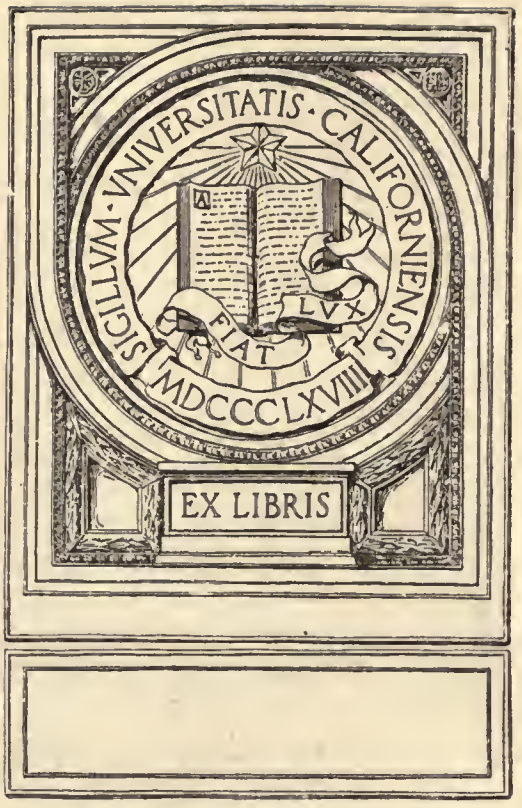
GARAGES

Country and Suburban

THE AMERICAN ARCHITECT
NEW YORK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Garages

Country and Suburban

A Series of Authoritative Articles

ON THE

Structural Features of the Private Garage and Its Equipment

The Care of the Car, the Safe Handling of Gasolene and Topics of Interest to the *Owner* and *Driver*.

To which is added *more than eighty illustrations* of Garages of recent construction, showing both exterior and interior views and floor plans together with architect's working drawings for a

TYPICAL GARAGE

THE AMERICAN ARCHITECT
NEW YORK

GARAGE, WITH CHAUFFEUR'S AND COACHMAN'S COTTAGES, BRISTOL, RHODE ISLAND
Messrs. Kilham & Hopkins, Architects

The Private Garage

By W. H. K. and J. C. H., *Architects*

THE coming of the automobile has introduced a new phase into the architect's daily work. The smart, shining, highly developed machine, quick, accurate and efficient, full of the very essence of modernity, with its irrepressible and confident chauffeur, seems to require more "chic" accommodations than did even the smartest horses and vehicles of the last generation. The age of the automobile is the age of cement, of high efficiency electric lighting and of the banishment of germs and crevices which harbor them. The garage must be modern, light, shining and not only clean, but free from any possibility of harboring dirt in any form. So, though the architect may still affect the homely and reliable bicycle as his own personal mode of locomotion, he enthusiastically approves the change in habits of clients which makes necessary the designing and providing of a new type of building.

This article assumes that it is written for the class of owner who desires a well developed building which will be an ornament to his place as well as a mere housing for his machine. One automobile can be protected from the weather by a building costing from $300 up, or possibly even less. The writers know of garage, not without a certain "style," that was even built for $100, but the owner who is looking for a substantial and reasonably fireproof structure should be prepared for a larger expenditure. If the house and other buildings of the owner possess any particular architectural quality it would seem reasonable that the garage should harmonize with them, but if the other buildings are not of any special type the owner is free to choose his materials and style.

At the outset it may not be amiss to refer to the subject of placing the garage on the site and the laying out of the roadway that approaches it. As

REAR OF GARAGE AT BRISTOL, R. I.
Messrs. Kilham & Hopkins, Architects

commented on elsewhere, in the one-car garage, the shifting about of the car has to be done out of doors. As a rule, the car when returned to the garage will be run into the building "head first." When it is wanted to run the car out again, it will be necessary to back it out and turn it. Sometimes, owing to lack of ground space or improper laying out of the road, the car will have to be backed from the garage to the street. While this may not be difficult for a man, it often happens that the women of his family use the car, and it would be difficult and inconvenient for a woman to get the car out of the garage and pointed in the right direction.

It will therefore be seen that it is necessary to provide a space, laid out as a road, in front of the garage to give sufficient room to turn the car, or else, perhaps, install a turntable.

The size and character of the garage is influenced in many ways. It may vary from one to house a single car, a box-like structure without architectural treatment, to a more pretentious building providing accommodations for a number of cars with living quarters for the chauffeurs, their families and assistants.

Whether the owner's house is already erected, and the garage is built later, or whether it forms one of a group of buildings, the materials used and the design employed would, under ordinary conditions, correspond to that of the house. It is therefore not possible to set down any fixed rule of style or material to be used. These matters can only be determined by the architect after he has studied the local conditions. There are, however, some general observations as to available and suitable materials, and features of planning, that it may not be unprofitable to consider. Even in the simplest form of building these will apply—they are the result of the experience of owners and drivers of cars. To ignore them would be to invite inconvenience and expense.

While, as indicated, the choice of materials used in construction will naturally correspond to those used in the house and other dependent buildings, it must be borne in mind that all garages are storage places for gasoline, oil and other combustible materials. The building, therefore, if a permanent structure, should

be absolutely fireproof. Not alone because it must afford protection for its contents, but also on account of its usual proximity to other buildings it presents a serious "fire hazard" that materially affects the rate of insurance on all contiguous buildings. The ideal garage would be one using absolutely no combustible material in its construction. With Portland cement, hollow tile blocks and a great variety of brick available in most localities and at moderate cost, the problem of materials for the exterior walls of the garage seems practically solved, and the adaptability to certain schemes of ornament of these and other fireproof materials permits the architect to combine with the essential qualities of a strictly fireproof structure much good architectural detail. He may thus evolve a structure that will be more than merely utilitarian.

While the size of the building will, of course, vary, according to the importance of the owner's establishment, the provision of room for the visiting car or cars should never be omitted. Even where the owner is sure that he will never own but one car and that the visitor's car can go to the public garage, he should always be urged to provide more than enough room for his actual needs, for the second car follows easily after the first, and the friend's car will generally want to stay near its owner. The writer's firm has had a large experience in the planning of garages and has never known this prediction not to come true. The garage should always be planned to contain the largest size cars. A large touring car requires a space about 7 feet by 18, and should have not less than three feet all around it under any circumstances, especially if one cares for his own car. To this should be added space in the apparatus room for the lockers, where blankets, coats, etc., are kept—for the gasoline pump, and room to turn in going out, in case the door is not directly in front of the car, so that a width of 21 feet is advisable for a two-car building.

A fairly good and economical type is to build of thin brick walls with buttresses at corners and junction of interior and exterior walls, each space separated and used for one car only. This allows expansion and the use of the different compartments for shops, storage or even to stand a horse and carriage or visitor's automobile. By the use of the brick interior walls the roof is easily supported without expensive trusses or girders and can therefore be built in lightest possible manner. These interior brick walls make the spread of fire impossible.

Another good method for inexpensive but substantial construction is that shown by the detailed drawings of Mr. Anthony's garage at Beverly Farms. Here the concrete foundation is carried up in finished form two feet or so above the floor. This makes the lower part of the walls (where gasoline vapor might collect) reasonably fireproof and saves much wear and tear on plaster or wood. Above the concrete the walls may continue in frame.

In cities or closely built suburbs where it is necessary to build close to the line of the lot the local ordinances generally prescribe fireproof construction for garages. The photograph of the garage in Brookline, Mass., shows a type of construction adapted for great economy of space. The walls are built of three-inch T-irons filled with porous terra-cotta block—wire lathed and plastered outside and inside.

Planning the Exterior Walls and Roof

CONSIDERING the building as a strictly fireproof structure, the different materials available in most localities would be about as follows:

Stone, either field stone or dressed.

Brick, or a combination of brick and stone.

Hollow hard burnt terra-cotta tile.

Light steel frame construction, with wire lath and stucco.

Concrete, either in the mass or with or without reinforcement of rods or fabric.

Concrete hollow tile and concrete blocks.

These or such combinations as the architect may decide on are all available. In the choice of materials, the architect and his client would be influenced by cost, in addition to the considerations already referred to. This would depend on the facility of getting material and the cost of labor. In some sections it is not yet possible to find labor sufficiently skilled in the technology of concrete to make it a safe and economical material in construction.

While the small, one-car garage may not be more than a simple, box-like structure, even here there are essentials of locating and proportioning the window and door openings that it is of importance to consider. It will be remembered that the modern gasoline or electrically driven vehicle is a complex machine, and to insure its highest efficiency must have the best of care. Not only should it be cleaned frequently, but it should be carefully overhauled to keep its parts in such condition that the best service will ensue. Even in the smaller garage there must be room to get about on all sides of the car, and the light should be so arranged that it will facilitate every necessary operation. The door openings should permit the entrance of the car with its top up to its fullest height, and the window sills sufficiently low that the entering light will

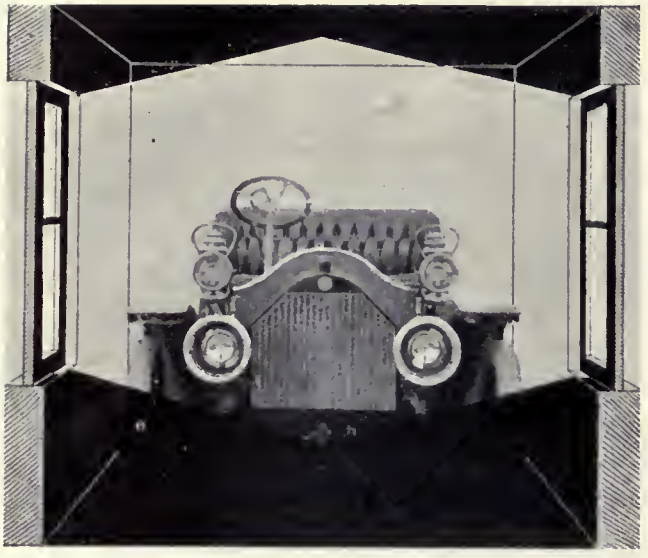


Fig. 1—Presents a narrow structure, with the windows the customary height, showing inefficient illumination with the machinery part in the darkness.

reach entirely under the car body without throwing heavy shadows. Daylight is the cheapest thing known and the only thing of which the price has not "gone up," and no owner should be compelled to burn electricity on account of the lack of windows in his garage. In case skylights are used, provision should be made for shades, so that the hot sunlight may not blister the finish of the cars. With reference to the height of window sills, Figs. 1, 2 and 3 illustrate how important it is to give attention to locating the sills.

