that was needed was a building which could last five or six years; floors are calculated not for stiffness but for strength, and all sections are reduced; one and a half by three inch floor joists, sixteen inches on centers, with span of five feet, are used in one system, and studs are two inches square.

In all of the European systems, after experimenting with single walls, the double wall with an air space has been adopted as being an absolute necessity for hospital wards.

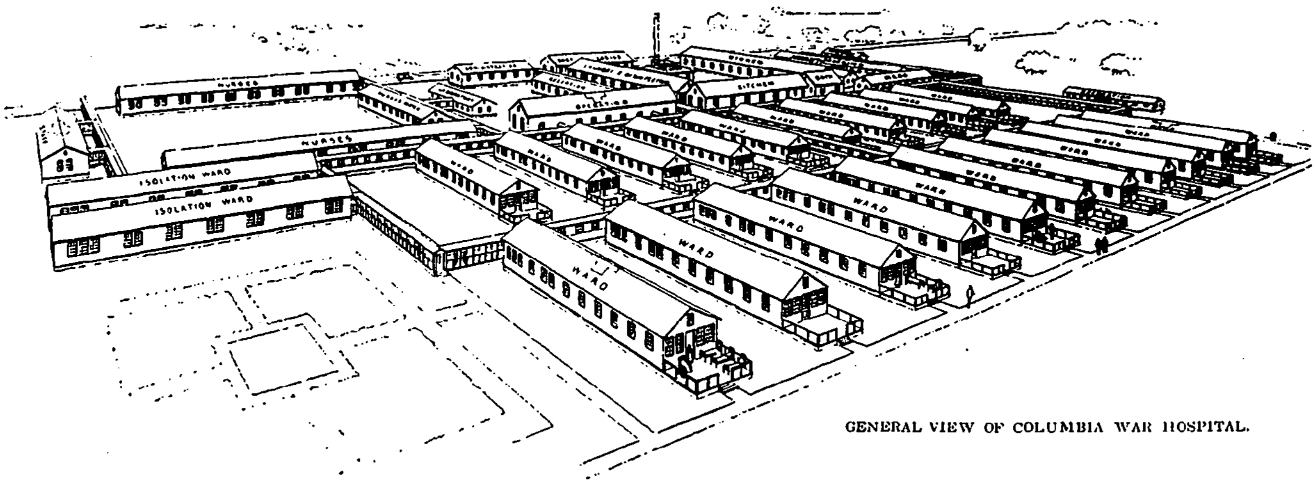
While in general these buildings are heated by stoves, in many steam heat is being installed; some have plumbing, and all electric light. A necessity for wooden buildings is an efficient layout of water supply to hydrants in ample number, for the buildings will burn quickly.

Editor's Note.—Some confusion of terms seems to exist concerning branches of war hospital work, and a brief explanation may be of service. The military units which the Red Cross is authorized by the War Department to create are base hospitals, hospital units, surgical sections, and general hospitals. The work is divided into three zones: the first being the service at the front; the second, the military base to which the wounded are brought and where, in the *base hospital*, the first complete equipment is found; the third, the home country, where military hospitals, called *general hospitals*, are created from existing civil ones. Hospital units are organized groups of physicians, nurses, etc., assigned to military hospitals or hospital trains and ships. Surgical sections are special detachments to reinforce the operating staffs in time of emergency, and consist of four surgeons, seven nurses, two orderlies, and a clerk.

The hospital units, surgical detachments, and base hospitals are movable units, each with individual equipment, and available for service wherever the government may designate.



MICHAELHAM HOME, CAP MARTIN, NEAR MENTONE, FRANCE, FOR CONVALESCENT BRITISH OFFICERS.



GENERAL VIEW OF COLUMBIA WAR HOSPITAL.

Military Hospital at Columbia University

Portable Ward Buildings of Wood With Double Walls—Complete Buildings May Be Erected by Six or Eight Men in Two Days

By Dr. F. C. Wood, Columbia University, New York.

EMERGENCIES incident upon the entry of the United States into the war have, among other things, made very evident the necessity for the design and erection of a large number of hospitals to care for the normal percentage of sick among the enlisted men in camps and also for the wounded who will be returned from France. Two types of construction have been considered: (1) a completely portable form, the so-called standard base hospital type, which can follow the movements of the troops; and (2) a type to be erected in connection with cantonments and other permanent stations, which need not, therefore, be portable. The latter has been the subject of much discussion in army circles, and various plans have been evolved. There is nothing especially novel about these non-portable buildings, however, as they follow the ordinary lines of hospital construction, except that they occasionally employ rather unusual makeshifts which would not be used in more permanent structures, such as the lining of rooms with building paper to insure their being kept at a comfortable temperature even during winter weather.

The Columbia War Hospital, which is the subject of this paper, is of the completely portable or base hospital type and accommodates five hundred patients. The design is a composite one, and is the result of a study of the methods employed on the English and French fronts. It combines the portability of the old tent hospital with many conveniences which the latter can never possess in the way of ventilation, freedom from dampness, and ability to keep the wards at a reasonable temperature even during extreme cold weather.

The first plan, as shown by the architect's sketch, called for buildings to occupy a space considerably over ten acres in extent. In order to adapt the buildings to the slightly irregular piece of land available because owned by Columbia University, some minor changes in the original arrangement were made, though the number of buildings, thirty-eight in all, remained the same.

The situation of the roadway on the south side of the property, for instance, necessitated the removal of the reception and administration buildings to a court to the south. This reversed the position of the wards so that if all the porches on the wards were made to face the south, as is the generally accepted rule in hospital construction, a very long series of corridors for the transport of food from the kitchen would be necessary. One-half the wards were, therefore, turned around so as to make the porches face the north, though they still have a complete east-and-west exposure to sunlight and receive some sun from the south owing to the low roofs of the ward buildings.

The other half of the series of wards has a southern exposure for the porches. By this arrangement the entry of food wagons directly along a single central corridor from the central kitchen to the diet kitchens in the wards was made possible. The operating room was placed on the extreme eastern end of the plot, so that it would have a central position if the hospital is extended to one thousand or one thousand five hundred beds. The garage was placed across the street so that the patients and staff would not be disturbed by the clatter of motors while these were being repaired or tested.

All patients and supplies will be received in a central court, about which are grouped the reception building, where patients are examined before admission, the building containing the offices and record rooms, and the stores and kitchen.

The reception building contains complete equipment for the disinfection of the patient's clothes on admission, facilities for removing vermin, shower baths, etc., and a series of small examining rooms for individual patients.

The general size of the buildings can be approximately estimated from the plan. The dimensions of the ward buildings are twenty-four by ninety-nine feet, with, in addition, an uncovered porch at the end measuring twenty-four by sixteen feet. The isolation wards are slightly longer, eighteen by one hundred and thirty-eight feet. The height of the wards at the eaves is about eight feet; at the peak of the roof, about fifteen feet. Ventilators will be placed in the roofs of the ward buildings if, after trial, it is found to be necessary. So far the wards have proved to be exceedingly comfortable. The operating room measures about twenty-four by one hundred and fifty feet; the kitchen, twenty-eight by one hundred and twenty feet; the laundry, twenty-eight by one hundred and seventy-four feet; the stores, twenty-eight by one hundred and seventy-six feet; and the garage, twenty by one hundred and sixteen feet.

The operating room, kitchen, laundry, and garage are built of thin sheet steel, which comes in sections and is fastened together with a simple arrangement of a yoke and key made so that it can be driven in with a hammer. The steel sheets are thin enough to permit bending by hammering if they have been deformed during transport. Each section is light enough to be handled by two men, the trusses require five or six. The foundations are concrete posts. The steel buildings were supplied by the Trussed Concrete Steel Company.

The remaining buildings are of wood. It was anticipated that the steel buildings would be exceedingly hot, so arrangement was made to have cowls in the roof; these turn with the wind on ball bearings, and as a system of ventilation have proved to be quite satisfactory; even in the hottest weather the buildings are comparatively cool, while before the installation of these ventilators they were often unbearably hot.

The wards and the other buildings are made of a double thickness of wood separated by an air space. The sections are supplied complete with the windows in place. The wooden buildings are set upon short posts, about four feet high, which come as a part of the structure, though, of course, in case of emergency, the buildings can be placed directly upon the ground. On these posts are set the girders. The joists can be seen lying within the rectangular framework. When in place these are held by bolts and nuts, the holes being already bored in the joists when they are received. Over these goes a steel yoke; and the notched floor beams are hung on these yokes. The floor, which also comes in sections, is then laid on and the erection of the walls is begun, the first few pieces being braced by nailing to them a piece of scantling which extends over to a near-by post. As soon as the end of one of the buildings is constructed, the roof girder is put in place and bolted on. This portion of the building will then stand by itself, and the further construction can be rapidly carried out.

Six or eight men can erect one of these buildings in two days, a larger number in correspondingly shorter time.

The protection of the roof is accomplished by laying over the wooden portion a layer of waterproof flexible composition roofing which can be fastened down with nails or can be held down by a board nailed to the roofing at each end.

The general waterproof character of the buildings has been sufficiently tested, as several of them have been erected and have stood through a number of heavy rain and wind storms without any discomfort to the inmates.

Each ward is planned to accommodate twenty-five patients and contains toilets and baths for the patients, a diet kitchen for the serving of meals and preparation of special foods, and a quiet room in which moribund or difficult individuals can be placed.

The drainage, in the case of this particular group of buildings, is accomplished by piping directly connected with the New York City sewers. If the buildings were to be erected at a distance from a city, of course, a special sewage system would have to be constructed. Owing to the availability of electric current, also, the buildings have been wired for electricity; some different scheme would be necessary if current could not be obtained.

The laundry machinery is supplied with direct-drive motors, and the steam used is furnished from a small auxiliary portable boiler. If electricity were not available, a separate power plant would have to be installed to furnish the necessary current. In France and Belgium the base hospitals have usually been placed where current can be obtained.

The method of heating the buildings has not been finally decided upon. The army has been in the habit of using small stoves which can be fed with wood and are very satisfactory. As it is not intended that the plant under consideration shall be moved during the period of the war, it is probable that steam heat will be laid on in the buildings, with the exception of the kitchen and laundry, which are sufficiently heated by the ranges, hot water heaters, and steam pipes.

A portable ice machine which can be towed by a traction engine furnishes sufficient ice for five hundred patients and the necessary personnel, and supplies cooling coils to three portable ice-boxes in the kitchen.

The cost of one of the wooden ward buildings, including the painting, plumbing, electric wiring, and terracing, is approximately $3,300; the cost of the operating room building, which is of steel ceiled with wood, and including the electric light, plumbing, concrete floor, painting, etc., is approximately $8,000, with an additional $400 for metal skylights and ventilators.

The total cost of the plant for five hundred patients, with water, light, and gas connections, painting, fencing, and grading, will not exceed $250,000. The equipment will cost about $20,000 more. A steam heating plant and the necessary plumbing and extras will possibly bring the total to something under $300,000, thus producing a hospital at a cost of about $600 per bed.

The life of the wooden buildings is estimated to be at least five years in good condition. The removal of the buildings to another site has been computed to result in a loss of about three per cent., this loss being chiefly allotted to the waterproof composition roofing and the concrete floors which have been placed in the operating room, the kitchen, laundry, and garage, in compliance with the rules of the fire underwriters controlling structures within the limits of New York City. In the field, wooden floors would be used instead. The steel buildings have, if properly cared for, an indefinite life.

The time required for the erection of the buildings, if sufficient labor is available and all the material can be delivered at once, would probably not be over three weeks, and with a very large force of trained mechanics could be reduced to less.

While the general plan of the buildings has been approved by the War Department for its base hospitals, it is possible that the experience gained in handling and working in these structures will be useful, also, from a civilian point of view as showing what can be accomplished in the way of rapid erection of hospital buildings in case of an extensive epidemic or in connection with the undertaking of large engineering enterprises, such as the building of canals, dams, or similar public works, away from large centers of population.

INSTALLING WARM AIR HEATING

At a special meeting of the National Warm Air Heating and Ventilating Association, held recently, a code was adopted to regulate the installation of warm air furnaces. The various points covered in the code are: meaning of the term warm air heating plant; certified heating contractors; permits; concealing pipes or register boxes; round basement pipes; smoke pipes; stack and registers; cold air ducts; provision for register boxes and stacks; rules for estimating warm air pipe requirements; and furnace casings. The section containing rules for estimating warm air pipe requirement, has the following to say regarding such requirements for seventy deg. F.:

"In no case shall warm-air pipes, extending from furnace be less than eight inches in diameter. To find the area of warm-air pipes leading from furnaces through which heat is to be distributed to building or rooms contained therein, requiring the maintenance of a temperature of seventy deg. F., with the outside temperature at zero, the following rules are to be used:

"To the area of outside doors and windows expressed in square feet, multiply the result thus obtained by seventy-five. To the result thus obtained add an amount equal to the total cubical contents of the building or room as expressed in cubic feet; divide the result thus found by eighty. The result thus obtained will equal the sectional area of the warm-air pipes expressed in square inches."

The following suggestions for improving furnace heating work were made:

1. Set furnaces low and have a good pitch to leaders.
2. Insist upon larger wall stacks to upper rooms.
3. Insist upon fully enclosed metal return ducts, and eliminate the duct formed by rough floor joists and wall studding.
4. Urge an ample fresh air connection to the return system in every furnace job.
5. Insist upon vent ducts through warm walls from bath room and kitchen to attic, with no returns.
6. Develop humidifying furnace attachments.
7. And *most important of all,* each manufacturer should have follow-up system on each furnace sold, so as to learn if it has been installed to the satisfaction of the purchaser. This would eventually run out the sham furnace dealer, who thinks only of his income, and nothing of the reputation of the manufactured product he handles.

A cold storage plant will probably cost twenty-five per cent. more this year than it did last, but it is worth one hundred per cent. more. The goods going into cold storage are higher in cost and are worthy of better protection. In other words, the earning capacity of a cold storage plant is much higher in proportion than the increased cost of the plant itself. With present high prices for food products it is little short of business suicide to try and get along without the best of cold storage facilities where food products of an extremely perishable nature are handled. The actual loss from spoiling will often pay for a cold storage plant in a single season.

Building Costs of Twenty-Two Hospitals

Data Giving Segregated Costs of the Construction of a Group of Hospitals, in an Address by Oliver H. Bartine before the American Hospital Association

It is clearly demonstrated that the degree of efficiency with which the building serves its purpose and is made comfortable and convenient depends most largely upon the character and completeness of its mechanical equipment. Quite as important also is the fact that the heaviest of the operating expenses of the hospital are those connected with the heating and power plant, and the extraordinary repairs and replacements necessary there.

Regardless of the differing views as to the status of artificial ventilation as applied to the hospital, there can be no disputing the fact that the heating plant of the hospital is the most important department. Provision must be made for the heating of the entire building and for a source of steam for laundry, kitchen and sterilizing work. Further, there should be thorough means of ventilating all toilets, kitchens (including diet kitchens), laundry and many other service rooms. It is believed that the consensus of the best opinion also requires that there should be provided exhaust ventilation for all large wards, and in case of hospitals built in congested districts in the cities a supply of fresh air by means of an artificial ventilating system is also desirable.

A great deal is said of the success of natural ventilation, but it may be questioned whether the exponents of such a method of ventilation give proper consideration to the nuisance caused by open windows because of dust and noise, and to the effect of the dry air resulting from natural ventilation, as well as to the difficulty of controlling this method of ventilation.

Serious objections may be offered to any detail of the heating and ventilating equipment which is so arranged as to prevent thorough cleaning of all parts. To this end the hospital type of radiators should be used, these being constructed with an enlarged space between the radiator sections, and the radiators should be suspended from the walls with a space of not less than three inches, and preferably four inches, at the back of the radiators, and not less than five inches between the bottom of the radiators and the floor.

The ventilating grills should be so installed that they may be removed or be readily opened to permit of cleaning of the backs of the grills and the connecting ducts.

The question of the advisability of the installation of an electric power plant depends only upon the size of the hospital. Wherever fire room service for twenty-four hours is necessary and boilers of 100 H.P. capacity or greater are required, there can be little doubt as to the advisability of installing an electric power plant. In practically all hospitals steam at sixty pounds pressure is required for sterilizing purposes and also for laundry purposes. Steam also is required for cooking purposes at forty pounds pressure. The piping system for the sterilizing and laundry work may be combined, but the cooking apparatus should be provided with a separate system of piping, while the heating is connected with still another separate system of piping. Thus the steam must be generated originally at sixty pounds pressure for cooking and to approximately two and a half pounds pressure for heating purposes. It is just as easy and quite as economical to generate steam at eighty to one hundred pounds, or even one hundred and twenty-five pounds pressure, for the operation of engines for driving electric generators.

In the summer, when heat is not required, a considerable proportion of the exhaust steam

TABLE NO. 1a. COST DATA —HOSPITAL BUILDINGS

Building.	Cubiture of building.	No. of patients.	Cu ft. per patient.	Total cost of building. Total.	Per cu. ft.	Per patient.	Cost of heat. & vent. Total.	Per cu. ft.	Per patient.	Cost of electric system. Total.	Per cu. ft.	Cost of electric system. Per patient.	Per outlet.	Cost of electric fixtures. Total.	Per cu. ft.	Per patient.	Per fixture.	Cost of plumbing system. Total.	Per cu. ft.	Per patient.	Per fixture.	Cost of refrig. plant, incl. boxes. Total.	Per cu. ft.	Per patient.
1	2,096,000	225	9,320	$897,166	$0.428	$3,987.00	$86,461	$0.04	$384.00	$26,399	$0.012	$111.00	$16.50	$7,971	$0.003	$35.40	$7.00	$61,789	$0.029	$274.00	$226.40	$17,308	$0.008	$77.00
2	1,919,287	181	10,603	610,000	0.317	3,370.70	55,500	0.029	306.70	15,920	0.008	88.00	....	3,250	0.002	18.00	...	45,800	0.023	253.04	....	16,900	0.008	93.92
3	1,687,000	152	11,098	525,000	0.311	3,453.94	41,660	0.025	272.00	12,962	0.007	85.00	7.35	5,000	0.003	32.89	6.39	37,500	0.022	246.05	143.70	13,700	0.008	90.13
4	3,338,000	500	6,676	851,000	0.255	1,702.00	104,705	0.031	209.40	31,729	0.009	63.46	....	9,772	0.003	19.54	...	55,332	0.013	110.60	....	25,947	0.008	51.88
5	4,230,103	450	9,40[illegible]	1,736,739	0.41	3,815.00	141,137	0.033	313.60	27,632	0.006	61.40	8.00	10,000	0.002	22.22	5.80	109,664	0.026	243.70	165.65	37,722	0.009	83.82
6	1,343,815	150	8,958	516,733	0.384	3,445.00	48,595	0.036	324.00	....	....	....	....	3,575	0.002	24.83	...	32,600	0.024	217.33	150.00	.....	....	....
7	756,355	150	5,042	251,081	0.332	1,606.00	26,452	0.035	175.00	9,594	0.013	63.90	10.90	2,180	0.003	14.10	6.00	23,000	0.03	153.00	[illegible]	5,300	0.007	35.50
8	1,406,400	232	6,062	531,954	0.40	2,720.00	....	....	....	3,000	0.002	14.90	....	....	....	....	...	....	....	....	....	.....	....	....
9	508,375	70	7,262	214,164	0.44	3,061.00	10,855	0.018	155.20	....	....	....	....	....	....	....	...	....	....	....	....	3,368	0.007	48.10
10	1,327,413	179	7,416	679,182	0.51	3,800.00	82,887	0.06	460.00	26,886	0.02	149.00	13.00	6,561	0.005	36.00	6.32	65,265	0.05	362.50	253.00	21,211	0.01	118.00
11	905,800	250	3,623	599,220	0.44	1,600.00	46,000	0.05	184.00	7,600	0.008	34.00	....	....	....	....	...	17,000	0.019	68.00	....	.....	....	....
12	249,700	85	2,937	87,367	0.35	1,027.85	5,688	0.022	67.00	1,700	0.007	20.00	....	....	....	....	...	6,200	0.025	73.00	....	443	0.002	5.21
13	210,300	—	—	74,945	0.35	—	4,600	0.022	—	2,500	0.011	—	....	....	....	—	...	2,525	0.012	—	....	.....	....	—
14	1,718,010	410	4,190	686,754	0.40	1,675.00	70,000	0.04	170.30	8,700	0.005	21.22	....	3,640	0.002	9.00	...	51,439	0.03	125.45	....	.....	....	....
15	1,877,931	350	5,337	789,795	0.42	2,256.60	52,180	0.028	150.00	49,501	0.024	141.50	....	9,750	0.005	28.00	...	72,840	0.04	208.11	....	40,000	0.021	114.30
16	927,415	—	—	500,876	0.51	—	57,500	0.06	—	6,800	0.007	—	....	1,744	0.002	—	...	85,000	0.09	—	....	62,000	0.066	—
17	534,150	—	—	394,000	0.73	—	*....	....	—	1,100	0.002	—	....	....	....	....	...	10,000	0.018	—	....	.....	....	....
18	1,967,762	407	4,834	758,404	0.39	1,863.40	63,125	0.039	155.08	14,366	0.007	35.30	....	4,000	0.002	9.82	...	62,650	0.032	154.00	....	6,882	0.003	17.01
19	3,768,282	303	12,440	1,366,780	0.36	4,510.80	137,000	0.037	452.14	20,875	0.006	68.72	....	6,823	0.002	22.51	...	111,200	0.03	363.70	....	58,250	0.017	192.24
20	777,308	150	5,182	257,761	0.33	1,718.40	20,611	0.026	137.40	9,000	0.011	60.00	....	....	....	....	...	20,900	0.02	179.33	....	3,500	0.004	23.33
21	367,200	110	3,340	146,521	0.40	1,332.00	3,000	0.008	27.27	3,200	0.009	29.09	....	2,540	0.007	23.09	...	12,197	0.038	110.90	....	.....	....	....
22	3,704,287	220	16,837	1,134,974	0.30	5,159.00	115,989	0.031	527.22	19,984	0.006	90.83	....	5,938	0.002	27.00	...	102,614	0.019	467.00	....	7,433	0.002	33.80
Avrge. cost p'r cu. ft.	......	...	....	......	0.382	....	....	0.033	....	....	0.009	....	....	....	0.003	....	...	....	0.029	....	....	.....	0.012	....

*In power plant.

may be utilized for heating water for laundry purposes, for heating driers and for other purposes.

In many such plants the electric current is being made at a cost of one cent per K.W.H., and one of our largest New York hospitals made their electric current for $\frac{5}{8}$c. per K.W.H. In another of our New York hospitals an installation costing $17,000, and including electric power plant and refrigerating plant, resulted in a saving of $7,100 annually

A great deal has been written concerning the cost of hospital buildings. Any statement of cost based upon the cost per bed may be misleading to the trustees, superintendent and others. For instance, a hospital caring for a special class of patients requiring extra rooms and special equipment cost $4,000 per bed. If the same building had been planned as a general hospital beds could have been placed in the special extra rooms mentioned, thus increasing the bed capacity of the building to such an extent that the cost of the building would not have exceeded $3,000 per bed. This hospital has special employees for special purposes and rooms, but perhaps not as many as would be required to care for the extra number of patients which might have been accommodated in the special rooms, but even after making liberal allowances for these conditions it is found that this hospital would not have cost over $3,300 per bed if used as a general hospital instead of $4,000 per bed, as it actually cost, based upon the number of patients accommodated.

After making a careful study of this matter of costs the author has come to the conclusion that a better basis of determining the cost of the hospital building is the cost per cubic foot. In determining the number of cubic feet of the hospital, measurements should be taken from the basement or sub-basement (lowest floor level to the mean of the outside of the roof, and from outside to outside of walls. In other words, the cubic feet of air displaced by the exterior dimensions of the building should be considered, eliminating approaches, balustrades and all other projections not enclosing space.

It is true that it is quite possible to be wasteful in space, so that the cubic feet of space per patient may also well be given consideration.

In table No. 1 are presented segregated costs of the construction of twenty-two hospitals and hospital buildings. In the case of hospital No. 22 the cost per patient is shown to be $5,159, which is very high, while the cost per cubic foot is shown to be 30 cents, and this is very low.

It has been stated that no hospital building should cost in excess of 30 cents per cubic foot, but it will be observed by reference to this table that rarely is a general hospital built at such a low cost. The fact of the matter is that local conditions, the character of the hospital and its work, and the elaborateness of the structure must all be carefully considered in determining the price per cubic foot. Eliminating No. 17 (which is a boiler house), the cost per cubic foot of all of the hospitals listed averages .382 cent. The cost of the heating and ventilating equipment per cubic foot averages .033 cent (after eliminating No. 9, which included no boiler plant).

The cost of the electric system averages 1 cent per cubic foot; electric fixtures average .003 cent per cubic foot; plumbing averages .029 cent per cubic foot (omitting No. 16, which is a laundry building); refrigerating plants average .012 cent per cubic foot; vacuum cleaner systems .002 cent per cubic foot; elevators .007 cent per cubic foot; laundry equipment (excluding Nos. 13 and 16, which are purely laundry buildings) .004 cent per cubic foot; kitchen equipment .004 cent per cubic foot; power plants average .005 cent per cubic foot. Thus the construction of the building (exclusive of its fixed equipment) averages .273 cent per cubic foot, as shown by this list.

Table No. 2 gives a segregated statement of the cost of hospital buildings exclusive of equipment, in the case of thirteen hospitals.

In the case of certain items, as masonry, the cost per cubic foot corresponds very closely in the case of practically all of the hospitals listed.

TABLE 1b. COST DATA—HOSPITAL BUILDINGS

Building.	Cost of vac. cl. syst. Total.	Per cu. ft.	Per patient.	Cost of elevators. Total.	Per cu. ft.	Per patient.	Cost of laundry equipt. Total.	Per cu. ft.	Per patient.	Cost of kitchen equipt. Total.	Per cu. ft.	Per patient.
1....	—	—	—	$22,225	$0.016	$99.00	$9,729	$0.004	$43.20	$3,239	$0.001	$14.30
2....	$1,900	$0.001	$10.49	11,200	0.006	61.80	6,320	0.003	34.90	6,475	0.003	36.00
3....	—	—	—	3,360	0.002	22.10	5,956	0.004	39.11	4,000	0.003	26.32
4....	—	—	—	22,475	0.007	44.95	11,707	0.003	23.41	—	—	—
5....	2,603	0.006	5.70	32,280	0.008	71.73	20,713	0.005	46.00	13,802	0.003	30.70
6....	....	....	....	16,515	0.012	110.00	5,298	0.004	35.32	4,118	0.003	27.45
7....	....	....	....	2,450	0.003	16.30	3,575	0.005	24.00	....	....	....
8....	....	....	....	.....	....	....	4,954	0.004	21.40	9,000	0.006	39.00
9....	—	—	—	.....	....	....	—	—	—	....	....	....
10....	—	—	—	16,100	0.013	90.00	—	—	—	6,900	0.005	38.33
11....	....	....	....	8,000	0.009	32.00	....	....	....	....	....	....
12....	....	....	....	1,115	0.005	13.00	....	....	....	....	....	....
13....	—	—	—	.....	....	—	16,000	0.08	—	—	—	—
14....	5,575	0.003	13.60	6,200	0.005	15.12	....	....	....	....	....	....
15....	5,985	0.003	17.10	19,000	0.01	54.28	....	....	....	....	....	....
16....	2,400	0.002	—	8,000	0.009	—	53,382	0.059	—	—	—	—
17....	—	—	—	1,500	0.003	—	—	—	—	—	—	—
18....	3,625	0.002	9.00	7,625	0.004	18.73	....	....	....	....	....	....
19....	....	....	....	16,500	0.005	54.45	....	....	....	....	....	....
20....	4,500	0.005	30.00	9,000	0.01	60.00	....	....	....	....	....	....
21....	....	....	....	2,700	0.008	24.54	....	....	....	2,500	0.007	22.72
22....	....	....	....	5,855	0.0016	26.61	15,601	0.005	709.13	8,000	0.002	36.66
Avrge. cost p'r cu. ft..	....	0.0023	....	.....	0.007	....	....	0.017	....	....	0.0037	....

Building.	Cost of power plant. Total.	Per cu. ft.	Per patient.	Per K.W.	Percentage contracts bear to total cost of building. Building.	Heat. & vent.	Electric.	E. fixtures.	Pl'bing.	Refrig.	Vac. cl'n.	Elevators.	Laundry.	Kitc'n.	Power plant.
1....	$15,000	$0.007	$66.66	$75.00	72.2	6.9	2.9	0.9	6.9	1.9	—	2.5	1.1	0.4	1.6
2....	7,400	0.004	40.90	30.00[2]	73.4	8.1	2.6	0.5	7.5	2.8	0.3	1.8	1.0	1.0	1.0
3....	7,078	0.004	46.50	70.78	75.2	7.9	2.5	0.9	7.1	2.6	—	0.64	1.1	0.76	1.3
4....	15,440	0.005	30.88	44.11[1]	67.1	12.3	3.7	1.1	6.5	3.5	—	2.6	1.4	—[1]	1.8
5....	21,570	0.005	17.90	95.86	74.26	8.1	1.8	0.6	6.4	2.1	0.15	2.6	1.4	0.79	1.8
6....	.....	....	....	....	...	9.4	0.6	..	6.3	..	..	3.2	1.2	0.8	..
7....	4,530	0.006	30.00	75.00	...	10.2	4.6	0.8	9.2	2.1	..	1.0	1.4	..	2.0
8....	—	—	—	—	...	...	0.6	..	..	..	..	..	0.9	1.6	—
9....	14,176	0.028	202.50	141.00[2]	...	5.0	...	..	.	1.5	—	..	—	..	6.6[1]
10....	.....	....	....	....	...	12.0	4.0	1.0	9.6	3.1	—	2.4	—	1.1	..
11....	.....	....	....	....	...	11.8	2.0	..	4.6	.	..	2.0	..	..	..
12....	.....	....	....	....	...	6.9	2.0	..	7.0	0.5	..	1.3	..	..	..
13....	—	—	—	—	...	6.1	3.3	.	3.4	—	—	—	21.3	—	—
14....	.....	....	....	....	...	10.2	1.3	0.6	7.5	..	0.8	0.9	..	..	..
15....	†.....	....	....	....	...	6.6	6.02	1.3	9.3	5.8	0.8	2.5	..	..	..
16....	—	—	—	—	...	11.5	1.3	0.3	16.0	12.3	0.4	1.6	10.6	..	..
17....	161,500	0.302	—	....	...	...	0.3	..	3.0	..	..	0.5	..	..	41.0
18....	.....	....	....	....	...	8.4	1.9	0.5	8.3	0.9	0.5	1.0	..	..	..
19....	.....	....	....	....	...	10.0	1.6	0.5	8.9	4.3	..	1.2	..	..	..
20....	.....	....	....	....	...	8.0	3.5	..	8.0	1.3	1.7	3.5	..	..	..
21....	.....	....	....	....	...	2.0	2.0	1.9	8.0	..	..	2.0	..	2.0	..
22....	66,000	0.018	300.00	....	...	10.2	1.7	0.4	9.0	0.6	..	0.5	1.4	0.7	6.0
Avrge. cost p'r cu. ft..	.....	0.047	....	....	72.44	7.2	2.4	8.0	7.6	2.9	0.80	1.76	3.9	1.01	7.0

[1]Provides capacity for several other buildings. [2]No piping included. [3]Large amount of piping involved.

†In electric system.

CEMENT PAINT PROTECTS STEEL

It is generally conceded that steel embedded in concrete will not rust so long as the concrete is free from voids. In the trials that were carried out a number of steel rods were painted, some with red lead, others with boiled linseed oil, some with neat Portland cement, and a few were not treated in any way. The painted rods were allowed to dry in the shade for one week, and then all were embedded five inches deep in concrete. After a time the specimens were tested in an Olsen machine by pulling the steel rods out of the concrete, and, although the adhesion of the uncoated rods was perfectly satisfactory, it was found to be still better in the case of the rods painted with cement. During the experiments the best results were obtained when the cement setting was maintained repeatedly for several days, either by rain, dew, or by an artificial spray of water. In the first two or three days the coating can be rubbed off easily, but after that it adheres firmly to the steel. The adhesion is increased about thirty-five per cent. by a coating of neat cement. To determine the cost of applying a coating of cement to structural steel, one pound of Portland cement was mixed with two-thirds pound of water. This quantity was found sufficient to cover seventy square feet one coat, and, consequently, the expense, other than labour, was very trifling.