The roof of the garage should be of slate, terra-cotta tile, tin, copper, asbestos shingles—some incombustible composite or fire resisting material.

Of course, the garage should have some means of

Fig. 2—The width of the building in proportion to the width of the car is such that the light strikes the floor outside of the line of the wheels with a good lighting effect.

natural ventilation aside from that furnished by the windows. Inlets along or just above the floor levels, with outlets near or in the ceiling, are the approved form. It will not do to overlook this most important feature, as aside from the necessity for carrying away gasoline vapors it insures easy and economical heating of the interior.

Doors

THE entrance doors should be nine feet, or nine feet six inches wide, if possible, with heavy guards to prevent the hubs from striking the jambs in case of bad steering, and with horizontal rollers set in the floor, in case the door slides, to keep the bottom in place. In calculating the height of a door it is well to remember that a limousine with a trunk on top may well be eight feet high or more, and something more must be allowed for the car tilting up

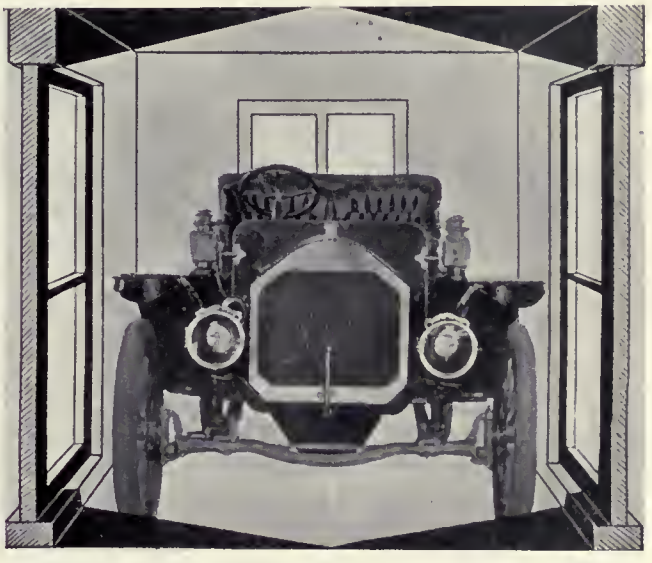


Fig. 3—A narrow structure with the windows passing down almost to the floor line and lighting up the machinery portion of the automobile.

in going up over the threshold, as shown in the illustration, Fig. 4. Our own practice is to keep on the safe side and never make a door less than nine feet high. A small door at the side saves opening the large heavy doors when it is not desired to take out the car.

Interior Materials Used in Construction

IN small garages, used for gasoline automobiles only, the cement floor will be the logical choice. This should be constructed in the most substantial manner, and, as it will probably rest directly on the ground, care must be taken in its construction to pre-

vent upheaval by frosts or sinking by reason of faulty workmanship or shallowness of construction. The cement floor is permanent, and while its surface may be easily repaired, radical changes would be expensive. It will be necessary to anticipate certain details of floor construction in order to secure the best results.

Ignoring the possibility of the construction of a pit in the floor, this feature being left for future discussion, and as the care of the car, particularly its washing, must be provided for inside the garage, some provision should be made to carry off the water. It will be necessary to introduce a drain for this purpose. This drain in the small garage may be of the "blind" type. The floor should be slightly "dished," the drain outlet in the center. Converging grooves in the floor will not be necessary—in fact, they should be avoided, as they form lodging places for oil and dirt and consequent untidiness of the interior.

The dishing of the floor should be so arranged that the car will never stand on a side slope. The interior finish of the private garage may follow the principle of the so-called "sanitary trim" of modern houses, particularly in kitchens and pantries, where all right-angled corners are avoided, and the floor and ceiling angles rounded to permit perfect cleaning. The finish of the interior walls would naturally depend on the character of the materials used on the exterior.

Projections for shelves and closets, that might interfere with the entrance and exits of the car, should be avoided. These necessary features are best placed along the rear walls, or if on the side walls, as far towards the rear as possible. All lockers, shelves, racks and similar utilities should be of metal. As many firms supply this line of fixtures their cost is not prohibitive, and as the added feature of safety from fire is important, and as they are practically indestructible, it is urgently advised not to use wood for these essentials.

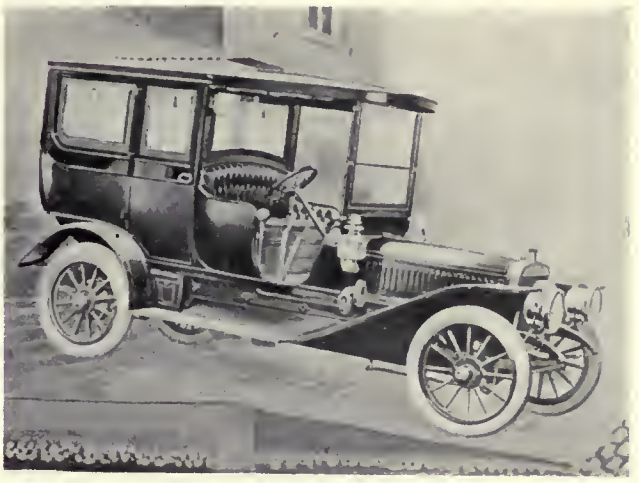


Fig. 4—Showing a limousine passing through the door with the front wheels on the runway and an incline such as will cause the back of the limousine to strike the top of the door framing.

To avoid as far as possible during hours of daylight the use of any form of artificial light, the interior walls should be light and reflective in color, preferably white, that the interior may be as bright as possible. Dark corners are to be avoided, not only because they are the places less liable to be kept clean, but for the further good reason that one never knows just what part of the car may demand attention. A well lighted garage, even of the smallest, is much to be desired.

For the walls, white, glazed tile would be ideal.

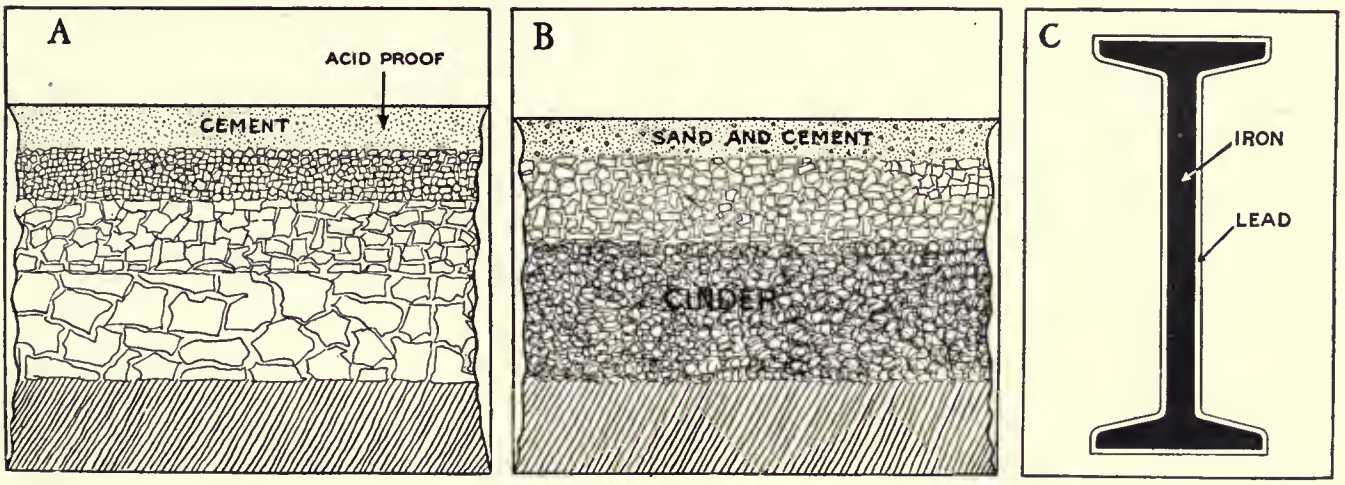


Fig. 5—A presents an acid proof cement floor employing neat cement for the top layer, and broken granite with cement beneath. B, cement floor using ordinary cement on a cinder bed when gasoline automobiles are stored. C, lead sheathing over ironwork to render it acid proof in an electrical garage.

This carried up as a wainscot to about five feet, with the remaining wall surface either of white cement or cement painted white, makes a good interior finish.

All wall and ceiling surfaces should be as non-absorbent as possible ,so as not to hold the dampness created in washing and to prevent the staining consequent on the careless handling of oil and waste. Cleanliness is a first essential in the care of the motor car, and every feature of construction that insures this is important.

Floor of Garage for an Electric Automobile

SHOULD the garage be devoted to the storage of an electric automobile, if the battery is of the lead-lead genera, and provided it is to be charged by means of a suitable equipment attached to the garage, there is an excellent opportunity to induce a relatively high depreciation of the floor, in view of the fact that the sulphuric acid electrolyte used in the battery will attack ordinary grades of cement, and if this condition goes on sufficiently, the floor will be destroyed.

To get around trouble of this sort, the plan as indicated in Fig. 3 may be accepted. In this plan, the lower strata is broken granite, coarse at the bottom, and tapered off to sizes which will pass through a one-inch mesh, the whole occupying a depth of say four inches. The next layer is made up of broken granite in sizes which will pass a ¾-inch mesh and is grouted down, using acid-proof cement in fine granite screenings for the layer next to the top to a depth of possibly two inches, and finally neat acid-proof cement to a depth of three-quarters of an inch for the top coat. Fig. 5 shows how iron work may be protected from the corroding effect of acid and its fumes, which come from charging the battery; the plan comprises sheathing over the iron work with thin sheet lead. In a small establishment this sort of thing should not be necessary; iron work may be avoided.

If the building is well ventilated the question of the acid action on the surrounding metal will be lessened in any case, but it is necessary to settle a matter of this sort when the structure is being planned.

The Pit

WHILE the introduction of a pit into the floor of the garage may present some good features of utility and convenience, it is well to keep in mind that it also serves as a lurking place for gasoline vapors. It will be necessary when constructing the pit to give due regard to this. It is important that all corners of the pit should be rounded so that it may be cleaned thoroughly. Proper drainage should be provided with ventilating inlets at the bottom to insure sufficient motion of air to carry away the gasoline vapors that would otherwise lurk in the bottom of the pit. A side exit should always be provided if possible, as several bad accidents have been caused to men caught in a pit by an explosion and unable to escape. This exit is readily arranged for when the building is on a side hill. It is also important that the drain in the bottom of the pit should be properly trapped. In a small private garage the best way to avoid complications is to do away with sewer connections. If for any reason one is desirable, it will be well to give attention to a suitable trap, having in mind the fact that gasoline vapor is sure to form in the sewer

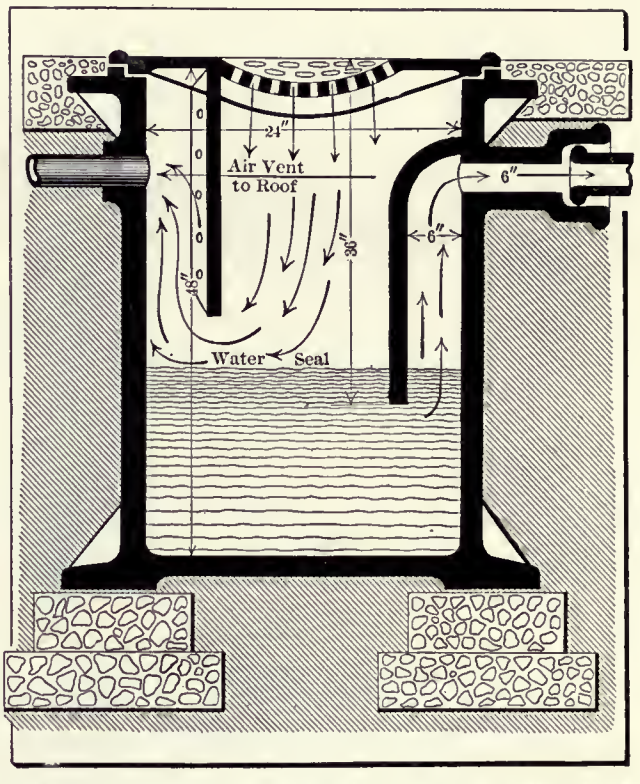


Fig. 6—Well hole so shaped as to serve as a safety trap at the sewer opening in a garage, with means for preventing gas from entering the sewer, and a draught pipe to dispose of the gas.

openings, and when accumulated in sufficient volume presents a source of much danger.

Fig. 6 shows a form of "well" particularly adapted to public garages. It has been demonstrated as correct and a smaller and equally efficient trap may be constructed embodying these principles to meet the requirements of the private garage. In the example

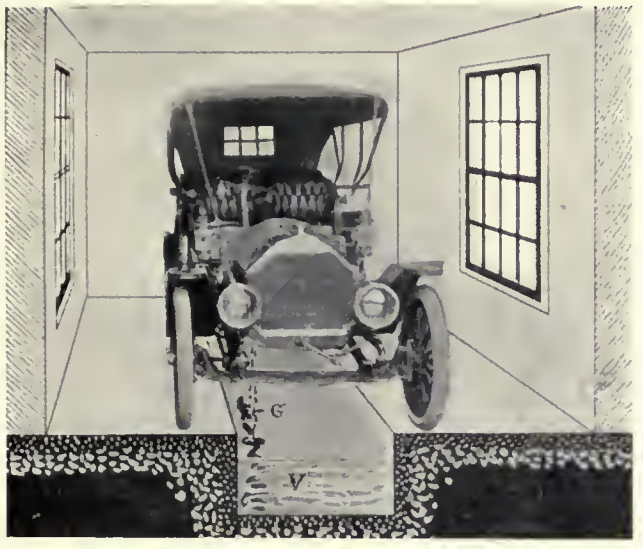


Fig. 7—Section of a garage showing a pit under the automobile to accommodate the workman and to trap in accumulations of explosive mixture.

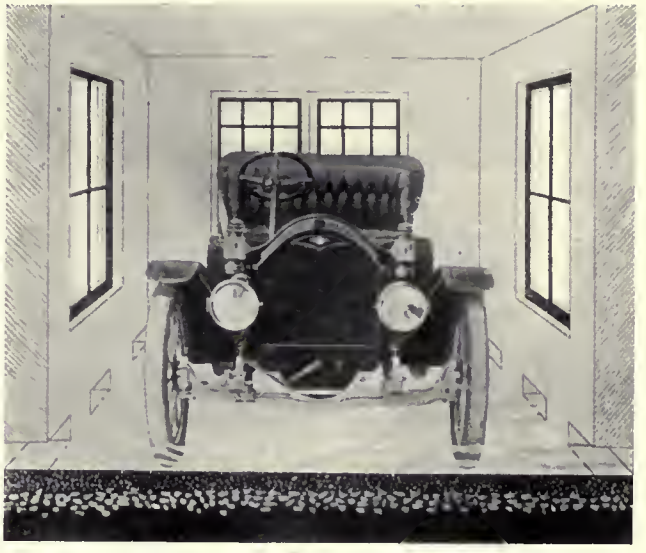


Fig. 8—Garage floor without a pit; openings in the walls near the floor, mixture of air and gasoline being swept away by air currents which are formed by draughts set up.

illustrated the cover of the "well" is perforated, the floor is supposed to slope toward the well, and when water drains into it from the surrounding floor, it passes down and forms a seal; excess water will then pass out through the sewer connection. By connecting the lead from the air vent to a stand-pipe, which should lead to the roof of the structure, a current of air will be set up and the gasoline vapor will be conducted up to the roof, and thence to the outer air. In a private establishment, especially if it is in the wooden district, with little room to spare, all the precautions as here intimated and many more, as set forth in the various insurance rules, as promulgated by the Board of Fire Underwriters for the respective districts, should be observed.

In locating the pit in the floor of the garage, it is well to select a place where it will not, while open, interfere with the maneuvering space. As the pit is constructed primarily to give easy access to the underbody of the car, it may be located near the side walls. A feature often lost sight of is provision for entering and leaving the pit while the car is over it. To crawl out of a pit during use is difficult, and also unnecessary, if proper attention is given at the outset to this feature. A good size for the pit is 10 ft. by 3 ft. 6 in. and 4 ft., or 4 ft. 6 in. deep. Seats in each side are a convenience for the mechanic, and may be 18 in. high and 12 in. wide. This length is such as to admit of a short flight of steps to reach the bottom, making it possible to move the car backward and forward, often very desirable. While it is economy to have the fewest possible tools, it is often well to have duplicates so that they may be near at hand. It would, therefore, be well to have certain tools in the pit and a place to keep them. This may be easily arranged by a pocket or recess in the side wall of the pit, protected by a door or cover in which to store such tools as experience teaches are most likely to be required. One owner has in the end of his pit an oaken board about eight inches wide, serving as a bench, on which is a small vise to hold parts that it is often necessary to give some minor attention in adjustment. This obviates many trips to the bench and loss of time.

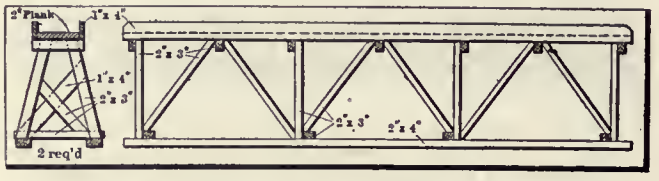
If the garage is situated on a side hill, as, for example, some of the buildings illustrated, the pit question becomes a simple one. In fact, it ceases to be a pit, for a trap door in the floor is all that is necessary, which with a platform below the proper height, or one with a series of steps to provide for varying heights and reaches, easy access to the under parts is obtained. This perhaps is the best arrangement that can be devised. In the basement would also be an ideal place for the workshop and tools, but it will, of course, be necessary to provide for light and insure against dampness.

There have been many ingenious devices introduced in garages by owners whose mechanical bent makes the care of the car one of its most interesting features. These men, as a rule of professional and commercial activities, find mental relaxation in this mechanical exercise.

An improved movable trestle, to do away with the pit, is described and illustrated in a recent issue of The Automobile; we quote: "The necessity for a pit

not being realized until after the house had been built, a pair of comparatively small and light horses were built, or more correctly, a pair of trestles. These were 31 inches high and built strongly enough to support a car, the length being just sufficient to care for the whole length of the car.