COST DATA OF HOSPITAL BUILDINGS

BUILDING		1	2	3	4	5	6	7	8	9	10	11	12	13		AVERAGE COST PER CU.FT.
CUBITURE OF B'LD'G		905,800	249,700	210,300	1,327,413	1,718,010	1,877,931	327,415	534,150	1,967,762	3,768,282	777,508	367,200	2,096,000		
COST OF CONSTRUCT'N		320,620	72,221	49,320	441,682	541,214	540,539	224,050	219,900	594,131	1,016,132	190,250	120,384	647,045		
COST OF MECH. EQUIP'NT		78,600	15,146	25,625	237,500	145,540	249,256	276,826	174,100	164,273	550,648	67,511	26,187	250,121		
TOTAL COST OF B'LD'G		399,220	87,367	74,945	673,182	686,754	789,795	500,876	394,000	758,404	1,566,780	257,761	146,521	897,166		
EXCAVATION	TOTAL	22,220	1,110	2,500	28,541	33,000	40,000	40,000	33,600	79,750	138,000	5,000	4,917	50,893		
	PER CU. FT.	.024	.004	.011	.025	.019	.021	.043	.063	.041	.036	.007	.013	.025		.026
MASONRY	TOTAL	111,700	25,216	23,420	175,303	260,950	196,760	91,050	105,900	249,147	417,095	71,650	53,654	222,878		
	PER CU. FT.	.12	.10	.11	.132	.152	.105	.098	.198	.127	.111	.092	.146	.12		.124
STRUCTUR'L STEEL & IRON	TOTAL	55,450	11,500	9,500	59,958	66,000	90,414	35,000	37,500	71,738	115,750	33,100	17,000	80,648		
	PER CU. FT.	.06	.03	.04	..045	.038	.048	.038	.070	.036	.031	.043	.046	.04		045
CARPENTRY	TOTAL	20,400	7,400	6,500	46,348	58,500	60,000	22,000	5,800	65,535	61,000	19,025	12,000	71,226		
	PER CU. FT.	.022	.03	.03	.035	.032	.032	.024	.018	.033	.016	.024	.033	.035		.028
ROOFING	TOTAL	18,000	5,800	3,000	9,700	9,319	48,365	8,100	9,500	13,823	41,687	In Steel & Iron	8,967	23,080		
	PER CU. FT.	.02	.02	.014	.007	.005	.026	.009	.018	.007	011	—	.024	.011		.010
GLASS & GLAZING	TOTAL	In Carpentry			In Carpentry	In Carpentry	In Carpentry		In Carpentry		36,000	1,000	400	6,202		
	PER CU. FT.	—			—	—	—		—		.0095	.001	.001	.003		.0036
SKYLIGHTS & SHEET METAL	TOTAL	In Roofing			In Roofing	In Roofing	In Roofing		In Roofing	In Roofing	In Roofing	8,525	In Roofing	In Roofing.		
	PER CU. FT.	—			—	—	—		—	—	—	.011	—	—		.011
PAINTING	TOTAL	5,000	1,095	950	In Carpentry	4,250	In Carpentry		In Carpentry	3,564	In Carpentry	In Carpentry	5,000	26,478		
	PER CU. FT.	.005	.005	.004	—	.002	—		—	.002	—	—	.014	.013		.006
LATHING & PLASTERING	TOTAL	10,000	2,660	1,750	16,509	22,800	20,000	6,000	400	20,225	37,500	15,000	10,060	41,237		
	PER CU. FT.	.01	.017	.008	.012	.013	.011	.007	.0008	.01	.01	.009	.027	.026		.0123
COMPOSITION FLOORING	TOTAL				13,103	20,000	14,000		5,000		29,000	3,750	In Masonry	8,106		
	PER CU. FT.				.01	.015	.008		.009		.008	.002	—	.004		.008
TILES, MOSAICS & MARBLE	TOTAL	46,000	17,000	1,200		18,200	31,000	1,500	800	41,260	65,600	11,000	2,886	63,029		
	PER CU. FT.	.05	.07	.006		.016	.017	.0016	.0015	.021	.0174	.014	.008	.031		.0211
HARDWARE	TOTAL	4,850	440	In Carpentry	In Carpentry	4,100	5,000	400	400	5,125	9,500	2,200	In Roofing	9,080		
	PER CU. FT.	.005	.002	—	—	.002	.003	.0004	.0008	.0026	.025	.0028	—	.004		.005
CAST IRON	TOTAL	27,000	In Steel & Iron	In Steel & Iron	30,000	49;095	35,000	20,000	21,500	44,210	35,000	19,000	5,500	44,189		
	PER CU. FT.	.03	—	—	.023	.023	.019	.022	.04	.022	.009	.024	.015	.022		.022
BRONZE & BRASS WORK	TOTAL															
	PER CU. FT.															
TOTAL COST PER CU. FT.		.44	.35	.35	.51	.40	.42	.51	.75	.39	.36	.33	.40	.428		.432

Canada's Selling Problem After The War

A New Viewpoint of Salesmanship Presented in a Thoughtful Address Delivered by Mr. George A. Simpson, Sales Manager of the Steel Company of Canada, at a Recent Convention of the Sales Staff of that Large Organization

WE have been and are passing through a period, the like of which does not appear in history, and through this abnormal condition, a prosperity that is, in my judgment, spotted, has sprung up all over the North American continent, and it will come to a temporary end directly the war terminates; in fact, I anticipate a decided change the moment there is any definite indication of peace.

The abnormal conditions produced by the war have also created abnormal conditions in every line of industry, and, in consequence, the producers of all kinds of material, especially iron and steel products, have increased their output to an enormous and alarming extent. This applies, not only to Canada, but also to the United States. Practically every blast furnace on the continent to-day is in operation, and to take care of the increased tonnage of finished product that this abnormal condition demands, our producing capacity has been largely increased, consequently when conditions again assume their proper shape we will be confronted with a competitive condition such as the world has never seen before, and this condition will, in a sense, bring into effect the law of the survival of the fittest. Competition, in my judgment, will be fierce, and, in consequence, the burden will fall on the shoulders of the salesmen.

GEORGE A. SIMPSON.

Before becoming Sales Manager of the Steel Company of Canada, Mr. Simpson had an extended experience in the steel industry, learning the trade in England and moving to Pittsburgh in 1886. His most recent United States connection was as special representative of the Berger Company, Canton, Ohio.

After the war the business that expects to succeed will have to be safeguarded by active, alert, attentive, vigilant men—men of big vision, men who realize that while there can be only one captain of the ship, there is captain-material in the crew, and as such they must be recognized. The order of the day will be: systematic organization, so adjusted as to permit of aggressive, intensified action, all moving in harmony with a determined purpose toward a definite end. The day of the "One Man Business" is gone; just as sure as the day of intoxicated salesmen has passed into the discard. Business to-day is too big for any one man to personally direct, and where any man aspires to be "IT" in an organization, that business will only expand or succeed to the extent of his vision, and, in consequence, if he persists the progress will be arrested in proportion to his ability to direct. The expansion and growth of the business will be retarded. Therefore, the burden of successful business must fall on many shoulders, and the salesman worthy of the name will be recognized and in great demand.

PRODUCTION FACILITIES GREATLY INCREASED.

It will not be a question of production, as it has been during the past two years; it will be a question of selling the production we are able to produce, and this, in my judgment, is going to be a very serious problem. Every producer of iron and steel products all over this continent has increased his output to such an extent that the market will be flooded with material. To make this argument more specific, we need only refer to our own facilities, which, at the outbreak of the war, were such that we had a certain melting capacity of open hearth steel. This we have increased, until to-day we have facilities to produce more than double the amount, and so all along the line, as a result of the terrific demand on our manufacturing facilities, our output has been speeded up to a greatly increased extent, in consequence of which we will have a very large volume of iron and steel products to sell.

With this condition confronting us, the thought uppermost in my mind is, how we shall best prepare ourselves to successfully cope with it, and I have concluded that considerable work and preparation is necessary for each and every one of us. In past years we have heard a great deal about "getting the name on the dotted line," which, of course, as you all know, means the closing of a Contract of Sale. While this expression has been made in the spirit of enthusiasm—all of which I recognize is a determining factor in salesmanship, as there has been nothing of any consequence accomplished without enthusiasm—yet, nevertheless, the advice to get the name on the dotted line is merely an expression and an empty phrasing of words, unless it is accompanied with some common-sense suggestion as to how to prepare ourselves to bring about this much-desired objective. "Getting the name on the dotted line" is usually the final operation. In other words, it is merely the approval with our signature of the transaction which has been concluded, and, in consequence, the importance does not lie in getting the name on the dotted line as much as it does in the manner in which we conduct the transaction, as you will readily see from this argument, that the name would never be put on the dotted line unless the transaction had been conducted in a thorough manner and to a successful end. In other words, it should not be necessary for a salesman to urge or use any mysterious tactics, or enthusiastic efforts to get the buyer's name on the dotted line; but, to the contrary, he should so present his argument and create in the mind of the buyer such an intent desire to purchase that which the salesman has to sell that the buyer would really be more anxious to get his name on the dotted line than the salesman would be to have him put it there.

CREATING DESIRE FOR PRODUCTS.

It seems to me that salesmen should fully appreciate the fact that it takes two to make a transaction, and that it is just as necessary for the buyer to purchase the material the salesman has to sell as it is for the salesman to sell it; in fact, he could not run his business without the material, consequently, isn't it reasonable to suppose that if you represent a high class organization who manufacture their products with the thought of quality uppermost in their mind, and whose very foundations are built on quality and service, fully understanding and appreciating the definitions of these two words, a purchasing agent, representing a company who desires the best products than can be purchased, will want to have his name on the dotted line of that company's contract? It seems to me that it is the salesman's mission to so represent the company he works for, and so place before the buyer the articles he has to sell, as to create a desire on the part of the purchaser to want to do business with the company the salesman represents.

There are a number of manufacturing concerns in different parts of the world who have brought their business up to this very desirable condition, and it is considered a badge of honor or compliment to the good standing of a company when they can state they buy from such a concern. The salesmen who represent such concerns are imbued with the spirit of the organization of which they are a part, and, in consequence, they convey and impart that feeling to the man they are trying to interest. And in proportion to their sincerity of purpose and their belief in the statements they make do they impress and convince and create in the mind of the buyer a desire to do business with them.

COMMERCE IS HUMAN SERVICE.

Commerce is no longer exploitation—it is human service; and no business concern or body of men can succeed or exist permanently whose efforts do not meet a human need and add to human happiness, as we succeed only through the good-will and good wish of the people we serve. "Quality" and "Service" to-day correspond with the word "Sterling" on silver, and happiness is the true end and aim of life, the result of all that is truly right and sane. Therefore, it is not to urge your getting the name on the dotted line that I propose to touch on, but to try and put forward what, in my judgment, is necessary for a salesman to understand in order to carry the transaction to a successful issue.

The subject of "salesmanship" is one that has been discussed from all angles. We have heard a hundred different views from a hundred different people on the one subject, and I am free to admit that but very few of them analyze the subject to the point of rendering a service to the salesman who hears the discourse. In other words, they deal with the subject in the abstract rather than in the concrete. In my judgment, what a salesman ought to know and understand should relate to the underlying principles pertaining to salesmanship; that is, he should be familiar with the principles which would enable him to take care of all the preliminaries necessary to bringing the transaction up to the point of getting the name on the dotted line. The question of selling is one that requires a great deal of thought, and for any man to become proficient in this science it is as necessary for him to study all the elements that enter into his success as it is for a surgeon, doctor or lawyer, or any other professional man, to make a study of his profession before he becomes recognized. I know of no calling in which it seems to be understood that anyone without training may enter, other than the field of sales. It seems to be accepted in a general way that the constituent parts of a salesman are: ability to talk—irrespective of whether he says anything—to dress well, carry a good-looking grip, and last, but not least, he is always expected to be loaded up and able to tell the latest joke and relate a funny story. This, of course, is looking at salesmanship from a ridiculous standpoint, but it is really the viewpoint from which it is seen by a great number of people.

BORN INTO THE PROFESSION?

We have also heard that salesmen are born; and "a born salesman" is a common expression. I am free to admit there are a number of salesmen who were born with certain faculties essential to successful salesmanship, a little more pronounced than in others, in whom some other faculty is more pronounced, but that a man cannot be trained to become a good salesman—if he will give the right amount of study and desires to be successful in that line—is sheer nonsense. We may just as well say that all men who follow certain professions are born into those professions, or born with certain faculties especially fitted for those professions. In my judgment this is wrong, and I maintain that any young man, endowed with commonsense, fair personality, good health and the love of work fairly pronounced, can, with the right amount of study, become a successful salesman. The truth, as always, lies between the two extremes. There is no salesman so born to his duties that he can dispense with a knowledge of the goods he sells, or so independent of experience that practice teaches him nothing he did not know. You should know what you want to do, then hold the thought firmly, and do every day what should be done, and every sunset will see you that much nearer to the goal. Now the question is: "What should he study, and how can he prepare himself?"

Last year I embodied in my discourse the science of thought and the law of attraction, both of which I know are essential factors in the success of a salesman. I will now touch on another vital element, which we will call Personality. There is something about one's personality that cannot be explained; it cannot be photographed; neither can the painter or sculptor reproduce it; yet it is one of the most important factors in our success or failure in life. It is this indescribable quality, which some persons have in remarkable degree, that holds an audience spellbound, and makes people applaud beyond the bounds of enthusiasm. Charm of personality is a divine gift that will sway the strongest characters. We are unconsciously influenced by people who possess this magnetic power. Of course, that rare charm of manner which captivates all who come within the sphere of its influence, and that strong personality which inclines all hearts toward its fortunate possessor, are largely natural gifts. But we find that the man who practices unselfishness, who is generously interested in the welfare of others, who feels it a privilege to do a fellow-creature a kindness—even though polished manners and a gracious presence may be conspicuous by their absence—will be an elevating influence wherever he goes. He will bring encouragement to and uplift every life that touches his. He will be trusted by all who come in contact with him. This type of personality we may all cultivate if we will.

PERSONALITY IN BUSINESS.

Personality is intangible; this mysterious something which we sometimes call "individuality," is often more powerful than ability that can be measured, or qualities that can be rated. And while it is, like poetry, music or art, a gift of Nature, it can be acquired and cultivated to a very great extent. And in this connection it is well to cultivate a mild, gentle and sympathetic voice, and a sure way to cultivate it is to be mild, gentle and sympathetic yourself. The voice is the sounding board, the index of the soul. It is through the voice we give expression to our thought; therefore, fix your mind on the thought and the voice will follow; and if it is filled with truth, it will vibrate with sincerity, echo with sympathy, and so convince your hearers that thoughts in their mind contrary to your own are impossible. It is the man who acts his thought and thinks little of the act who succeeds. Because success is the most natural thing in the world there is no secret to it. The man who does not succeed fails because he has placed himself in opposition to the laws of the universe, which is progress. The pathway to success is in serving humanity. By no other means is it possible. Just live your life—work hard—and don't explain. Mind your own business and give others a chance to mind their's, and you can depend upon it great men will appreciate you for this very thing; and while I am not sure that absolute, perfect justice comes to everybody in this world, I do know that a very good way to get a fair slice of justice is not to think of it, or be too anxious about getting it. The great rewards gravitate to the man who fits himself to receive them. The man who does his work so well that he needs no supervision has already succeeded, and the acknowledgment of his success is sure to follow. The work of the world must be done, and civilization is simply a search for men who can do it.

THE FACULTY OF OBSERVATION.

Tact is also a very important factor; next to a fine manner, perhaps the most important. One should know what to do and be able to do the right thing at the proper time. Observation, good judgment and commonsense are indispensable to those trying to acquire the power of personality. Referring to observation, Herbert Spencer says: "An exhaustive observation is an element of all great success." Therefore, there is no position in life where a trained eye and the faculty of observation cannot be made a great success asset. The efficient salesman is always growing; he is always accumulating knowledge of every kind. He does not merely look with his eyes—he *sees* with them; and he not only uses the optic nerve, but he uses his *mind*. He keeps his mind open to all that is new and helpful. Careless, indifferent observation does not go back of the eye. If the mind is not focussed, that which we see is not clear cut; we do not carry it with force and distinctness to the brain, and, therefore, we are not able to draw accurate conclusions. The faculty of observation is particularly susceptible of cultivation, and is capable of becoming a mighty power and a big asset in the success of a salesman. No matter where you go, study the situation thoroughly; observe and store your observation away in your mind—some day it will serve you well. Good taste is also one of the elements of personal charm, as you cannot offend the tastes of others without hurting their sensibilities. The power to please is a tremendous asset. What can be more valuable than a personality which always attracts. It is not only valuable to a salesman, but to everyone in every field of life.

The ability to bring the best that is in you to the man you are trying to reach, to make a good impression at the first meeting, to approach a prospective customer as though you had known him for years—without offending his taste, without raising the least prejudice, but getting his attention and good-will—is a great accomplishment. There is charm in personality from which it is hard to get away. It is difficult to snub the man who possesses it. There is something about him that arrests our prejudice, and no matter how busy we may be, or how much we dislike to be interrupted, we rarely turn away a man with a pleasing personality. We must give much in order to get much; the more we radiate, the more generous we are, and the more we fling ourselves out to others, the more we get back. The current will not set toward you, until it goes out from you. What you get from others is the reflex of the currents you give out. The more generously you give, the more you get in return. In other words—as you pour out your personality, born of courtesy and kindness and the other character-forming virtues, so do you inspire respect and confidence, and invite from others a return of that which you give.

COURTESY ALWAYS PAYS.

Courtesy and consideration in every walk of life is now the accepted rule. No strong man lowers himself by giving somebody a lift, no matter who that somebody is. It may be an ignorant foreigner, unversed in our ways and language: or it may be an old man or woman, a cripple or a child—it matters not—and no time is lost, for the more people you rightly direct and the more intelligence and consideration you rightly lend, the more valuable will be your life. Many men fail because they do not see the importance of being kind and courteous. Kindness, consideration and courtesy to everybody always pays; and besides, it is a pleasure to be kind. It increases our store of happiness. I have seen men lose important positions and their reputations—which are more important than position—through their lack of courtesy to men to whom they did not think it was worth while to be kind. Beauty of character, charm of manner, attractiveness and power of expression, blended with courtesy, consideration and kindness, will open the door to any proposition, and our sincerity of purpose will clear the path of its many obstructions.

DEVELOPING PERSONALITY BEST INVESTMENT.

The final thought I wish to convey is, that no investment will give greater returns than cultivating your better self, and thereby developing that indefinable something called *personality*. There is nothing that pays so well as training our minds and thoughts along the lines of the beautiful and true. It matters not how well-versed we are in the material things of life, or how well we understand the lines we have to sell; we may be experts pertaining to technique or detail in connection with iron and steel products, or any other articles of commerce for that matter, but if we are not in harmony with Nature and Nature's order of things, we cannot make the success of our lives that we otherwise would. Being in harmony with Nature, brings us into harmony with all about us, and above all, it brings us into harmony with ourselves, and when this is so, and the physical is subordinated and ruled by the mental, life becomes full and complete. I fully realize I am painting an ideal picture, although not an impossible one,

(Concluded on Page 281.)

A Study of Mediaeval Iron Work

Revival Due to Influence of Architects on Design —Several Examples From Old English Buildings

Written for "Construction" by John Y. Dunlop.

THE modern revival of taste for, and the appreciation of the ornamental part of the smith's work, has continued to make great progress since our architects have pointed out the artistic capabilities of wrought iron.

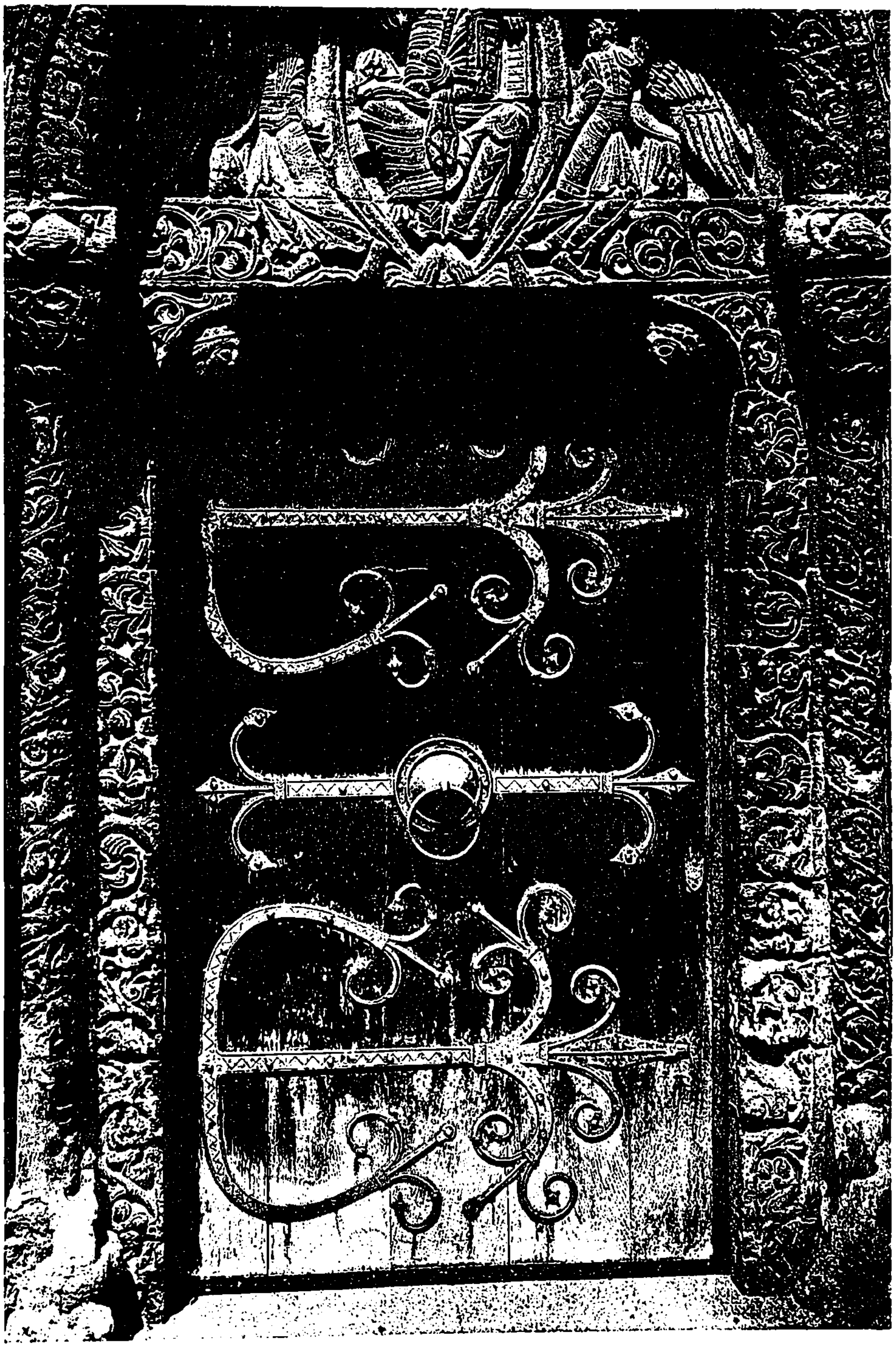
At the beginning of the present century the art of the founder ruled supreme, with the result that for some time we were faced with tasteless rows of monotonous palisades, which were masterpieces of malformation and crude and monstrous in design.

But the art of the founder, whatever be the metal in which he works, can never hope to command the highest homage of a cultivated taste.

That is reserved for the article which owes its fitness and beauty to the skill of the hand, the artistic eye and the dexterously wielded hammer, it matters not whether it be iron or precious metal.

The application of artistic wrought iron work on mediæval lines has now been largely extended, with the result that we have to-day some very fine examples of gates and railings in almost every district.

How far the influence of those early artistic examples which we still have with us to-day has had on our present craftsmen it is very difficult to say, but there is no doubt that our present architects have learned much from the production of the hammer of the mediæval smith.



ORNAMENTAL IRON HINGES, ELY CATHEDRAL, ENGLAND.

The ancient smith must have enjoyed a great number of advantages over the modern workman, who has to be content now to take bars of iron as they come from the rolling mill, and to at once convert it into a marketable article.

Long ago the country smith could only bring his iron into that state by repeated forging, and that is the sole reason for its tenacity and ductility when compared with the present time material.

The productions of the hammer of those early smiths were held in such high esteem that he could afford to give much time and care to those special fabrications.

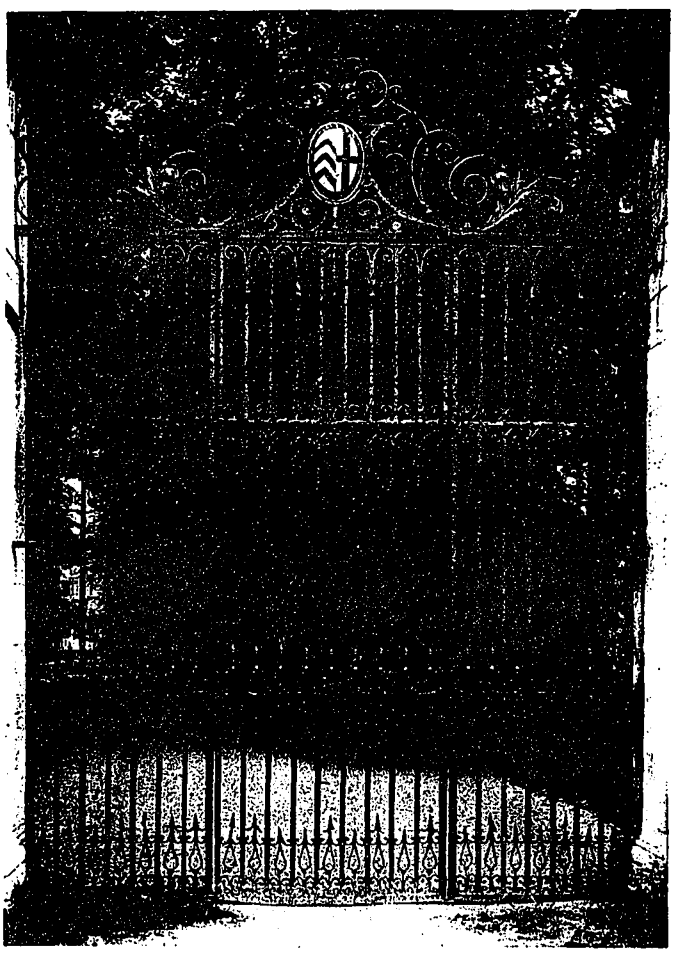
In examining those interesting relics of ironwork which have come down to us we can only conjecture as to the means employed to produce them.

Still it is safe to say that the methods adopted by the ancient smiths were substantially those of the present day workmen. In actual work nothing has been more frequently represented than the door-hinge wherever any approach to architectural detail has been attempted.

These are usually strap hinges, with simple scrolls, but in many of our cathedrals the doors are to be seen with elaborate scroll work and ornamental strengthening pieces, and occasionally the entire door is covered with ironwork of great richness.

The half-tone illustration of the door hinges at Ely Cathedral is certainly a very elegant specimen of this class of early work.

It is a marvel of wrought iron stamped work,



ENTRANCE GATE, CLARE COLLEGE, CAMBRIDGE, ENGLAND.

and together with the strengthening frame, which is round the door, is admired by all lovers of real smithy art.

How these things have been made is a matter of guess work, but it is quite likely that the master smiths would have a working drawing made with chalk on a large drawing board, and bend his scrolls in the scroll-wrench to the outline.

Possibly he would commence the hinge by making the centre part, then adding the side pieces and scrolls as he made them.

The frame which runs round the job and the hinges are welded together.

After the work had been framed up the metal would be stamped on the face.

To produce stamped work the smith has to strike the iron hot into prepared dies as wax is pressed into a seal, and by this means the designs on the face have been executed with the same minute carefulness as in carving on stained glass.

The secret of preparing steel dies was certainly known to the English at an early time, but a really lavish use of them was first made in France.

The frequent use of mystic figures are to be found in this class of work, and many interesting specimens are still to be seen in England.

Two of the many are to be seen at Stillingfleet, in Yorkshire, and at Staplehurst, in Kent.

The first has crescent hinges ending in serpents' heads, with an interlacing rope strap, and what appears to be a Viking ship with two figures.

The Staplehurst example is somewhat similar, but more confused.

Whether this fanciful ironwork was simply a notion of the blacksmith who wrought it, it is very difficult to say, but it may be said that the effort was both original and spontaneous, with a beauty and eloquence of form which has never been surpassed or equalled.

Another English development of smithing of an early type is seen in tomb railings, formed of plain and massive vertical bars, of which the spear-headed boundary railing is a descendant.

The date of their introduction is uncertain, but none now exist of a date older than those in the line drawings.

The oldest monument in which they are used is the tomb of the Black Prince, at Canterbury, in which the rail is supported with a heavy battlemented cornice, the vertical railing finished at the top rail.

At the corners the posts are forged with buttress projections, which are common to the early style of church architecture, and is carried above the top rail with a heavy forged moulded and spiked head.

In all the vertical bars the angles are placed to the front.

Soon after this tomb railing was designed the vertical members were carried upward and sharpened at the point in the form of spears, or barbed like arrow heads.

An example of this kind of guard is shown in Archbishop Langton's tomb in Westminster Abbey.

A marked departure from these two types is to be seen at the tomb of Sir Thomas Hungerford, in the chapel of Farley Castle, which has at the corners vertical bars with massive foliaged ends, a detail of which is shown.

The vertical rails are arranged alternately with small foliage and spear ends, which are fixed into plain rectangular bars, which are hidden by richly decorated straps, cut with a variegated edge, and stamped on the face.

A very little study of those early grilles show that they were not selected because they were admired beyond others, but solely because they offered the best kind of protection at that time.

From this time forth doorways, or openings in masonary, came to have the principal members of their grille formed of upright bars, and a careful examination of this kind of work goes to show that practical consideration, and not taste, very often dictated the railing form.

This is very much so in the beautiful Gothic double door at Ely, which has been fashioned with all the decorative features of the architectural time of the building.

The door itself is hinged to an iron frame set into a checked jamb, which has been recessed with a square opening.

Still the outline of the four-centre Gothic arch has been retained, and the same characteristic feature carried out on the door.

The outer frame of the door is seven-eighths of an inch square, while the intermediate vertical rails are five-eighths of an inch square, placed with their corners to the front.

At the top there is four pointed arches on each side, with their welded-in trefoil ornament.

The bottom rail, which is made of an upper and lower member, is filled in to represent quatre-foil ornament, while the middle horizontal rail is hidden by a moulded and stamped strip of iron on each side.

Every little detail of this grille has been forged in keeping with the style of ornament to which the church belongs.

We have also many fine examples of entrance gates at the various colleges in Oxford and Cambridge.

No other cities have such a variety of design, all of which show the utmost variety of treatment, and are often beautifully finished with the old traditions of mediæval smithing peeping out in every detail.

In the entrance gate at Clare College the grille is composed mostly of vertical members, with rows of decorative features at each horizontal rail.

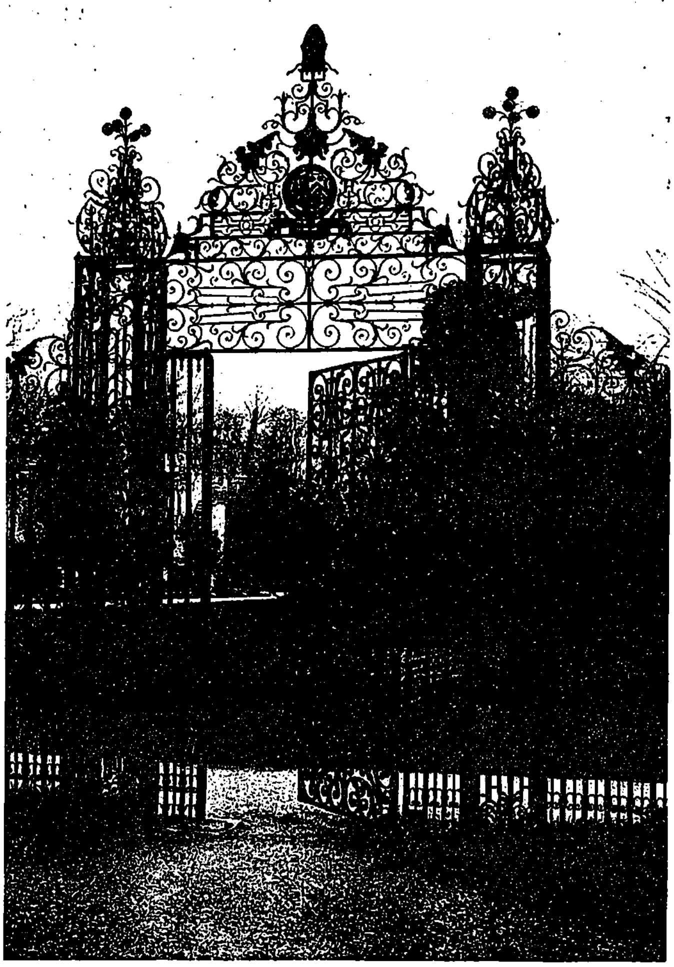
The elegant precision of the lines lend themselves aptly to the smith.

In the scroll work over the top the coat-of-arms of the college are inset.

This is bulged and stamped and riveted through from the back.

One of the finest productions of Oxford is the garden gate of Oxford's new college.

The main block of buildings occupying the garden court of this college was finished in 1684,



GARDEN GATE, OXFORD COLLEGE, ENGLAND.

and it is said that the design was in imitation of the Palace of Versailles, but it is more likely to have been suggested by Wren's work at the King's College, Winchester.

The courtyard is separated from the garden by an elaborate iron screen, over one hundred and twenty feet in length, which we are told was set up in the year 1711 by that ingenious artist, Mr. Thomas Robinson, Hyde Park, London.

An unusual amount of work has been put on the gate, which is richly decorated with scroll work.

The gate is in single leaf, with a plain part of the grille on each side, which is balanced with scroll panels running up past the ends of the frieze panel.

This beautiful ironwork is the result of well-balanced contrast of light open work, and by sheathing the scroll ends in thin grass-like leaves.

In the door we have a ribbon-like treatment

GOTHIC IRON DOOR, ELY CATHEDRAL, ENGLAND.

in each of the panels, producing the most effect with the smallest amount of labor.

It is scrolled up, bent into flowing and other outlines, and embellished with spirals or twists welded on and tied together at the functions.

The results are beautiful, and are not by any means as confusing as might be supposed.

The portion above the frieze is somewhat crowded, but the introduction of the arms and motto of the founder, William of Wykeham, Bishop of Winchester, has relieved it considerably.

The railing, which extends from each side of square wrought iron pillars, continues for a considerable length.

The smith of the middle ages had often to turn his skill to domestic constructional purposes, and to give expression to the thoughts of the designers of his age, with the result that his hammer and anvil were often employed to embody and gratify all sorts of fancies and ideas.

Sometimes it was the church; sometimes it was for the Lord of the Manor, from whom the request issued, with the result that in many districts isolated mediæval examples of the craft are to be seen.

Wrought iron porches are by no means common in England—still as an example showing to what extent the country smith had to pursue his operations it is an excellent one.

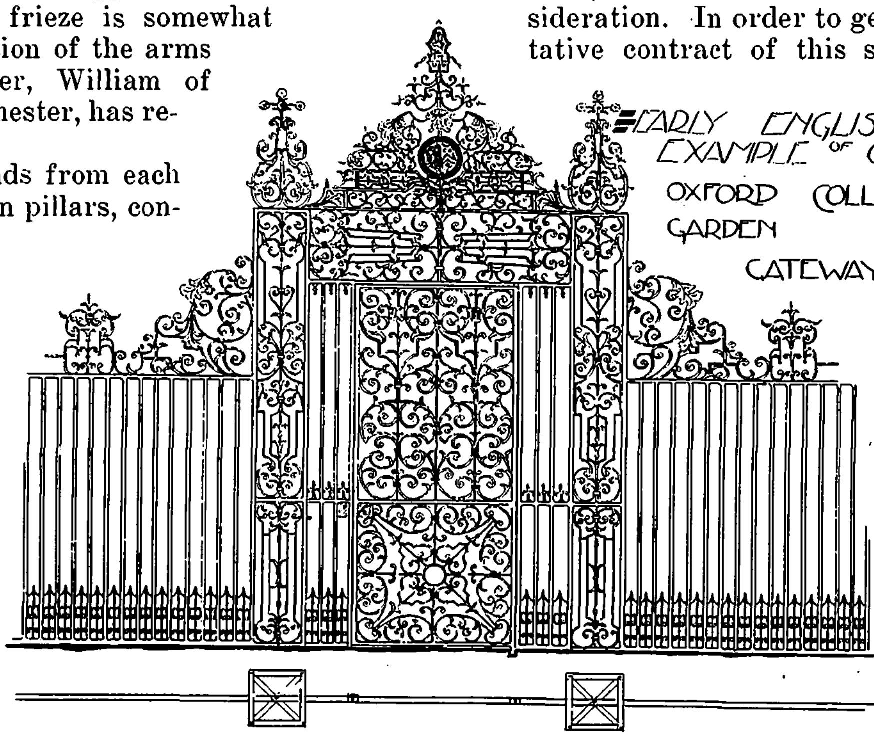
The design is light and graceful, and from what I have seen of it, it must have been forged as two corner posts, two wall posts, two intermediate posts, and then each of the frieze panels between.