"Of course, this was flat on top so that the car would stand on it of itself. So some method of getting the car up onto the top was necessary. For this purpose another short, inclined pair of trestles were built. Then to get the car onto the 'pit' the two sets of flat topped trestles were drawn to the center of the floor. Next the two inclined members were set into

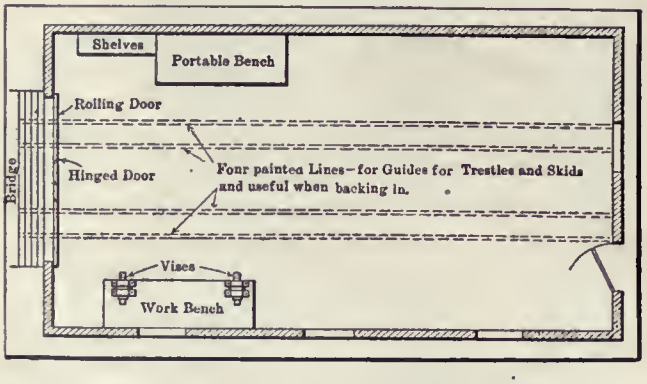


Trestle with Flat Top Which Serves as a Pit.

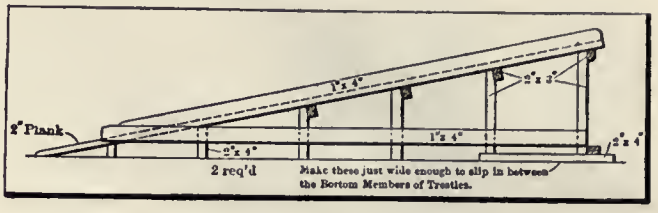
place in the front, and the car could then be driven onto it.

"In this position it was just high enough to permit working under the car, but since this meant much stooping and looking upward, one of which was hard on the back and the other tiresome to the eyes and neck, the owner built a reclining chair. This he used as a seat, pulling it under the part of the car upon which he wanted to work, or removing it when there was no necessity for it. The back of this was adjustable to any inclination, which was very handy at times, and being simple, could be altered very quickly, to suit the needs of the occasion. It is shown in detail in the illustration.

When there was no work to be done upon the car the four trestles and the seat were set acide in a corner or elsewhere, the size of the house allowing room for



it. In this way the whole floor was kept unbroken by openings. In addition, it left the whole floor for maneuvering space. Being practically indestructible, the whole outfit could be carried outside if at any time



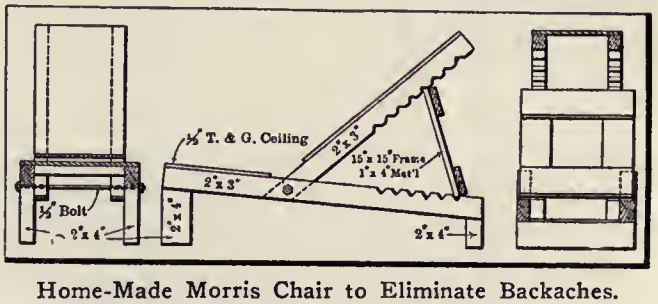
Trestle with Flat Top Which Serves as a Pit.

it was desirable or advisable to use the whole interior for cars, as in the case of several visiting cars."

The Handling and Storage of Gasoline

SAFE handling of fuel in the private garage is difficult and requires constant care. A writer in The Automobile discussing this subject states:

"If it may be taken for granted that the 'hand-to-mouth' method of obtaining gasoline is not a good one on the ground that it has its decided uncertainties, even so, the Board of Fire Underwriters will object to the presence of more than ten gallons of gasoline in a garage, unless provision is made for its proper storage.



Home-Made Morris Chair to Eliminate Backaches.

It will also be remembered that the cost increases substantially 50 per cent when the fuel is purchased in ten-gallon packages, instead of by the barrel; then, too, it is a better grade of fuel as a rule which comes in the original barrel.

"Fig. 9 shows the customary manner of disposing of the fuel problem. A steel fuel tank is buried outside of the building line of the garage, and a supply pipe is led from the tank to a measuring pump, which may be placed at any convenient point within the building. The pump should be free from leaks, so that gasoline will not be spilled about, or else it should be placed in a suitably contrived fireproof closet with proper means of ventilation. All these details, in any event, will best be cared for by consulting the rules and regulations of the Board of Fire

INTERIOR OF GARAGE FOR MR. BERNARD JENNY, JR., BROOKLINE, MASS.
Messrs. Kilham & Hopkins, Architects
Showing work bench, tool case, revolving auto washer, telephone and accessories

Underwriters having jurisdiction, and it will be well to remember that the respective boards in the several districts do not always agree as to the efficiency of a plan. Money will be saved by consulting the rules and regulations of the board first, and making the plans in the light of information obtained."

The gasoline pump may be located in a corner near the door connected by a pipe to the tank,* which is buried about thirty feet from the building, but with its filler pipe near the drive, so as to be easily filled from the tank wagon. The measuring pumps are the most satisfactory. A good plan is to have two tanks so that when one is exhausted notice is automatically given to replenish the supply.

*Tank should be thirty feet or more from the building and the filler pipe should be near a driveway so as to be easily reached by the gasoline wagon.

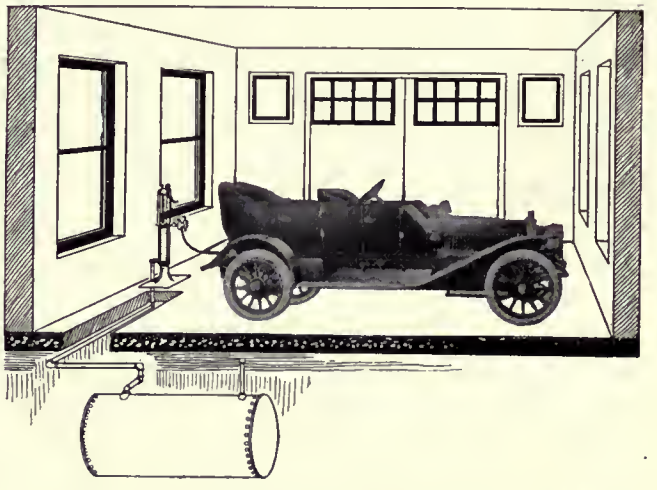


Fig. 9—Section of a garage showing source of gasoline supply, method of piping, and a measuring pump within.

It will be seen that in the method illustrated the only fuel in the building is that contained in the tank on the car. It seems unnecessary to state that this tank should always be closed, as should also the stop cock on the feed pipe. Most accidents occurring from gasoline explosions are due to the carelessness of constant use. Treating it as one would gunpowder or dynamite—as an always dangerous explosive—is the only way to safeguard against explosion and the oftentimes serious attending consequences.

The storage of lubricating oil and greases, while a less serious problem than that of gasoline, is equally important. The quantity kept on hand will depend on the number of cars in use, but even the small quantity necessary for one car should be stored in metal tanks and boxes provided with the necessary faucets and drip pans to prevent its spread about the floor. Perhaps the chief source of untidiness in the garage is the careless handling of oil and waste. For the latter, metal cans with tight covers should be provided, and these should be emptied and their contents burned every day. Spontaneous combustion is a frequent cause of fire, and a waste can, filled with cotton waste saturated with gasoline and oil, presents an ideal method of starting a conflagration.

The Interior Plan with Reference to the Proper Care of the Car

EVERY owner and driver should know his car and how to care for it. To do this properly necessitates a work bench, tools to work with and the proper facilities for their use. Even in the one-car building these utilities should be preferably located at the rear of the garage. The bench should be so placed that the worker will not obstruct the light, and the tools, as few as possible, be above the bench, along the wall within easy reach. Avoid the keeping of tools on the floor.

If a man has the natural ingenuity and ability to

INTERIOR OF GARAGE, BRISTOL, R. I.; VIEW OF WARDROBE
Messrs. Kilham & Hopkins, Architects

work with a few tools, so much the better. They should be of the highest quality—always cheapest in the end.

A good foot lathe and its usual equipment of taps and dies will often enable an owner or competent chauffeur to effect a saving in repairs that will many times repay its cost.

Adding to this the usual equipment that comes with the car and such few additional tools as experience may suggest, the garage is ready to care for ordinary repairs. As the owner gains experience in the care of his machine, it would be advisable to add a vulcanizer. Tire troubles are many, but with a vulcanizer considerable outlay may be saved.

The Work Room

THE work room is an appurtenance which may be classed as a "frill," but which probably develops more actual pleasure to the owner and his chauffeur than the car itself. This room frequently contains the heating apparatus and sometimes a forge—hence, as fire is present, it should always be separated from the apparatus room by a partition wall, of masonry if possible, and if possible by a tinned self-closing door. A good work bench should be installed as part of the building contract, together with a neat cupboard for tools, while the space under the bench may be utilized by cupboards for oil cans, etc., or wide shelves for spare tires. Every motor car owner will have his own ideas as to what machine tools to install in his garage, and a set which pleases one man perfectly will be thought useless by another. The following set, costing about $1,200, erected, is suggested as a practical equipment for a first-class private garage.

One Flather engine lathe, 14 in. x 6 ft.
One Blount grinder, with emery wheel truing device.
One anvil.
One air compressor, with tank, etc.
One Buffalo hand forge.
One one-spindle drill.
One one-horsepower motor for above.
One Coates's breast drill and buffer, with one-quarter-horsepower motor.
Shafting, hangers, etc., for above.

GARAGE AT BRISTOL, R. I., SHOWING PORTION OF MACHINE SHOP
Messrs. Kilham & Hopkins, Architects

The Wardrobe

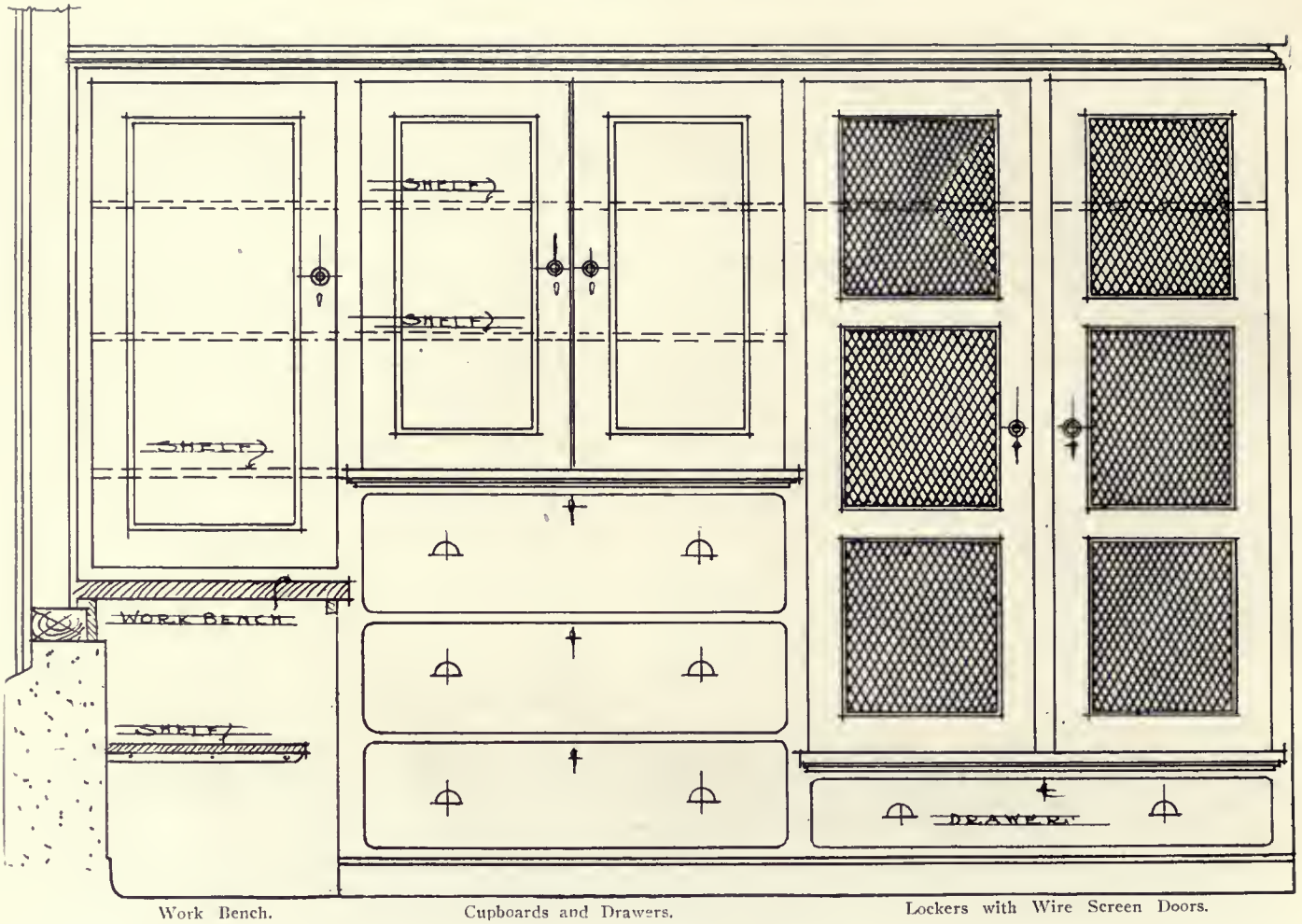
THE automobile requires a wardrobe of its own. Special blankets, coats, hats, goggles have always been necessary *per se,* but now these must harmonize with the color of the car or the "class" of the turnout is lost. With several cars this situation becomes complicated and requires storage space, even in a one-car garage. Somewhere in the building near the door there should be a cupboard with deep drawers for blankets, a closet for motor coats, with shelf for hats, etc., and a compartment for other accessories. Near the sea coast it is well to have galvanized nettings in the doors on account of dampness. Poles for blankets to dry on are placed along the walls.

Plumbing

A DEEP enameled or galvanized sink should be provided somewhere in the building, with a supply of hot and cold water. The hot water may come from a regular system, or may be drawn from a hot water heater, or in simple buildings may be heated in a copper tank on top of a stove.

Over the washing floor is located a revolving auto-washer, the carriage washer of earlier days with a new name—a swinging section of iron pipe with its end turned down at right angles and ready for attaching a hose.

A water closet for the chauffeur (and a bath in case his chamber is located in the building) with a sill cock or two, completes the list of plumbing accessories that are actually necessary.



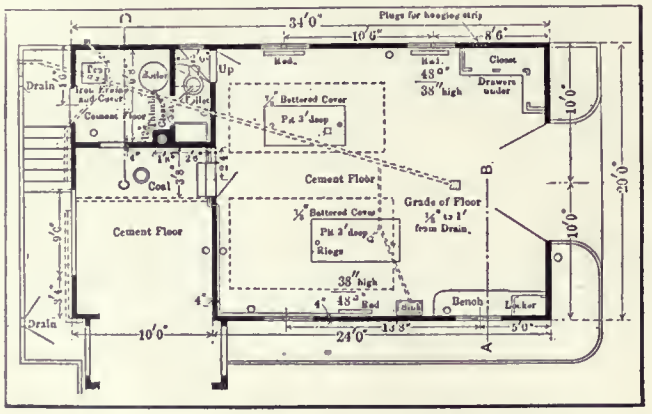
Work Bench. Cupboards and Drawers. Lockers with Wire Screen Doors.

DETAIL OF LOCKERS IN SHOP

Kilham & Hopkins, Architects

Heating

THE proper heating of the garage, is not, as may seem inconsistent to state, to keep the interior warm, although this is of course desirable, but to prevent the water in the jackets from freezing and the oil in the gear and crank cases from congealing.

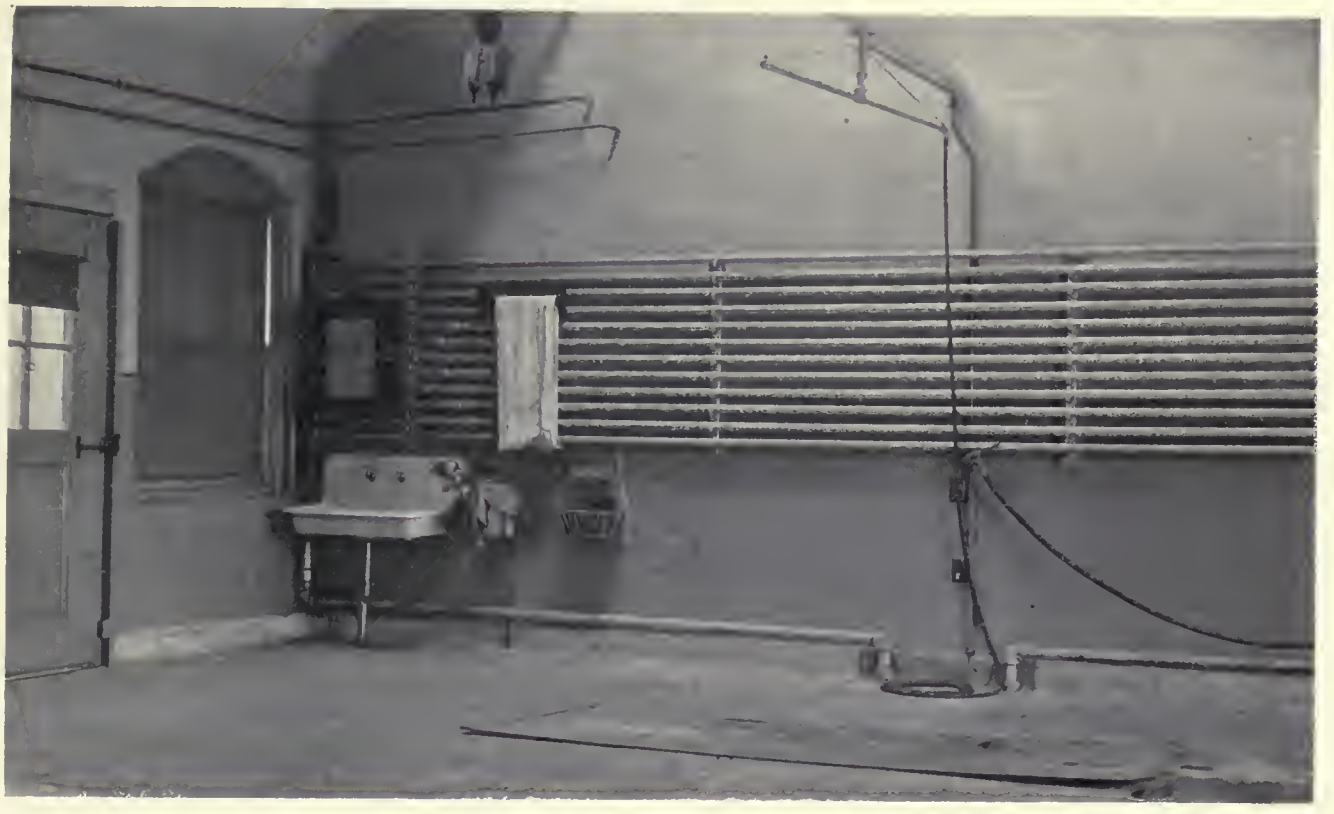


Plan of Two-Car Garage with Complete Heating Plant

The system of heating used in the private garage will of course depend on local conditions. While some owners may prefer stoves, either oil or coal, they are not for obvious reasons to be recommended. The logical means, we believe, is either steam or hot water.

It will be interesting to note how this heating may be handled in two ways, directly opposite in their relation to the house and the garage, both equally efficient. Given a one-car garage on the ordinary suburban lot, it will probably be sufficiently near the house to admit of a pipe run under ground and connected with the house heating system. If the garage is a large one, and space is available, a room might be planned without direct access to the storage part of the garage to accommodate a heating plant that would serve both the house and the garage.