Probably after being each completed in the smithy they would be riveted together in position, but on the whole the character of the work finds expression in thoughtful lines and superb finish.

FRENCH WAR RECONSTRUCTION CONTRACTS

Many Canadian and United States companies are planning to undertake after-the-war contracts in France and other European countries, and the system of financing this work adopted by the Chamber of Deputies is, therefore, of interest. The general plan under which this after-the-war work will be done is as follows:

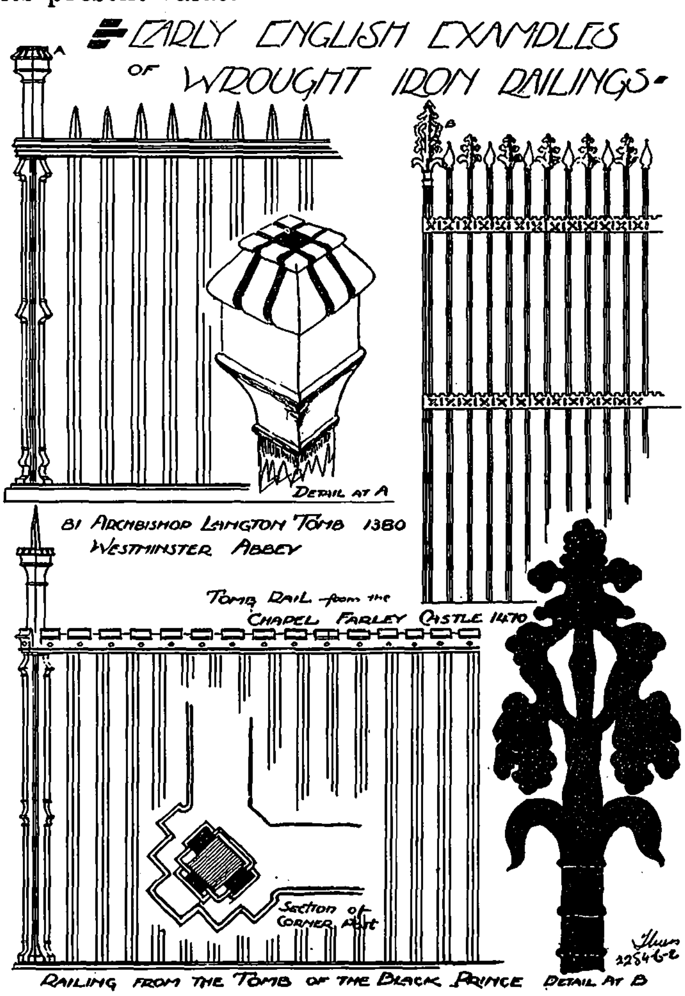
Each French city will ascertain through various committees the damage done to the property of the municipality, as well as to private parties. The Government will offer bonds for sale, the proceeds of which are to be used to furnish the money both to the municipality and to private parties. Contractors who are able to take contracts for the restoration of a city and take their pay in French bonds, to be disposed of by their own bankers, will receive the first consideration. In order to get a tentative contract of this sort the



contractor must show through bank reference that he has behind him parties capable of placing a sufficient amount of bonds to do the work that he offers to do.

For instance, one of the largest cities which is now very much damaged and still is within reach of the long-range cannon of the enemy, will have about $3,000,000 of municipal work. This will consist of rebuilding the municipal buildings, streets and sidewalks, and other work of like character, while the private work will amount to between $30,000,000 and $40,000,000.

Another city, well within the German lines, expects to spend about $100,000,000 in its re-planning and rebuilding; the most of this they expect to pay for in bonds, and the remaining part in land well located at about fifty per cent. of the rental value. This is a very common method of doing large improvement work in European cities. As an illustration of this, Italy expects to practically rebuild five of its well known cities in this way. The city condemns the private property in the area to be improved, and fixes an appraised value on the land based on its present value.



The proposition is to rebuild completely within the area mentioned, as all of it is in the heart of the oldest part of the city, the real business section. This whole area is then to be built


WROUGHT IRON PORCH, WHITE HOUSE, CRAWLEY, HANTS, ENGLAND.

up within a given number of years, and the city is to buy it and turn it over to one contractor at the price at which the city acquires it. The contractor can then sell it, or, if he prefers, rebuild it himself. In all cases, local banks will lend about two-thirds of the value of the real estate in its improved form. This is always sufficient, not only to pay for the land and the entire improvements on it, but it will allow for a fair margin of profit over and above the entire expense of the cost with the improvements. In addition to this, the city pays for the work on the streets, waterworks, telegraph and telephone lines, and all other municipal property. With this usually go most excellent concessions in streets, railways, ports, or other valuable income-bearing public property. For instance, a city in Italy has made an agreement for the execution of certain public works, including drainage, water supply, road improvements, etc., to the amount of about $5,000,000. The city guarantees four and one-half per cent. of the sum expended, of which one and one-half per cent. is to be refunded to the city out of future profits. The capital and interest will be secured by a mortgage on certain building sites of a value appraised at approximately $7,000,000, and by taxes on municipal income, drainage, and water, amounting in all to about $1,100,000 yearly.

The contractor in all cases is to furnish all the money, amounting to between $5,000,000 and $6,000,000. This contract, as in the case of all other municipal and governmental contracts, must be executed in the city or country where the work is to be done. The time for the execution of the work is given as six years, although the earlier it is completed the more profitable it will be, and the better it will please the city.

Clay Products in Engineering Construction

E. H. Darling, in an Address Before the Canadian Clay Products Association, Shows How Inferior Mortar, Poorly Drawn Building Laws, and Inefficient Labor Place Unnecessary Handicaps on Clay Products as Constructional Materials

FIFTY or sixty years ago there were very few of what could be called standard forms of building materials for engineering works. The engineer had not only to design his structure, but every detail of it, and then have the various forms manufactured specially for that structure. Gradually manufacturers grasped this engineering attitude, and got his viewpoint, and as occasion warranted, they employed their own engineers and technical men. They got together in one way and another and agreed on standards of forms, shapes, chemical and physical properties, and so forth, so that to-day the engineer has at hand a vast variety of standard material which he can specify with the same confidence as though it had been made specially for his particular work. This standardization of manufactured products was one of the great contributions which America made to the world's industry during the last century, and it has been a very important factor in the development of this continent.

WHERE A BROADER VIEW IS NEEDED.

However, it sometimes happens that the manufacturer of newer or smaller lines of products, intent on his own particular work, needs something to give him perspective—a broader grasp of what he is doing, and of the purposes to which his products are to be put. There is no doubt about it that there are many splendid ideas and valuable materials which now have no market simply because they have never been scientifically investigated, and their practical value demonstrated to such a point that engineers and other builders can specify them with confidence. It is in this field that the recently organized committee of scientific and industrial research will give valuable assistance. This is the basis of all engineering endeavor—the uniting of the theoretical with the practical—"applying the results of what has been learned everywhere to the matter in hand." And so it may yet be found that even in the manufacture of clay products, although of ancient origin and having seemingly simple process of manufacture, there are possibilities of development that are at present undreamed of. There is this reservation, however, if the product is for architectural uses, the manufacturer and engineer may do their best and fail, unless the results satisfy the requirements of the rules of architecture. These statements regarding the co-operation of the manufacturer and engineer have reference to the products themselves and to the uses to which they are put, but they are equally true when applied to the routine processes of manufacture. That is an entirely different branch of engineering, and while the writer is not in a position to make a sweeping statement, yet in one or two plants he knows of, they have hardly yet begun to apply the principles of efficiency which are doing so much for other lines, toward the cutting down of costs of manufacture and to the increasing of capacity.

Clay products perform many important services in all the various fields of constructive engineering. Their uses may not be as spectacular as that of some materials, but they are none the less most valuable. Clay, when properly treated, is a very poor conductor of heat and electricity, and very inert to chemical action, and most of its value in construction is due to these properties. The fact that it is a common material, widely distributed and found in a natural state, is because it is a stable chemical combination under all natural conditions of atmosphere and climate. When baked, burned or fused, it undergoes certain changes which tend to make it even more stable or inert to deteriorating chemical forces. All such other materials, as the metals, which are obtained by tearing them from the rocks by intense heat, or such as timber, which is built up by organic life, while stronger, hard and more elastic than clay products, they are not as stable, and they always have a strong tendency to return to their original state—to rust, decay, soften and disintegrate.

The writer has observed that in the carrying out of any important engineering work, the problems which call for the most careful attention and sound judgment are not so much those which have to do with the design of the body or main members of a structure, as those which relate to the stability of foundations and the protecting of the work against the destructive agencies of moisture and temperature of water and fire, corrosion and decay. For example, it is not a difficult matter to design a retaining wall, assuming certain conditions of foundation and backing, yet probably with the exception of dams, there is no class of engineering structure that has a larger percentage of failures than retaining walls. It requires better judgment—the outcome of experience—to so drain away the water which is likely to collect and alter the assumed conditions, than it does to design the wall. The same thing applies to road building and to foundations in general.

The electrical engineer would have no difficulty in high voltage transmission were it not for the problem of insulation. It would not be difficult to heat a building were the exterior walls perfect non-conductors of heat. All large sewers might be easily built of concrete, were it not for the fact that certain kinds of sewerage disintegrates Portland cement. All the study and thought put into the steel frame work of a sky scraper is rendered worthless in a few minutes if there has been carelessness in protecting it from fire. All these problems and many more like them, which in a sense may be called the finer problems of engineering, depend on clay products in the form of drain tile, insulators, brick, glazed tile, hollow tile, and so forth, for their solution. We use clay products for permanent construction, and where strength is essential we build a framework or skeleton of wood and steel, and protect them by a covering of the more durable material. It must be remembered, however, that what is true of clay applies more or less to certain other products of the earth, such as Portland cement, asbestos, mica, slate, and so forth, which also have their place in construction.

GREAT FUTURE FOR CLAY PRODUCTS.

But while clay products thus perform many services in construction, the end has by no means been reached. There is room for improvement in the way they are utilized, there are doubtless new uses to which they could be put, and besides, the demand for their use could be greatly increased. The following brief discussion will offer, from an engineering standpoint, a few suggestions along these lines.

The clay brick is one of the oldest forms of building material, and one would think that it must have long since reached its highest possible efficiency. It was used over 6,000 years ago in Mesopotamia, in the then fertile valleys of the Tigris and Euphrates, where an architecture of brickwork developed, based on the use of these small pieces of material. Thus, while in Egypt, and centuries later in Greece, roofs were supported by huge stone beams or lintels, the Ninevites were acquainted with the uses of the arch. These ancient builders, however, did not get very far, from an engineering point of view, for they apparently knew little of how to proportion a building for strength. Examples have been found of walls of great thickness for comparatively small buildings—one hall thirty-two feet wide, having walls twenty-six feet thick. It was the Romans who did more in the development of brickwork than any other people. They not only built their palaces, theatres and temples of it, but also their wonderful aqueducts and viaducts.

But common brickwork, as used to-day, when required to carry great loads, must be classed as a very inefficient material. Good, well-burned brick, has an average ultimate compressive strength of about one hundred and thirty tons per square foot, but when it is laid in lime mortar in the usual way, the average strength of the combination is not more than half of this. (70 tons). Here is a waste of fifty per cent. of the strength of the brick. It is only by the use of cement mortar that the value of the brick can be developed, for the strength of a wall depends on the strength of the mortar. Now, for any homogeneous material, such as steel, it is usually considered quite safe to allow a working stress up to one-fifth or one-fourth of its ultimate strength, but for brickwork conservative engineering practice does not permit more than one-tenth or one-twelfth, (7/8 tons). Thus to carry a given load we have to use two or three times as much brickwork as we would if we could have the same confidence in it that we have in steel. This is a further waste of the strength of the brick.

But there are still other handicaps put upon the use of brickwork which are not necessary. In some cities, the building by-laws will not allow even the conservative unit stresses given above, but fix the limit as low as four tons per square foot—about what is considered safe for solid earth. This means that in these cities, to carry a given load, the amount of brickwork must again be doubled.

SYSTEMATIC LAYING OF BRICK.

Now, approximately half the cost of brickwork is for the labor required to lay it. In this country we expect to pay masons at a somewhat higher rate, in proportion to that received by some other trades, because of the fact that there are four months in the year during which there is not much bricklaying done. In other words, we only use seventy-five per cent. of the available skilled labor of this trade. We are safe in saying, therefore, without casting any reflection on brick masons, that from an economic point of view bricklaying is not more than eighty per cent. efficient in Canada.

Something that requires more serious consideration is the claim made by Frank B. Gilbreth of New York, that by the elimination of waste motions and the adoption of systematic methods, the average mason can double his rate of laying brick.

Thus for every dollar we spend for brickwork, fifty cents is for materials and fifty cents for labor. For this latter half-dollar we obtain labor of which we only use forty cents worth and which it is possible to reduce to a cost of twenty cents. We are, therefore, getting seventy cents worth of brickwork for one dollar. But, as in some cities, we are required to use twice as much brick work as we need for strength, in such cities we only get thirty-five cents worth of strength for one dollar. The same by-laws will allow us to put about four times the load on plain concrete that is permitted on brickwork and the cost of concrete in piers and walls is approximately the same as brickwork. So for one dollar invested in concrete we will get about twelve times as much strength as we would from the same spent for brickwork; assuming that we get one hundred per cent. efficiency in the placing of the concrete.

These figures must not be taken too seriously, for they in no way express the true relative value of brick and concrete. They are given to emphasize the fact that there is room for improvement in the use of even the oldest of clay products, and that in order to successfully compete with other materials, the highest standard of product and efficiency in workmanship are essential. They also illustrate the evil effects of unreasonable building laws, but this will be referred to later.

WATER ABSORPTION QUALITIES.

One of the properties of burned (unglazed) clay is its ability to absorb moisture. This is a very useful property under some circumstances, but a very undesirable one for brick, the common variety of which will absorb as much as seventeen per cent. of its weight of water. Certain impurities in brick when acted on by water cause them to crumble. Water expands eight and a half per cent. with a force of about two hundred pounds per square inch, at the temperature of thirty-two degrees F., a temperature which we have on an average of sixty days a year in lower Ontario. It takes a pretty good brick to resist the action of water and frost for any length of time. Then too, lime mortar, unlike Portland cement, will not harden if kept moist, but loses its "life" and crumbles. For this reason many precautions have to be taken to protect brickwork from moisture or from contact with anything else which absorbs moisture, such as stone and concrete. It is well known that in this action which shows itself in the white effervescence, stain and disintegration that disfigure and injure so many buildings in which care has not been taken to interpose a layer of waterproofing between the brick and foundation, window sills, coping, and so forth. Partly on this account, and partly for architectural reasons, there has of late years been a growing demand for impervious brick. High class brick of this nature is being brought long distances, and fancy prices are being paid for it. There is also a noticeable extension in the use of glazed or vitrified material, all of which indicates a rising standard of construction.

In fireproof construction the principles of engineering are so greatly used that it is not more than necessary to mention the subject here. The desirability of this type of construction for large buldings, is admitted by all. But we have reached a point where fireproof construction can be used with splendid results for moderate size residences running from eight or ten thousand dollars in cost and up. In a well built house the extra cost is practically all in the floors and it is a comparatively small percentage of the total cost. While protection against fire is the point usually emphasized, there are many other reasons, sanitary and economic, in favor of this type of construction that in themselves are worth the extra cost. In fact, residences of this size built in the old way must now be considered second class, out of date, no matter how elaborate. How much more can this be said of schools and other large buildings.

In working toward this higher standard of building in which the construction features are entirely engineering, the engineer is closer to the manufacturer of clay products than the architect is. Those architects to whom the bulk of this class of residence work goes, make no claim of being engineers and it means a radical and expensive departure from their accustomed practice to undertake it. The owner on the other hand, knows even less about it, and, even if inclined to consider it, is easily discouraged by a hint at a great increase in cost. This is a field for fireproofing materials that has hardly been touched as yet.

FIRE LOSS PROBABLY DUE TO BAD CONSTRUCTION.

A great deal of effort has been put forth to awaken our people to the fact that our tremendous annual fire loss is for the most part unnecessary. Not only are there direct losses when a fire takes place, but the very fact that a fire trap exists depreciates all the property near it and adds a burden of insurance. But as yet, apart from the various and in many cases inadequate city by-laws, little if anything has been done toward a systematic campaign against this destructive element.