The plan of a two-car garage illustrated on this page shows a complete heating plant. It will be noticed that the radiators are wherever possible located under the window openings.



INTERIOR OF GARAGE AT BRISTOL, R. I.
Messrs. Kilham & Hopkins, Architects
Showing sink, Cooper-Hewitt lamps and auto washer; heating pipes are placed high to avoid splashing

Lighting

AS the electric current is now so generally available for lighting purposes this form of artificial lighting for the interior of the garage will be given first consideration.

There should be plenty of light everywhere about the garage. A good light outside over the door is obviously needed and plenty of light for the work bench. For the apparatus room opinions differ as to the kind of lighting. A very fair illumination may be obtained by the use of tungsten lamps in high efficiency shades, arranged so as to light the sides (not the tops) of the cars. The mercury vapor lamps, which give a greenish light, seem to be associated with garages, and they are certainly very efficient, having high illuminating power, low current consumption, and are not fatiguing to the eyes.

Several sockets for attaching plugs should be placed around the room for attaching hand lamps with wire guards, but all sockets and switches should be kept well out of the wet. Each little basket covered lamp will prove to be a "life saver" when looking for leaks in packings, loose connections, or any other one of the thousand mysteries which are always needing to be tracked to their lair and fixed.

While it may not be necessary to use all the lights installed at the same time convenience suggests that there be outlets and plugs set at places where they are apt to be most needed. A three-branch cluster in the center of the ceiling and at least two brackets on the side walls would seem to be a minimum of fixed lights. The side brackets should be connected with a switch at the entrance so that the light may be turned on or off on entering or leaving the garage. There should be at least two lights, properly placed over the work bench, with reflectors to throw the light directly on to the bench.

In addition there should be outlets along the base—one over the bench and not less than two, one on each side of the pit. Where in case of repairs made at night an iron standard carrying as many plugs and lamps as may be desired is a necessity. This should have a wide base, be adjustable as to height, and light enough to be easily moved about the garage. It would be well to place casters on all but one foot of this support.

With an equipment of the kind described every part of the garage and every part of the car can be easily and quickly illuminated and the work in hand greatly facilitated.

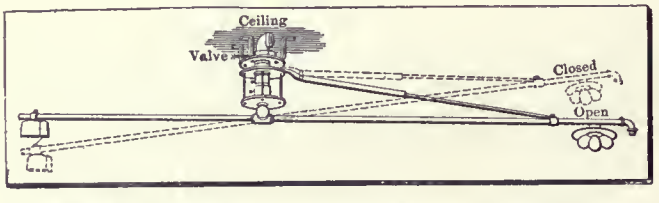
While other forms of lighting, by gas (either city supply or acetylene) or lamps, can be used where electric light is not available, they have not the same elements of "flexibility and safety" that electricity has and would not present the many conveniences that are at the command of the owner who can install the electric current.

Washing

WHILE nearly everyone will grant that adequate washing facilities are desirable, few would regard them as also economical. This is nevertheless true, for with improved and handy means for washing the car will be washed more regularly, more promptly and more thoroughly. This applies not alone to the painted parts of the body, but to many of the mechanical parts as well. To cite an excellent example (not a mechanical part, however), the wheels cannot be washed too much, particularly in warm weather.

Heat opens the joints in the wheels, while plenty of water will cause the wood to swell, thus closing the cracks. This applies to the miter as well as the felloe, to say nothing of the tenons, spokes into felloe.

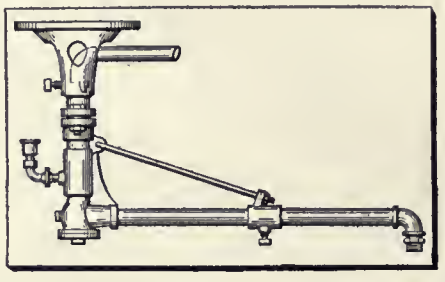
The overhead washer, two of which are pictured on this page, presents some ideas which cannot be obtained in any other way, and are desirable. This form



Overhead Washer with Weighted Arm and Cutoff

is always up out of the way, when not wanted, and aided by the hinged joint may be pulled down for use. The one shown first is weighted so as to balance itself in any position in which it is placed.

In the second one the construction is such as to suggest the making of a washer-using water pipe, obtainable at any plumbing shop. The only problem would be the swivel joint at the pivot point, but the plumber could doubtless furnish a full universal swivel which could be used for this purpose. In that case, making one of these is simply a question of knack with a stillson wrench and other pipe-fitting tools. The corner would be a simple elbow and the angle brace a pair of tees, with the tee end plugged, and the plugs drilled for the wire cable. This, in turn, could be made with turnbuckle in the middle, so as not only to tighten it



Overhead Washer Not Weighted

up at first, but to allow of later tightening, as opportunity presented or as it was found to be needed.

The Portable Garage

OWNERS of automobiles who have first acquired a car as a luxury ultimately find that it has become a necessity. Vacations, outings and journeys from home, all are based on the ability of his car to get him where he wants to go, serve his convenience after he has arrived and bring him safely back. He plans his camp site or selects his cottage where he will spend the summer with his family, with special reference to the conveniences at hand for housing his car.

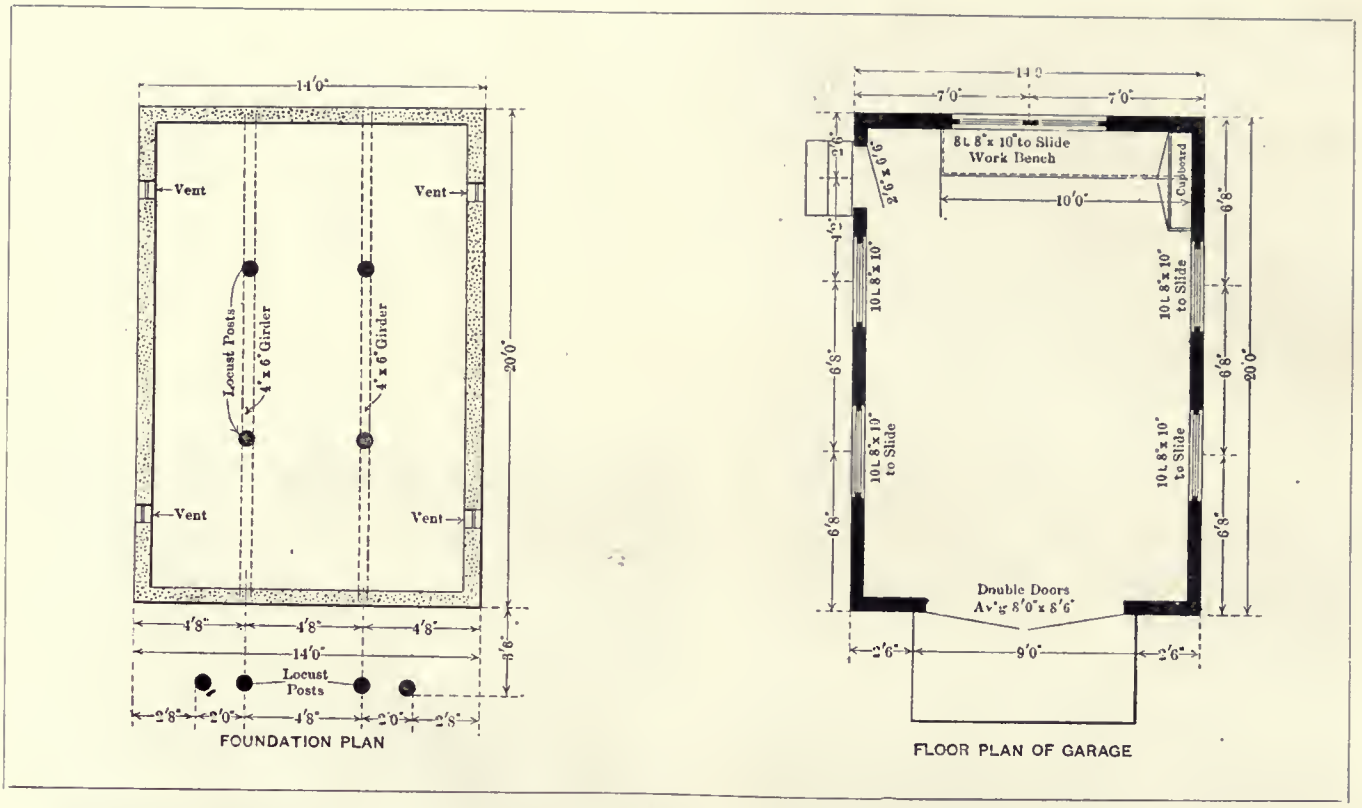
Now that portable garages are available he has a wider range of selection and can afford to ignore the fact that there are no permanent garages near by. He no longer is compelled to adapt some stable to his needs, and suffer all the attendant disadvantages. The portable garage has solved this question in a most satisfactory manner.

Elsewhere will be found several views of one of the portable garages now on the market. The plan shows that it is about 13 feet wide by 19 feet long inside. Of this, however, not all is available, some room being taken up by a large work bench, a cupboard and other conveniences. These cut the available floor space to about 12 feet by 16 feet.

There is a double door at the front, measuring 8 feet in width by 8 feet 6 inches in height. The latter is made large to allow of the car entering with the top up. In addition there is a small, narrow side door.

Two windows on each side, with two smaller ones at the back furnish plenty of light, the back windows being grouped over the work bench. These windows are all too high from the floor to supply the best angle of light to the interior. The foundation is more in the nature of a suggestion than a necessity. This is not

EXTERIOR AND INTERIOR VIEWS OF AN APPROVED FORM OF PORTABLE GARAGE



FOUNDATION AND FLOOR PLANS OF SMALL ONE-CAR WOODEN PORTABLE GARAGE

furnished by the makers of the garage, the plan being given to enable the prospective buyer to provide a concrete or stone foundation if he so desires. The locust posts, indicated by the round black spots, are furnished, these being 3 feet 6 inches long. Four of these are in front, and are for the support of the inclined platform or runway to be built there. The other four located in the middle are real foundation posts, in addition to which there are two more to form a foundation for a platform leading to the side door, these not being shown.