Great as our fire losses are, the writer would not be surprised if on investigation it should be found that the loss from poor building construction, not including that due to lack of fireproofing, is even greater. Take the losses due to the action of water alone, not considering that from freshets and failure of dams. Water being an almost universal solvent constitutes the best of mediums for chemical action. Its presence is also required for all the kinds of bacterial growth which attack organic substances. It is a fairly good conductor of electricity and is necessary for the phenomena of electrolysis. Buildings erected in the dry deserts stand unchanged after four thousand years, while in our climate they would practically disappear in one-tenth of the time. So in addition to the waste from the mechanical action of water, such as the back flooding of poorly designed sewers, the undermining of foundations, the heaving effects of frost, the damage to property from leaking roofs, and so forth, we have the disintegration of brickwork, as mentioned above, the rusting of metals wherever exposed or subjected to electrolytic action, and probably the most important of all, the decay of untreated and unprotected timber.

In the form of snow and ice, water does an immense amount of damage, but as a great deal of this is unavoidable, it cannot all be charged to poor construction.

WASTE DUE TO CITY BY-LAWS.

Another cause of waste is that referred to above—the unscientific and sometimes absurd requirements of the building by-laws of many cities. Conditions imposed in some cases are made so arduous as to be prohibitive and actually put a premium on the poorer type of construction. It was estimated (by C. R. Young, Can. Eng. Feb. 26, 1914) that the 1913 building by-laws of Toronto, entailed an average annual waste of a quarter of a million dollars by unreasonable structural requirements. Any legislation that requires an extravagant use of any article or material so adds to the cost of a building—often in a greater proportion than the cost of material itself—that instead of increasing the demand for it, it actually has a tendency to restrict its use and favor its competitor.

But the waste of wealth throughout the country due to faulty construction must be enormous. Every high wind or heavy snowstorm levies its toll of damages. How much of this is unnecessary, it is impossible to say. Every thunderstorm leaves a path of destruction behind it, and yet it has been demonstrated of late years that danger from lightning can all but be eliminated by the intelligent use of lightning rods.

There are smaller and indirect items of waste, such as is due to the poorly constructed small house where a few extra dollars spent in making it weather tight would be paid for many times over in the saving of fuel to heat it. Thus the subject gradually shades off into other economical problems which have to do with the sanitary, commercial and industrial welfare of the nation.

In the light of present day knowledge a large part of all this loss from fire, water, and waste, is unnecessary, if not criminal. It remains for ways and means to be devised that will restrain the careless, protect the ignorant and to supplement, and encourage the efforts of individuals to reach a higher standard of construction. What the Municipal and Railway Board is doing for our municipalities, what the Provincial Board of Health is doing for sanitation and public health, what the Hydro-Electric Commission is doing for good electrical installation, what we expect the Town Planning Act will do for our cities, that we need for building construction.

And the honest and efficient manufacturer of clay products may rest assured that the broader application of the principles of engineering to construction will mean an ever increasing appreciation of all his lines that enter into construction work.

CANADA'S SELLING PROBLEM AFTER THE WAR

(Concluded from Page 272.)

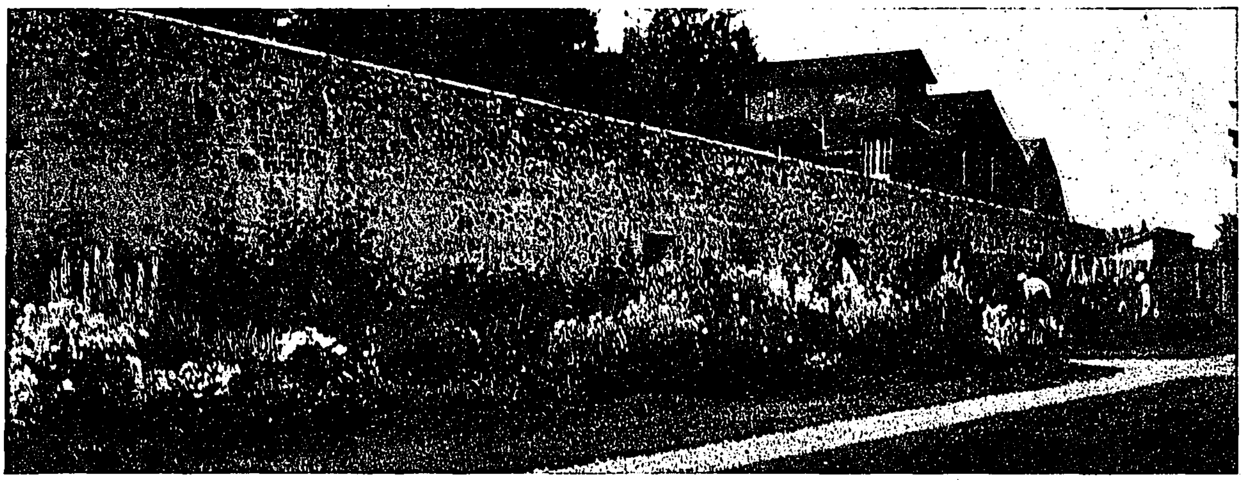
and while we may not rise to the height of this ideal, we can, by following it, at least go part of the way, and this part, no matter how small, will take the place of some discordant element, which would retard our success. Therefore, I recommend that you try to open your mind and heart to the wonderful influences of Nature—the beautiful and true. Realize your oneness with her and partake of the inspiration and power she imparts. Implant firmly in your mind the successful man you wish to be, and so will you become, for it is the vision we hold in our mind—the ideal that is enthroned in our hearts—that we build our lives by. This we will become. It is the beauty of our thought, the quality of our minds and ideals that make the man.

M. Pierre Paris has announced to the French Academy of Inscriptions the discovery of what may prove to be a second Pompeii, buried under the sands of Morocco. In carrying out excavations in the region of Bolonia, on the sea coast, M. Paris first came across an ancient factory, believed to have been established for the salting of fish, and more particularly perhaps of the tunny fish which abounds in those waters. This factory was indisputably of Roman origin, as proved by the style of the columns and marks upon them, careful photographs of which have been taken. Further search revealed on a vast terrace dominating the sea a big house obviously contemporaneous with the factory. The atrium of the dwelling has been completely cleared, and is surrounded by vestibules and chambers, a sketch of the plan of which had been executed. M. Paris says that this is merely a beginning, and that he is convinced a whole town in an exceptional state of preservation can be unearthed.

Visitor—"So this is the deaf and dumb ward! How do you call people to dinner? I suppose you don't ring a bell."

Superintendent—"No. We have a man who walks through the ward wringing his hands."

A SCENE NEAR MICHELHAM HOME FOR CONVALESCENT CANADIAN OFFICERS, FRANCE.



A HERBACEOUS BORDER IN GARDEN OF MR. GORDON OSLER'S LAKE SIMCOE RESIDENCE.

HEADQUARTERS OF THE R. F. C. AT CAMP HOARE, BORDEN.

CONSTRUCTION

A · JOURNAL · FOR · THE ARCHITECTURAL ENGINEERING · AND · CONTRACTING INTERESTS · OF · CANADA

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Garden Cities For France

That it is an ill wind that blows no good is again proved in the possibilities set forth by the action of the French Chamber which has adopted the principle of indemnities in full to property owners for the amount of their losses by the war.

The benefits that will accrue through such a policy will not, as might at first appear, be to the individual property owner, but more largely to the general public. Nationalization, or State ownership of land, decentralization of the population and the replacing of ruined towns by well planned garden cities, are among the principal topics now under discussion for the rebuilding of Northern France. Those who strongly urge the adoption of a measure of indemnity are as strongly in favor of the State's availing itself of an opportunity to take over certain lands, and thus to carry forward on the largest scale, experiments in the formation of garden cities.

These experiments, as is further pointed out, are at the outset assured of success, and as an instance of what can and probably would be accomplished, Dravoll, an experimental garden city, in the department of Seine and Oise, is referred to.

The success of this venture in co-operative housing has been so great as to cause many men who have tried to discredit such attempts to become the most enthusiastic supporters of the scheme for garden cities, now proposed by the French Government.

Dravoll started in 1909 with a capital of $4,000, and it now has a capital of $160,000 in which about three hundred families are interested.

The project as outlined for the rebuilding of the devastated area in the North of France, and which could be placed in practical operation if the proposed legislation is passed, comprehends that when the State has taken over the land by purchase, it may be leased to the different Communes which in turn would let it to societies formed on a strictly co-operative basis, or directly to individuals.

The improvement of the land in every case would need to comply with certain restrictions preventing too great concentration of population, and the setting apart in every settlement of such spaces as would provide public parks and playgrounds, the whole development to have the most improved hygienic installations.

A scheme of this sort would result, if properly conducted, in restoring a devastated section to habitable conditions, and affording an opportunity to carry forward on a large scale, ideas of co-operative town planning that have never before been attempted.

The result of this effort toward rehabilitation of that section laid waste by war will, as pointed out by the "American Architect," be watched with considerable interest.

Military Hospitals a Live Topic

The September number of CONSTRUCTION will be devoted almost exclusively to a description of the work of the Military Hospitals Commission in Canada in providing hospital accommodation for the thousands of wounded and disabled soldiers returned to Canada after having served their country on European battlefields.

With very limited accommodation available at the beginning of the year, mostly in old colleges and other reconstructed buildings, Canada now has military convalescent hospitals already completed, or in course of erection, accommodation for about fourteen thousand patients, while Capt. Symons, and the architectural and engineering staff of the Hospitals Commission, are working almost night and day to still further increase the accommodation.

In this number several articles are devoted to hospital construction in France and the United States, and this information, coupled with the data to be given in CONSTRUCTION for September, will be read with interest by all who have at heart the proper caring for of the disabled men who have fought their country's fight and have been returned to Canada for recuperation and reconstruction.

Efficient Heating For Institutional Groups

A. L. Baum Outlines the Advantages of Central Heating Plants for Hospitals.

THE present tendency in the design of our large institutions leans towards the village idea, i.e., a number of separate dwelling houses, interconnected by pleasant walks and passageways, and a few central buildings for service and administration purposes, the whole so arranged that it usually spreads over a considerable area. Generally speaking, sufficient funds are not at first available for the completion of the entire group of buildings as planned, but provision is usually made in such cases for future extensions and additions.

In serving such a group of buildings with heat, light, water and power, the general aim is toward the centralization of service. The advantages of such a central plant are so well known, and have been presented so frequently, that I need not review them again. I shall take them for granted, and shall use the central plant as a starting point for this discussion of the type of heating system best adapted to such a group of buildings. It is obviously important that such a heating system be simple, reliable and effective. Good and healthful living conditions are vitally connected with proper heating. An error in the determination of so important a feature is most serious, and likely to result in tremendous expense if a rectification of that error is to be made at a later date.

The central plant having been determined on, the two possibilities as mediums for heating are steam and hot water. In order to more clearly understand the nature of the problem, let us consider a layout such as shown in the diagram, which represents a large institution of the hospital type, with isolated buildings. The distance from the power house to the end of the group is seen to be about 2,500 feet, almost one-half mile, and institutions have been designed, such as Letchworth Village for the Feeble-Minded, at Thiells, N. Y., where this distance exceeds a mile.

Whether steam or forced hot water is circulated as a means of heating the buildings, some exhaust steam will be available from the engines or turbines of the central generating plant; usually, however, not nearly enough for the full heating load. With a back-pressure on the generating units of not more than 3 or 4 lbs., it is evident that the exhaust steam, even if enough were available, cannot be used for heating the far buildings. These, if steam heated, will have to be served with high-pressure steam, reduced in pressure at the buildings, which will at least permit the use of smaller distributing mains.

Economy demands that the condensed steam be returned to the boilers in the central plant. The facility with which this may be done with steam heat depends largely on the relative levels of the buildings. A gravity return system is by far the cheapest. If this is not possible, a vacuum return line system may sometimes be utilized. But here, again, not only are proper grades essential, but the distance from the last building to the central plant must also be considered. A last resort for getting back the heating returns (where relative levels forbid the use of either of the foregoing methods) is the system of pumping, and this means a number of return pumps scattered over the property, which must be provided with power, either steam or electric, and which also demand frequent attention both as to operation and maintenance. Such an arrangement materially decreases the advantages of the central heating plant.

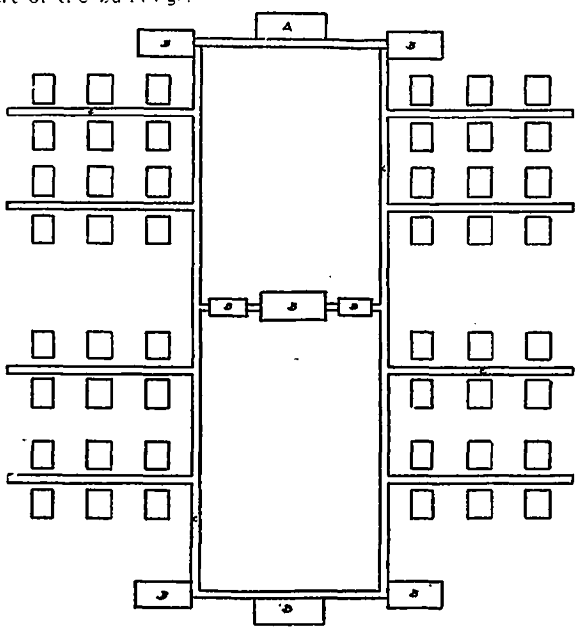
Hot water as a heating medium, however, is not subject to such great restrictions. The water can be pumped regardless of grade, so long as proper provisions are made for relieving the entrained air from all high points where it may otherwise accumulate and cause air-binding of the mains. The water is heated in the central plant, easily utilizing (with a medium back-pressure) exhaust steam, which, as steam, could not be made to reach the farthest buildings. In plants of this kind the heating load is usually much larger than the power load. Under such conditions all the exhaust steam available during most of the heating season can be used directly for the hot water heating equipment; furthermore, the water of condensation is immediately regained without the slightest inconvenience. By no other distributing system can the heat be distributed with such little difficulty.

It is at once evident what a great advantage is effected by the central control of the hot water heating system. The operating engineer can at all times watch the temperature of the outgoing water, and vary it to suit varying weather conditions. During very severe weather the water may readily be heated as high as 200 degrees F. (or even a little higher), thus giving out a large quantity of heat from the radiators and stacks in the buildings. As the weather becomes milder, the water temperature is reduced accordingly, thus cutting down the amount of heat supplied to each room in proportion to the decreased demands of the outside weather conditions.

With steam heat, overheating of the rooms is almost unavoidable, since the steam temperature in the radiators is nearly constant, regardless of weather conditions. The method usually followed in practice to avoid overheating in mild weather when a little heat is still required is to open the windows; this means, in effect, dumping out of the windows the equivalent of a large part of the coal consumed. One method of saving much of this waste is to use thermostatic control in all the scattered buildings; but thermostats are delicate instruments, and are also expensive, both to install and to operate. Tampering with them does them no good, and, where it is desired to make simplicity the keynote of design and operation, delicate instruments, scattered all over the building should be avoided. Another method of effecting coal economy is the use of a vacuum-return or open-return line system, with fractional steam control, and automatic return valves on the radiators. But the necessary appliances are expensive to install, involve care and maintenance, and require the frequent manipulation of hand valves all over the institution.

The hot water heating system, on the other hand, by its variation of water temperature avoids the need of thermostatic or other scattered means for controlling the temperature of the rooms. It therefore eliminates from the buildings all mechanical devices, with the exception of one or two automatic air traps in each building and a hand valve (which need rarely be touched) on each radiator. By means of this central control, and its ability at all times to avoid overheating the buildings, the forced hot water heating system secures the maximum of fuel economy with the minimum of mechanical elaboration and of attendance.

Besides avoiding the loss due to overheating of the rooms, as just explained, the hot water system has considerably smaller radiation losses from the distributing mains than any of the steam systems. With the forced hot water system the maximum losses from this cause occur in the coldest weather, when the maximum water temperature is carried. As the weather becomes milder, the water temperature is lowered, and this in turn decreases the radiation losses from the mains. Steam, however, does not recognize changes in the weather. Whether the rooms are controlled by thermostats or by hand, or by open windows, the heating mains carry the steam continuously at a high temperature, since the temperature and pressure of steam are related by physical laws beyond the control of man. Hence the radiation losses, instead of becoming materially less in mild weather, as is the case with hot water, remain fairly constant throughout the heating season. The excess of these losses in the steam plant over those in the hot water plant for the same particular group of buildings may easily amount to several hundred tons of coal per year, depending on the size of the institution and the distance apart of the buildings.



BLOCK PLAN OF INSTITUTION OF HOSPITAL TYPE, WITH ISOLATED PAVILIONS.

A—Central boiler house and power house.
B—Administration and service buildings.
C—Interconnecting passageways for pavilions.

The foregoing considerations have been presented from the point of view of operating costs. Coincident with operation are the costs of maintenance. The greatest part by far of the heating equipment of a large group of buildings on a widely extended area is the piping connecting all the heating surfaces with the source of heat in the central plant. In the steam heating system this entire network of piping carries during the heating season a mixture of steam, air and moisture, while during the summer it remains dry and empty. With the forced hot water heating system the piping can remain at all times filled with water, from which practically all dissolved air has been expelled. It has long been known that piping does not rust out nearly as rapidly while it remains filled with such water as when in contact alternately with air and moisture. This gives the hot water system the advantage of much longer life, and longer life means a cheaper maintenance and depreciation charge, as well as less trouble from repairs.