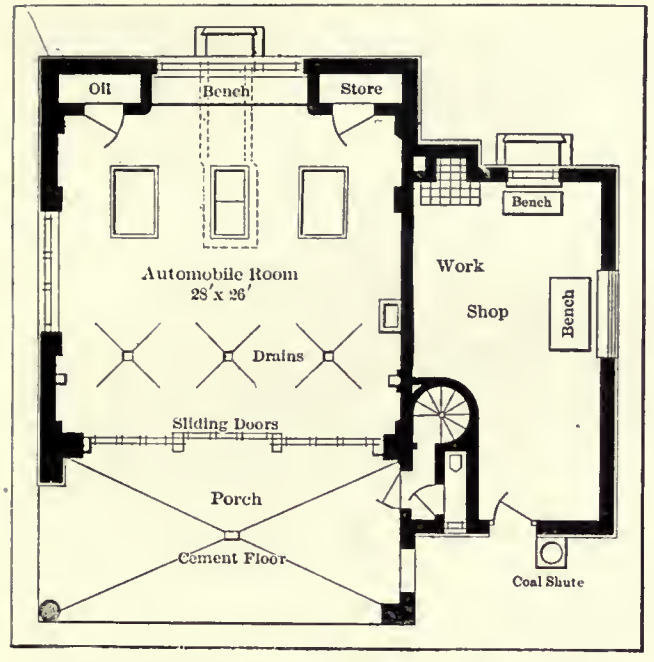
When foundations are laid a single width of brick, that is 8 inches, is recommended, or this same width in cement or concrete. A description of some of the other features may be of sufficient interest to warrant the space, so will be given.

The structure is designed with two lines of girders, giving a double support directly under the car. All exposed framing material is dressed lumber, while the walls and roof framing are well braced. The roof is sheeted over with a sheathing of surfaced boards laid tight. Over this shingles are laid, making a simple but good roof sure to be waterproof. Slate, tin, steel, or any roof composition may be had if desired, but not being regular, cost more. The cost of this house, as shown in the two plans, elevations and exterior and interior views, is roughly between $175 and $185 at the manufacturer's factory. This with the freight and charges for erection brings the whole cost up to about $225, which makes a very serviceable garage at low cost.

The Garage for More Than One Car

WHILE every class of building should, for æsthetic reasons, possess some measure of architectural expression, it is more difficult to impart this to the one-car garage than to the larger structure. Reference to the plate illustrations in this volume will show that artistic effect may be secured in even the smallest garages, involving a modest expenditure, if the work is intrusted to the capable architect.

"Rule of thumb" design and construction are never satisfactory. The added cost of the architect's fee is really economy. The size of the garage, its plan and equipment, will be influenced by the number of cars to be stored, to which must be added the necessary maneuvering space. A single-car garage necessitates that the shifting around be done out of doors, but in larger buildings the usual obstructions will demand some means of easily placing the car in the position assigned to it. The floor area should be computed on a basis of one car more than the number to be stored.



Plan of Garage Combining Original Features

This additional space will be for the pit, on the closed top of which, in the absence of a turntable, the cars may be shifted.

The Turntable

THE use of the latest turntable is almost a necessity, either inside or even outside the garage. They are so arranged that they can be used as a washing platform, being provided with dished surface and drained at the center. They are especially convenient in a garage of three cars and up, where the size of available land is restricted, as in the city or in the many very popular summer resorts.

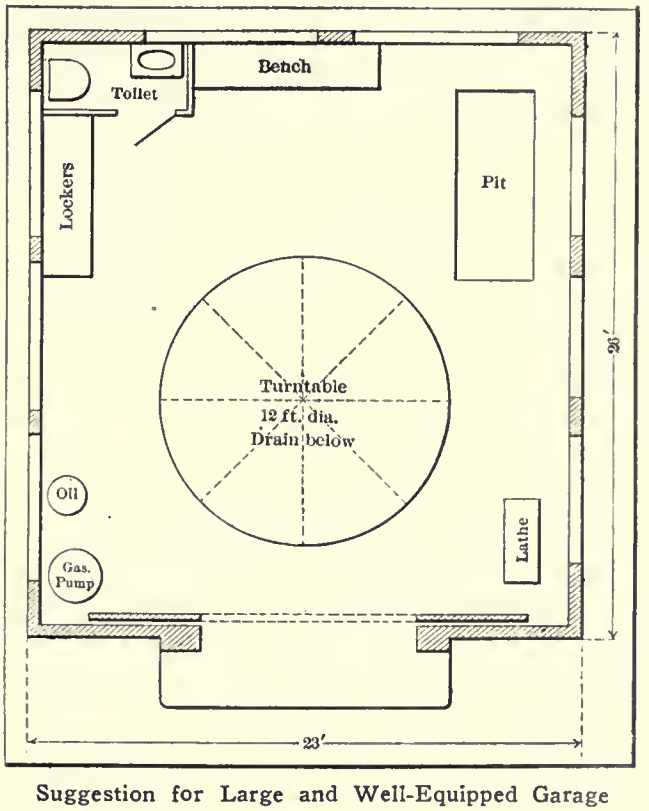
The maneuvering space needed when more than two cars are housed is very considerable. In this connection the turntable forms a very useful adjunct to the modern large garage, for it economizes on the floor space. That is to say, having a turntable in the center of the floor does not cut out any of the floor space as a pit does. It allows swinging cars around within its own narrow confines and with absolutely no maneuvering other than a straight ahead run onto the turntable and another similar run off.

Aside from the big house, where it saves space, and thus first cost, it is of great and daily use in the small well-equipped house, where it saves much work, either of pushing the car by brute strength, or by carrying in fuel, starting a cold engine, and then backing and filling until the required location is obtained. On page 17 is shown a design for a small garage in which this feature is included. The outside width of 23 feet is, like the length of 26 feet, ample. Although large, it is not any too large when the projected pit, lathe space, oil and gas pump space, lockers, bench, and toilet are all taken into account. Sliding doors are figured upon as economical of space and more handy to open and close than the hinged variety.

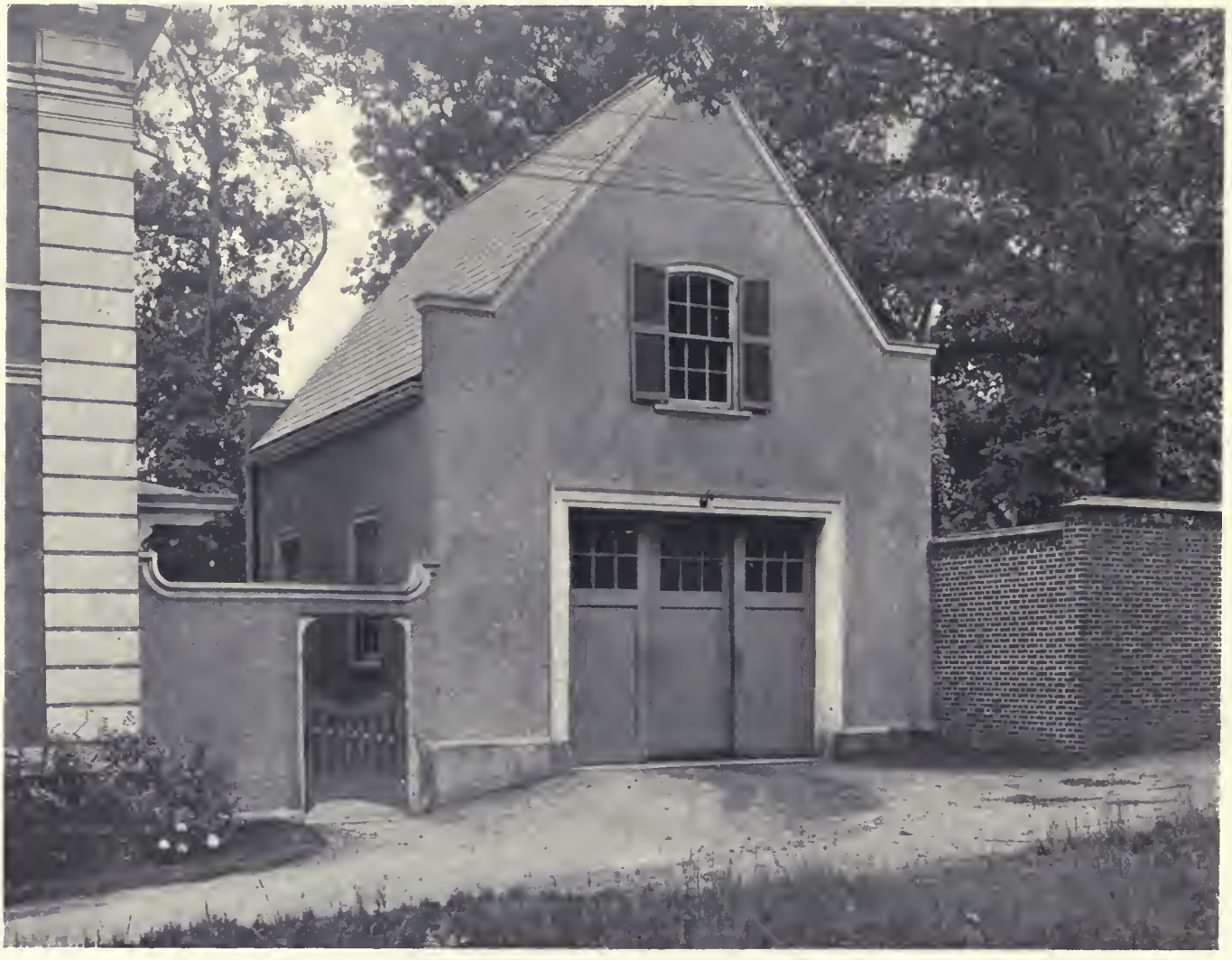
Elsewhere on this page is shown a concrete garage showing a number of novel and interesting features. The drawing shows only the ground floor plan, the second story being devoted to living rooms for the chauffeur.