There is still another phase of this question which, from a physician's point of view, should be important—namely, the health aspect of heating systems. Investigations have shown that particles of dust (largely organic matter) carried in the air begin to "burn" or decompose at about 165 degrees F., and, since the temperature of the steam-heated radiator is always much higher than 165 degrees F., it is at once evident what is taking place in a hospital ward heated by such radiators. The consistently lower temperature of the hot water radiators avoids in almost all cases this irritating annoyance from decomposing dust. It therefore secures a heating effect which is at once the more healthful of the two possibilities, and also affords a much more even temperature in the rooms due to the much lower intensity of radiation from the lower temperature radiators.

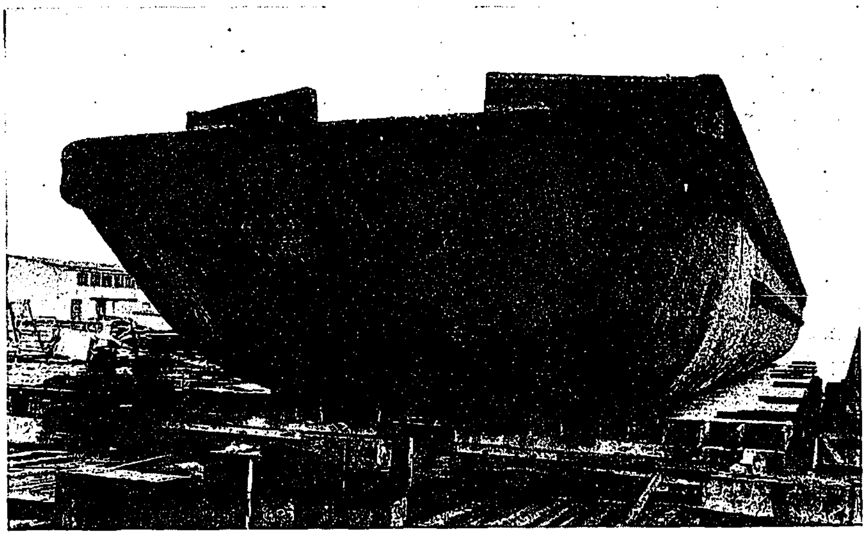
The only statement that can be made against a forced hot water system in favor of a steam heating plant for a group of buildings as herein shown is a possible slightly increased first cost of the hot water system. As opposed to this, however, are (1) the advantages of central control of the heat, (2) the simplicity of installation and operation, (3) the economy effected by avoiding overheating of buildings, (4) the economy effected by decreased radiation from the heating mains, (5) the longer life of the heating equipment, and (6) the more healthful character and more even distribution of the heat in the rooms, all of which go very far toward making forced hot water the ideal heating medium in a plant which proposes to be an effective and economic investment for the community as owner.

Will Build Concrete Ships to Defy Submarines

OUR country is confronted with the problem of increasing the merchant marine, and it requires the consideration of every possible method or material of construction. Several prominent engineers have suggested reinforced concrete.

A San Francisco firm of engineers is designing a ship with a length of 330 feet, a beam of 44 feet and a depth of 31 feet, with capacity of 4,500 tons—to be built of reinforced concrete. A concrete schooner was employed for some years in the North Atlantic coasting trade, having been constructed in about 1898. The London "Times" mentions a small boat of reinforced concrete built by a Frenchman in 1849, and still in service after a test of 68 years.

The concrete ship is only a further development of the concrete barge, and such craft have been in successful use for years. Concrete lighters have been used for the past six years on Chesapeake Bay, supplying coal and water to dredges, carrying loads of sand and gravel, etc., and the accompanying illustration of a 500-ton lighter on the ways just before launching is typical of their appearance. With such a craft there is no necessity for caulking or painting, the upkeep is small, and there is no danger of decay. Barnacles will not collect on a concrete hull.



FIVE HUNDRED TON CONCRETE BARGE BEING LAUNCHED.

A concrete barge has been in service on the Welland Canal since 1910, and has seen very hard usage. It has a length of 80 feet, a beam of 24 feet, and is 7 feet deep. It is interesting that the walls, which were constructed between forms, are 2½ inches thick, reinforced with steel rods, yet the barge is used for carrying loads of stone, etc., with conspicuous success.

Since 1910 reinforced concrete barges have been built for use on the various sections of the Panama Canal, and their experience has enabled the engineers to develop a very efficient type of vessel. Recently concrete pontoons were constructed for service as landing stages for boats up to 65 feet in length. These pontoons have a length of 120 feet, a beam of 28 feet, and are 8 feet deep. They are very thoroughly reinforced.

Vessels which are more like ships than barges have been built of reinforced concrete in Norway. A report from the American Consul-General at Christiania describes a plant at Moss, Norway, where vessels of 3,000 tons displacement are being constructed.

A Boston writer suggests a plan which makes little if any change in the outward appearance of our modern steel ship, except that the structural part of the ship is of a specially prepared emulsified concrete reinforced with a fabricated network of steel rods that bonds the ship together in every part, giving great strength, and making the structure one continuous monolith. All decks, bulkheads, partitions, etc., are interwoven together in one continuous mass of steel and concrete. The ship has two hulls and a double bottom; the double hull runs to above the water line all around the ship. There is a space of 3 feet between the outer and inner hull, which is divided every 12 feet, making a continuous number of watertight compartments 3 feet by 12 feet girding every part of the ship to above the water line. In the centre of this 3 feet space is a system of fabricated steel rods looking somewhat like a heavy wire fence; the purpose of which will be explained later. This space between the double hulls and double bottom is not wasted, but being watertight, is used as storage tanks for carrying oil cargoes and for storing fuel for the ship's engines, the vessel being driven by oil engines, requiring a much smaller crew than a steam driven vessel, and giving more space for freight.

The designs and methods of fabricating the steel reinforcing rods is such as to make a ship strong enough to resist the heaviest sort of a gale without straining herself, yet no attempt is made in this plan to build the outer hull heavy enough to resist the explosion of a torpedo; so let us suppose such a ship is struck by a torpedo fired from an enemy submarine; the force of the explosion is so great that a hole two or three feet in diameter may be shattered in the outer hull, and now appears the use for the fabricated rods (or strong wire fence) inside the space between the two hulls.

These rods work on the same principle as Mr. Maxim's gun silencer, they dissipate, or in other words, break up the force of the explosion; at the same time they protect the walls of the inner hull from being damaged by flying pieces of the concrete; thus a section 3 x 12 feet is damaged, and its cargo of oil is thrown against the force of the explosion, but this of itself helps to cool the hot gases caused by the explosion; each 3 x 12 foot section is vented at the upper deck with a hatch that opens outward to let the explosive gases escape. The torpedo has now done its worst, and the ship has lost a few hundred gallons, maybe, of fuel oil, but the damage can readily be repaired in a few hours on arrival at her destination, or even while at sea if necessary, as concrete will set in water without decreasing its strength.

It will also be seen that if a vessel of this kind should be damaged by collision or by striking a rock or an iceberg, only her outer hull could be damaged, while her freight and passengers are carried to their destination in safety. A few of the items to recommend such a vessel are:

First. A stronger and more durable sea-going vessel at less cost.

Second. Can be built in one-half the time required for a wood or steel vessel.

Third. An absolutely fireproof structure.

Fourth. A vessel practically free from vibration, greatly adding to life of machinery and comfort of passengers.

Fifth. A saving in up-keep; the hull, all outside and exposed surfaces can be of white cement, effecting a large saving in painting, etc.

Sixth. The attainment of graceful lines and good design at no added cost, owing to the flexibility of the material while in its plastic state.

Seventh. A powerfully, strong hull with an outer surface as even and smooth as glass and proof against barnacles and corrosion.

Eighth. The arrangement of a series of watertight compartments that will make the vessel practically unsinkable.

In view of such examples proving the usefulness of concrete vessels of this character, it would seem wise to consider concrete in the construction of ships which are to increase our merchant marine to the proportions demanded by the present requirements. If seagoing barges were to be constructed, or smaller craft suitable for lake traffic, this would release for other purposes many ships now in use in this capacity. The presence of the necessary materials for a concrete vessel at so many convenient locations would make it possible to provide a large tonnage, and progress in construction would be faster than with ships of steel, or even wood.

TRADE NEWS.

The American Steel Export Company has appointed Woodburn's, Limited, Montreal, as their exclusive agents for the Provinces of Ontario and Quebec.

FIRE LOSSES.

Glencoe, Ont.—The flour mill of the Woodburn Milling Company was destroyed by fire; loss $40,000.

Ingersoll, Ont.—The factory of the Ingersoll Machine Company was destroyed by fire.

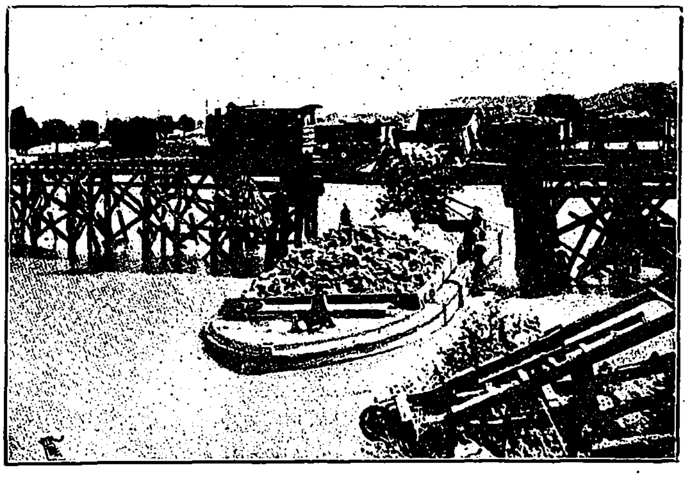
Kelvin, Ont.—The Methodist Church of the town of Kelvin was destroyed by fire.

Kitchener, Ont.—The Romo Theatre was destroyed by fire; loss $5,000.

Osnabruck Centre, Ont.—The town hall of the Township of Osnabruck was destroyed by fire.

Rodney, Ont.—The planing mill, storehouse and office of John A. McIntyre were destroyed by fire; loss $6,000.

Strathroy, Ont.—The factory of George Rivers was destroyed by fire; loss $40,000.



CEMENT SCOW IN OPERATION ON WELLAND CANAL.

Canadian Building and Construction News

New Structures to be Erected—Contracts Awarded for Large Works—Trade Literature Issued—Other Items of Interest

BUSINESS BUILDINGS.

London, Ont.—Architect H. C. McBride, Richmond street, is preparing plans for an office building for Hobbs Manufacturing Company, to cost $10,000.

Toronto, Ont.—The Dominion Bank, King and Yonge streets, are erecting a bank building at the corner of Yonge and St. Clair, to cost $25,000, and their architects, Darling & Pearson, 2 Leader lane, have awarded the following contracts: Mason, Witchall & Son, 156 St. Helen avenue; carpenter, F. Markham, 51 Orchard View Boulevard; roofing, G. Duthie & Son, 30 Widmer street; plastering, R. C. Dancy, 153 Spadina road; painting, J. McCausland & Son, 11 Nelson street; plumbing and heating, Purdy, Mansell, Limited, 63 Albert street; marble and tile, Canada Glass, Mantels and Tile, Limited, 328 Carlaw avenue. The Canadian Hanson Van Winkle Company, Morrow avenue, are erecting an office building, garage and dwelling at the corner of Morrow and Silver avenues, to cost $10,000, and their architect, F. S. Mallory, 65 Adelaide street east, has awarded the roofing and galvanized iron contracts to H. S. Smith, Crawford street. The Royal Bank, King and Yonge streets, are erecting a bank building on Yonge street, to cost $25,000, and their architect, F. S. Baker, Bank of Hamilton Building, has awarded the following contracts: Mason, brick and concrete, R. Chalkley & Sons, 34 Victoria street; ornamental iron and steel sash, McGregor & McIntyre, 1139 Shaw street; carpenter, A. Weller & Co., 54 Tecumseh street; plastering, Hanna & Nelson, 273 Rusholme road; roofing, Douglas Bros., 124 Adelaide street west; heating and plumbing, W. J. McGuire, Limited, 91 Jarvis street; painting, J. McCausland & Sons, 11 Nelson street; wiring, A. R. Rice & Co., 152 Bay street; composite floor and tile, Italian Mosaic and Tile Company, 429 Spadina avenue; dumb waiter, Turnbull Elevator Manufacturing Company, 126 John street.

CIVIL ENGINEERING.

Kincardine Township, Ont.—The Kincardine Township Council will erect four concrete bridges, to cost $1,000, and have awarded the general contract to Bert Duke and John Godwin, Kincardine.

CLUBS, HOSPITALS, THEATRES AND HOTELS.

Orillia, Ont.—The town of Orillia contemplates the erection of a memorial hospital, to cost $50,000. This building will be erected at the close of the war.

MISCELLANEOUS.

Fort William, Ont.—Davidson & Smith, Port Arthur, are erecting a flour and feed mill on the McKellar property, to cost $100,000, and have awarded the general contract to Barnet & McQueen, Fort William.

Hamilton, Ont.—F. A. Ward, 108 Campbell street, is erecting a garage on Roxborough and Dundas street, to cost $10,000, and have awarded the general contract to W. C. Coulter, London street. The Semet Solvay Company, Syracuse, N.Y., contemplates the erection of coke ovens at the Stipes Inlet, to cost $2,000,000.

London, Ont.—The London Engine Supplies Company, 85 Dundas street, are remodeling their garage on Dundas street, to cost $5,000, and have awarded the general contract to Tambling & Jones, 282 Horton street.

Niagara Falls, Ont.—The city of Niagara Falls are erecting a firehall at the corner of Walnut and Kitchener streets, to cost $20,750, and their architect, C. M. Borter, 103 Main street, has awarded the following contracts: General, Ireland & Dinham, Glenholme avenue; painting and glazing, W. J. Mullen, 222 Victoria avenue; electric wiring, Niagara Electric Company, Victoria avenue; plumbing, Reid Bros. Company, Fourth avenue.

Ottawa, Ont.—The St. Patrick's Orphan Asylum, Laurier avenue, are erecting a boiler house and stack, to cost $13,500, and their architect, H. H. Tucker, Ottawa, has awarded the general contract to E. Monette, 60 Sterling avenue. Thomas A. Stott, Wellington street, is erecting a garage on Wellington street, to cost $5,000, and has awarded the concrete work contract to H. Haley, Chapel street.

Sarnia, Ont.—Architects James, Louden & Hertzberg, Excelsior Life Building, Toronto, are preparing plans for a brass foundry for the Mueller Manufacturing Company.

Sarnia, Ont.—The town of Sarnia contemplates the erection of an incinerator plant, to cost $25,000.

Toronto, Ont.—The T. Eaton Company, 190 Yonge street, are erecting a garage on Alice street, to cost $6,000, and have awarded the general contract to Thomson Bros., Ryrie Building. The British Forgings, Limited, Royal Bank Building, are preparing plans for temporary buildings to be erected on Atlantic avenue, to cost $15,000. The Imperial Oil Company, 56 Church street, are preparing plans for a fuel oil tank, to cost $70,000. The Willys-Overland, Limited, Weston road, are erecting a machine shop on Weston road, to cost $15,000. The Danforth Day Nursery, 859 Carlaw avenue, contemplates the erection of a nursery building, to cost $6,000. H. L. Bowles, 7-9 King street east, has purchased a site at the corner of King and Bay streets for the erection of a lunch room or a restaurant building. Gunns, Limited, Gunns road, have prepared plans for a workshop, to cost $12,000.

PLANTS, FACTORIES AND WAREHOUSES.

Hamilton, Ont.—The National Abrasive Company, Biggar avenue, are erecting a factory on Biggar avenue, to cost $15,000, and have awarded the steel work contract to the Hamilton Bridge Works Company, Limited. Architect G. J. Hutton, Bank of Hamilton Building, is preparing plans for an addition to the factory of the Steel Company of Canada, Harvey lane, to cost $100,000.

Mitchell, Ont.—A. Burritt Company, Mitchell, Ont., are erecting a factory, to cost $25,000, and have awarded the following contracts: Mason, John Avery, Fullarton road; carpenter, Wm. Eisermann, Toronto street; steel, A. Hill & Co., Main street.

Niagara Falls, Ont.—The Herbert Morris Crane and Hoist Company, Toronto, are erecting a factory on Stanley street, to cost $80,000, and their architects, Harkness & Oxley, Confederation Life Building, Toronto, have awarded the following contracts: Steel work, the Dominion Bridge Company, Montreal; general contract, Toms Construction Company, Kent Building, Toronto; sash operators, King Construction Company, 40 Dovercourt road; plumbing and heating, Keiths, Limited, Campbell avenue, Toronto; roofing, Reggin & Spence, 530 Front street, Toronto.

Petrolia, Ont.—The Colonial Knitting Company, Elmira, Ontario, will erect a factory at Petrolia, to cost $10,000. Mr. R. Kirkpatrick is their architect and general contractor.

Toronto, Ont.—The Newell Building Company, Limited, are erecting a warehouse on Duchess street, to cost $55,000, and have awarded the following contracts: General, John G. Kent and T. Essery, Confederation Life Building; plumbing and heating, A. Welch & Son, 304 Queen street west. The Cluff Ammunition Company, Limited, 111 Sterling road, are making repairs to their factory, at a cost of $10,000, and their architect, J. W. Siddall, Confederation Life Building, has awarded the general contract to M. Manley, 1058 College street.

Toronto, Ont.—The Williard Chocolate Company, Limited, Spadina avenue, are erecting a factory on Wellington street, to cost $80,000, and their architects and general contractors, S. L. Yolles and H. Rotenberg, 67 Baldwin street, have awarded the following contracts: Plumbing and heating, A. Welch & Sons, 304 Queen street west; elevators, Otis-Fensom Elevator Company, 50 Bay street; electric wiring, J. E. Myers, 4 Gould street. Davis & Mehr, Union Bank Building, are erecting a warehouse on Spadina and Grange avenues, to cost $100,000, and have awarded the general contract to J. G. Kent and Thos. Essery, Confederation Life Building.

Windsor, Ont.—The Maxwell Motor Company, Detroit, are erecting a factory on Tecumseh road and McDougal avenue, to cost $130,000, and have awarded the general contract to R. Westcott & Co., Chamber of Commerce Building.

PUBLIC BUILDINGS AND STATIONS.

London, Ont.—The Canadian Pacific Railway are rebuilding their station at London, Ont., at the cost of $15,000, and have awarded the general contract to G. Hayman & Sons, 432 Wellington street. Mr. M. Williams is the local superintendent.

Sudbury, Ont.—Plans for the new library building for the town of Sudbury, to be erected at the corner of Elm and Lorne streets, have not yet been prepared. The building will not be erected until next year.

Sarnia, Ont.—The Pere Marquette Railway have purchased a site on Clifford street for the erection of a station.

RESIDENCES, ETC.

Ford City, Ont.—C. J. Montreuil, Ford, Ont., is erecting a bungalow on Sandwich street, to cost $10,850, and his architects, G. Jacques & Co., Hydro Building, Windsor, have awarded the following contracts: General, E. Jacques, Assumption street, Windsor, Ont.; mason, George Sewell, 219 Ouellette avenue; carpenter, E. Jacques, 87 Assumption street; stone work, Maul & Rigg, McDougal street; plastering, John Reid, 158 Goyeau street; painting and glazing, J. Lauckner, 69 Sandwich street west; wiring, G. Campeaux, 121 Tuscarora street; heating, J. L'Heureux, 12 Wyandotte street east; plumbing and sheet metal, Windsor Hardware Company, Sandwich street.

Guelph, Ont.—Mrs. Jessie F. Auld, 123 Glasgow street, is erecting a residence on Glasgow street, to cost $7,500, and her architects, Wickson & Gregg, Kent Building, Toronto, have awarded the following contracts: Carpenter, George Scroggie, Woolwich street; electric wiring, W. W. Stuart, Quebec street; plumbing, F. Smith, Quebec street.

Hamilton, Ont.—Crafton & Co., James street north, are erecting a departmental store on James street north, to cost $100,000, and their architect, G. J. Hutton, Bank of Hamilton Building, has awarded the plumbing and heating contract to Adam Clark, 7 Main street. The Pattison Estate are erecting an apartment at the corner of King and Park streets, to cost $15,000, and their architects, Scott & Wardell, Sun Life Building, have awarded the following contracts: Mason, Hancock Bros., 35 Locomotive street; carpenter, Murray & Connor, 158 Victoria avenue south; sheet metal, Thomas Irwin & Son, 22 McNab street south; plastering, Hill Bros., 307 Emerald street north; painting and glazing, George Metcalfe, 16 Park street south; electric wiring, Culley & Breay, 35 King street west; plumbing and heating, Stanton & Mitchell, 159 York street.

London, Ont.—J. Cottam, care of Cottam Bird Seed Company, 87 Bathurst street, contemplates remodelling his store and apartments on Dundas street, at the cost of $8,000. R. H. Dowler, 176 Dundas street, is remodelling his store on Dundas street, at the cost of $10,000, and has awared the general contract to S. Willis, 765 Talbot street.

Ottawa, Ont.—Leon Petergorsky, 351 Chapel street, is erecting an apartment house on Elgin street, to cost $25,000, and has awarded the fire escape and stair contracts to M. Baylin, 96

Nelson street. Lt.-Col. D. S. Street, 227 Somerset street, is erecting a residence on Range road, to cost $10,000, and his architect, W. F. Noffke, 45 Rideau street, has awarded the following contracts: Mason, Lindle & Co., Ottawa; carpenter, F. A. Grieck & Co., Ottawa; plastering, Murphy & Morrow, Billing avenue; painting and glazing, Duford, Limited, 70 Rideau street; wiring, D. Ackroyd, 416 Bank street; marble and tile, A. K. Mills & Son, 191 Sparks street; plumbing and heating, J. T. Blyth, Frank street. Dr. J. F. Argus, 189 O'Connor street, is making an addition and alterations to his apartment house, at the cost of $6,200, and his architects, Taylor & Horwood, Castle Building, have awarded the following contracts: Painting and glazing, G. Higman & Son, 176 Rideau street; electric wiring, P. Ackroyd, 416 Bank street; heating and plumbing, J. T. Blyth, Frank street.

Renfrew, Ont.—Thomas A. Low, Renfrew, is erecting an addition to his residence at the corner of Stewart and Brush streets, at the cost of $10,000, and his architect, W. E. Noffke, Central Chambers, Ottawa, has awarded the tile roofing contract to McFarlane-Douglas Company, 250 Slater street, Ottawa.

St. Catharines, Ont.—A. E. Jenckes, 139 Ontario street, is erecting a residence on Ontario street, to cost $5,000, and his architect, T. H. Wiley, 128 St. Paul street, has awarded the following contracts: Mason, Newman Bros., 75 St. Paul street; carpenter, Nunnemacher & Parke, 5 Dufferin street; heating, John Peart, St. Catharines.

Toronto, Ont.—M. Healy, 153 St. George street, is erecting a residence on Rose Park Drive, to cost $5,000. Jas. Thompson, 31 Farnham avenue, is his architect. Plans have been prepared for a residence for M. Reid, 2341 Queen street east, to be erected on Crown Park road, to cost $4,200. Grimshaw Bros., 24 Brookmount road, contemplate the erection of ten pairs of residences to be erected at the corner of Lockwood and Dixon avenues, to cost $60,000.

Toronto, Ont.—A. D. Langmuir, 2 North street, is erecting a residence on North street, to cost $8,000, and his architects, Denison & Stephenson, 18 King street west, have awarded the following contracts: Mason, G. T. Cayton, 56 Lyall avenue; carpenter, J. C. Scott Company, 106 River street; painting, A. E. Phillips, 49 Richmond street east; plastering, A. Petrie, 457 Roxton road; tile, Canada Glass, Mantel and Tile, Limited, 328 Carlaw avenue; sheet metal and roofing, A. Mathews, Limited, 256 Adelaide street west; plumbing and heating, A. Wright, 3 Gerrard street east. W. P. Levack, 159 Roxton road, is excavating for his residence on High Park avenue, to cost $5,000, and has awarded the plumbing contract to Wm. Howard, 74 Borden street. Plans have been prepared for a residence for Wm. Scott, 125 Mutual street, to be built on Victor avenue, at the cost of $5,000. The excavation has been commenced on stores and apartments for E. D. Morris, 2167 Queen street east, on Queen and Wineva avenue, to cost $25,000. Architect W. G. Hunt, Confederation Life Building, has prepared plans for a residence for Mr. Crawford, Toronto, to cost $6,000. C. F. Wagner, Toronto, is erecting a pair of residences on Bellefair avenue, to cost $5,000, and has awarded the following contracts: General, J. T. Moore, 34 Brookmount road; plumbing, Fiddes & Hogarth, 122 King street east. G. H. McLaughlin, 48 Hogarth avenue, has excavated for a pair of residences on Millbrook crescent, to cost $8,000. Wm. Vokes, 228 Rusholme road, is excavating for a duplex residence on Rusholme road, to cost $6,000. L. Gelber, 133 Lowther avenue, is erecting a residence on Lowther avenue, and his architect, J. A. Thatcher, 37 Cowan avenue, has awarded the following contracts: Mason, J. McMurren, 19 Roxborough road; carpenter, C. Gallichan, 62 Dovercourt road; painting, Bavington Bros., 48 Glenlake avenue; heating, W. Schulkins, 932 College street. W. H. Cawthra, 60 Forest Hill road, is making an addition and alteration to his residence, at the cost of $11,000, and his architects, Eden Smith & Sons, 33 Scott street, has awarded the following contracts: Mason, T. & A. G. Ham, 83 Salem avenue; carpenter, Robinson & Wilson, 34 Alcina avenue; plastering, W. H. Little, 62 Tranby avenue; roofing, G. M. Byron, 503 Yonge street; painting, F. G. Roberts & Co., 106 Wells street; wiring, R. A. L. Gray & Co., 85 York street; plumbing, Fiddes & Hogarth, 122 King street east; heating, Jos. Morrison, 8 St. Mary street; hardware, Canada Hardware Company, Limited, 39 Richmond street east.

Windsor, Ont.—Charles Jessop, 75 London street west, is erecting a residence on Caron street, to cost $5,000.

SCHOOLS, ETC.

Apple Hill, Ont.—Architects Millson & Burgess, Union Bank Building, Ottawa, Ont., are preparing plans for a church to cost $20,000, and have awarded the general contract to Alex. Cameron, Alexandria, Ont.

Brantford, Ont.—The Polish Roman Catholic Church contemplates the erection of a church on Terrace Hill.

East Toronto.—The trustees of Separate School Board No. 7 are erecting an addition to a school at the cost of $22,000, and their architects, S. B. Coon & Son, Excelsior Life Building, have awarded the following contracts: Mason, steel work, concrete and composite floors, R. Chalkley & Son, 34 Victoria street; carpenter work, plastering, painting, wiring and roofing, Hudson & Mosley, 5 Jerone street; heating, Sheppard & Abbot, 78 Harbord street.

Hamilton, Ont.—St. Luke's Church are erecting a parish hall at the corner of John and MacAuley streets, to cost $12,000, and their architect, W. G. Brown, Clyde Block, has awarded the following contracts: Sheet metal, H. Trewolla, 729 Cannon street east; painting and glazing, E. Scoffin, 520 St. John street north; heating, Burrow, Stewart & Milne Company, Cannon street east. The Township of Barton are making an addition to a school at the cost of $25,000, and their architect, J. A. Armes, 183 Bold street, has awarded the general contract to Isbister Bros., 811 King street east.

Kingston, Ont.—The Regiopolis College contemplates the erecting of a boarding school, to cost $50,000.

London, Ont.—The Provincial Secretary's Department, Parliament Buildings, Toronto, are making repairs to the Asylum for the Insane at London, and have awarded the general contract to Jones Bros., Hamilton road, and the slate roof contract to Charles Riddle, 119 Wellington street, St. Thomas, Ont. Architect W. G. Murray, Dominion Savings Building, is preparing plans for a school for the school trustees of Westminster Township, to cost $10,000.

London, Ont.—Architects Watt & Blackwell, Bank of Toronto Building, are preparing plans for a women's pavilion at the Byron Sanitorium, to cost $10,000, for the London Health Association, London, Ontario, and have awarded the general contract to R. G. Wilson & Son, 193 College street, and the carpenter contract to J. Moran, 921 Maitland street. The Military Hospital Commission, Ottawa, are preparing plans for a school to be erected at the Byron Sanitorium, to cost $10,000.

New Toronto.—The Public School Board of New Toronto contemplates the erection of new schools.

Perth, Ont.—The Public School Board of Perth, Ont., are making improvements to a school at the cost of $30,000, and their architects, Ellis & Ellis, Manning Chambers, Toronto, Ontario, have awarded the plumbing and heating contracts to W. G. Butler, Gore street, Perth, instead of to J. T. Blyth, Frank street, Ottawa, as previously reported.

Simcoe, Ont.—The Western Suburban School Section contemplates the erection of a new school on Glazebrooke property.

St. Ferdinand, Que.—The Les Soeurs de la Charite, St. Ferdinand, Que., will erect a convent, to cost $80,000, and their architect, J. S. Bergeron, 103 St. Jean street, Quebec, has awarded the following contracts: Mason, Charles N. Paradis, Quebec; carpenter, Poudrier & Boulet, Black Lake; heating and plumbing, O. Picard & Fils, Quebec; sheet metal, Eugene Falardeau, Quebec.

Thornhill, Ont.—The Public School Board of Thornhill con-

GLIMPSE OF GARDEN AT GOVERNMENT HOUSE, TORONTO.

templates the erection of a school, to cost $20,000, and have commissioned James, Louden & Hertzberg, architects, Excelsior Life Building, Toronto, to prepare plans.

Toronto, Ont.—The Women's College and Dispensary, 125 Rusholme road, are erecting an addition to their hospital, and their architects, Gordon & Helliwell, Confederation Life Building, have awarded the following contracts: Mason, Thompson Bros., Ryrie Building; carpenter, D. McMurren, 66½ Hayden street; heating and plumbing, Sheppard & Abbot, 78 Harbord street; plastering, Hanna & Nelson, 273 Rusholme road; fire escapes, Canada Ornamental Iron Works, 88 River street; terrazzo, Italian Mosaic and Tile Co., 429 Spadina avenue. Architects Burke, Horwood & White, Ryrie Building, are preparing plans for a church and Sunday school for the Weston Road Baptist Church, to cost $20,000, to be built on the corner of Silverthorne and Rowantree avenues.

CATALOGUES and BOOKLETS

Booklet on Tin Plate.—The American Steel Export Company has recently published a sixteen-page illustrated booklet thoroughly describing in a most concise way the practice of American makers of tin plate. The chief object of the booklet is the elimination of the confusion existing in the export trade, because of the difference in the methods employed in the various countries where this commodity is manufactured. It deals first with a brief history, then the process of manufacturing. Numerous pages are devoted to the proper placing of orders, the exact method of figuring prices and the usual method of packing for export. So far as can be learned this is the first time that any information of this character has been issued, and the booklet should meet with considerable approval.

War-time Economy in Steel Equipment.—Steel lockers and factory equipment is usually considered for purchase chiefly on the grounds of its being modern, fireproof, indestructible, sanitary and of good appearance.

In these days of war saving, however, the economical side comes more prominently to the fore. Steel lockers effect a positive and noticeable economy wherever installed. They save in ultimate cost, because they are unbreakable, consequently do not have to be either repaired or renewed. They save in floor space—a valuable consideration. They save in time otherwise lost by employees looking for a safe and suitable place to bestow clothing, tools, etc. They stop petty thefts and prevent trouble with and among the help.

The chief aim in the ever-growing "welfare movement" in this country is to so provide for the health, comfort and convenience of work people that they will be more attached to the firm employing them, more contented in their positions; therefore easier to handle and less liable to change.

The firm or individual providing the best accommodation for help will most assuredly obtain the choicest class of employees—a further decided benefit, and a factor well worth considering, in view of the general scarcity of help.

Every employer who is anxious to conduct his plant, store or institution on lines of war-time economy would be well advised to write The Dennis Wire and Iron Works Co., Limited, London, for their illustrated catalogue.

THE PROBLEM OF CONSERVATION IN OFFICE PRACTICE.

While efficiency, which may be termed conservation gone mad, has become epidemic, and has led to "following copy out of the window," as printers would term it, in a considerable part of the business world, the golden mean, conservation, still stands for prudence, order and consequent success in the conduct of business affairs. Nowhere is this element of system so necessary, and so little observed, as in the offices of the average architect. Those offices in which volume of business has in a measure supplanted artistry and study of design and effect, have of necessity adopted systems of procedure, but by many even the need of definite office hours and the employment of a stenographer is not realized. Not alone temperament, but many other circumstances are responsible for this lack of order in the conduct of the business end of the profession. The pure gambling nature of his work is largely the starting point from which other irregularities grow. December and January has found the office bare of work and little prospect in sight. A consequent dropping of the hardly acquired and organized office force follows. March brings many "prospects" and a search for draftsmen. May too often finds these prospects "put over till next year," and others hanging, until the question of reduction again becomes a serious problem. This leads to a general disorganization that affects every department of the office procedure. There are, however, a few conserving rules and methods by which the meeting of both ends through the elimination of waste may be effected in most offices. First, a card index for recording jobs and their office cost and other definite details is a business requirement that too few architects realize. Second may be placed the absolute rule that no sketches, no advice, be given a prospective client until a contract has been signed by him and a fee charged for such preliminary work. Third may be placed the absolute rule to avoid competitions except when paid for without regard to the success in their adoption. The following of these rules will eliminate the accumulation of an unnecessary and largely unremunerative office force, and also give time to look up work that will keep the regular organization employed in the slack periods of the year. This procedure makes for steadiness in the office work, and, while it reduces the volume of its output, it conserves its executive strength. It eliminates as far as possible the element of fluctuation, which is fundamentally the losing factor in achitectural practice.—The Western Architect.

John Watson & Son, Limited, Montreal, have been awarded the following contracts for metal and architectural iron works: New Toronto Terminal Station, Toronto, Ont.: Canadian Northern Railway Station, Montreal, Que.: American Canadian Factory, Montreal, Que.; Power House, Lennoxville, Que.; Aird's Bakery, Montreal, Que.; Consumers' Cordage Co., Montreal, Que.; ten-storey building, Greater Montreal Land and Investment Company.