Three cars are provided for. The provision, in marked contrast to the usual case, is in triplicate, three pits and three washstands being provided, as well as three doors. The front end of the house includes a porch with cement floor and housed over by the living rooms above. This would, without doubt, be used for most of the washing done in fine weather, in preference to the washstands within. In fact, it would appear as if the designer, a well-known Chicago architect, had this idea in mind.

Most notable in the whole design is the large and very roomy workshop provided alongside of the motor room, yet entirely separated from the latter by a thick solid wall. This would reduce the fire hazard very materially were the gasoline kept in the work room.



Suggestion for Large and Well-Equipped Garage



GARAGE AT BROOKLINE, MASS.
Messrs. Kilham & Hopkins, Architects
Fireproof construction, built of T-irons, fitted with terra-cotta blocks and plastered inside and outside

The floor plan, however, does not indicate this, and the oil being in the automobile room, one is forced to the conclusion that the fuel was kept there as well. In that contingency, not only is the fire hazard not reduced, but, on the other hand, all parts or units to be worked upon would of a necessity have to be taken out of the car, carried outside through the big sliding doors, and then back into the work room through the front door. The same process would have to be gone through after the repair had been effected.

Among the good features may be noted the location of all work benches—there are three shown—in front of windows. The only work bench in the automobile room is placed at the back in front of the large and wide window, while the two benches in the shop are placed directly in front of the only windows in that room.

The foregoing represents most of the requirements of an up-to-date house for the automobile. Accessories may be multiplied as much as the owner's purse will allow or his imagination suggest. A telephone to the house is a necessity, of course, but there are many appliances which have no real use. While much thought and care must be expended on the selection and operation of the car itself, probably nothing helps to round out and complete the pleasures of motoring like a sensibly equipped, convenient and picturesque garage.

No one yet ever regretted the expense put into the garage. As much avoidance of annoyance comes from the well-planned garage as pleasure from the car. Let the little building be picturesque and attractive outside, surrounded by hollyhocks and asters, and inside be bright, shining, practical and clean.

The Safe Handling and Storage of Gasoline and Lubricating Oil

TO those who in any degree understand the nature of gasolene the term is synonymous with danger both to life and property. Its gas, like almost any other gas, may explode or may burn, depending on conditions surrounding it at the time it is brought in contact with the flame. But if one is to intelligently discuss the hazards incident to the handling and storage of gasolene they should properly begin with the fundamental conditions and analyze its physical properties, they can then determine from what combinations and under what conditions the various degrees of hazard will be reached.

Gasolene is obtained by fractional distillation from crude petroleum. The crude petroleum is slowly heated and at the temperature of 140 to 158° Fahrenheit gasolene is obtained. Its specific gravity is .636 to .657 and it constitutes 1.5 per cent of the volume of crude petroleum.

Gasolene has practically no flashing point, that is, if placed in an open vessel it will vaporize under almost any ordinary temperature, in fact below freezing point. It is three and one-half times as heavy as air, and from this fact lies one of the greatest inherent hazards, for while, for instance, city gas is lighter than air, and, escaping, rises and is gradually carried off, gasolene vapors fall to the floor and collect and stand in cellars, openings in the floor, etc., where it remains ready to flash from contact with the first open flame.

In the liquid state gasolene is innocuous, that is so long as it remains absolutely a liquid it can neither ignite, burn nor explode. Again, a pure gasolene vapor will neither ignite nor burn. It must not only be brought into contact and mixed with air, but must be mixed with such quantities of air as will support combustion. It is for this reason that a carbureter forms so important a part of gasolene lighting, heating and power systems; the function of the carbureter is to mix the pure vapor of gasolene with a sufficient quantity of air to make it combustible or explosive according to the purpose for which it is to be used. Gasolene reaches its highest point of explosive violence when vapor mixture stands about eight parts of air to one part of gasolene vapor and falls off in combustibility with the relative increase of either gasolene or air.

Another property of gasolene which must be borne in mind is that when it evaporates and becomes properly mixed with air it has its definite point of ignition just as has any combustible material. In other words the temperature in a room might reach a very high degree, yet there would be no explosion of the gasolene vapor, whereas an open flame, a lighted cigar or cigarette, or electric spark would ignite it instantly.

Although gunpowder and dynamite are considered very dangerous, gasolene is even more dangerous, for while the former will remain where placed, the latter vaporizing from a vessel in a room will creep along the floor until it comes in contact with a flame one hundred or more feet away from the vessel. It will then flash back to the latter through this strata of gas, causing a resultant explosion or fire at that point.

Gasolene or naphtha should be stored under ground in a well and thoroughly made steel tank designed for this purpose. The tank should be so constructed as to prevent evaporation and should be placed below the pump, so that all pipe lines would slope to the tank from the pump. The flanges and all openings should be at the top of the tank and under no conditions should there be any openings on the side or bottom, for if the pipe line leading from the bottom of the tank be ruptured by either accident or fire the gasolene would be poured into the building either by siphonic action or gravity, a condition which could not be overcome. The thickness of the material used in the manufacture of the tank should depend on the quantity to be stored. A plan which is followed in many cases suggests a tank of 12 gauge material for quantities up to and including 500 gallons, and 3-16" material for tanks of larger capacity.

The automobilist will find many advantages in the underground storage systems, as shown in Figure 1. The gasolene is maintained at an even temperature and, therefore, retains its original quality. The tendency for evaporation is absolutely eliminated by proper venting, and, therefore, there is no loss from this source. Along with these features every automobilist will appreciate the economy and convenience of always having on hand an adequate supply of gasolene. He will, therefore, not find himself embarrassed without this very essential fluid which may cause delay and expense in renewing the supply.

The tank should be placed two feet below the surface of the ground. It is not necessary to install a gasolene underground storage tank in either a vault or pit, as such installation does not lengthen the life of the tank, and it has been found by actual experience that the sinking of the tank in the ground is absolutely safe. Should the ground be exceptionally moist, so that the tank would be in water, a vault would overcome this obstacle. In all cases, however, where it is necessary to install a gasolene under-

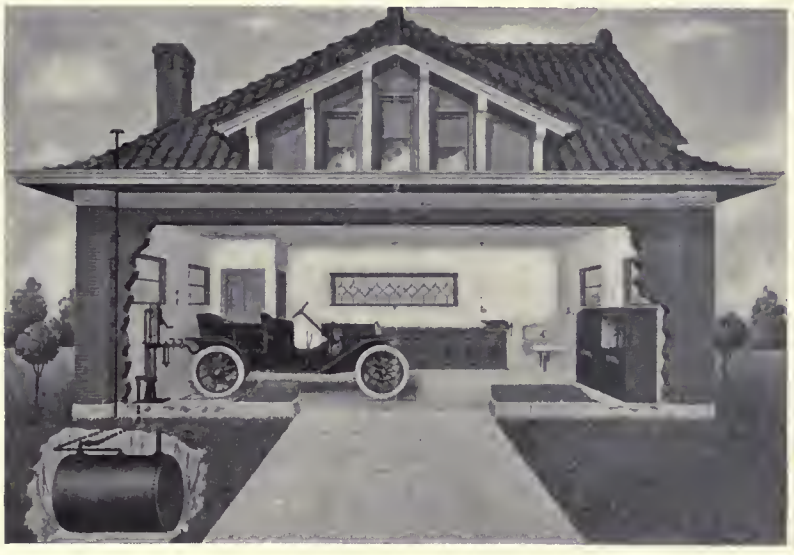


Fig. 1.

ground storage tank in a vault or pit the pit should be filled in with sand around the tank.

The vent pipe from the tank should extend two feet higher than the building so that any gases that may be expelled from the tank during filling will be carried off without possibility of contact with the flame. This vent should be protected by a fine mesh wire gauze. The fill pipe should also be protected by a fine wire gauze.

There are several methods of drawing gasolene from a tank, but that which is most commonly in use and which is apparently the most successful and absolutely safe is by means of an approved pump which draws the gasolene by force from the tank and no discharge of gasolene can be had without placing the pump into operation. This eliminates any possibility of discharging gasolene should accident occur to the pipe line, in case of fire. The suction pipe should at no point be lower than the top of the tank and care should be exercised in the making up of all joints and connections of the pipe line that they be absolutely tight. This can best be done by use of a cement which is insoluble in gasolene. Gasolene or other volatile or inflammable liquids should never be handled by pressure systems controlled either by water or air. It is obvious inasmuch as the pressure remains constantly on the system that in the case of an accident or fire, should the pipe line be ruptured, the gasolene would be automatically discharged and cause a situation which would be difficult to handle. The proper method of overcoming such a difficulty as this is to install a pump approved and accepted by insurance underwriters, which draws the gasolene, by work applied to the pump, and then there can be no disturbance of the liquid in the storage tank without the direct application of the pump. By the installation of a pump of this nature, should a fire occur and the pipe line be ruptured, no resultant difficulties will be encountered inasmuch as automatic check valves are placed in the suction line which make it impossible for the blaze to reach the storage tank.

There never has been a fire started from such underground storage systems as described above, and in no case has a fire been increased on account of such a system. In fact there is no case on record where the gasolene in one of these systems has been affected by fire, or caused any trouble whatsoever during the fire. This proves conclusively that the danger is not from the storage of gasolene when properly provided for. The handling of gasolene should be expedited in every possible way and so arranged that the gasolene is not exposed to the air. This is usually overcome by drawing the gasolene directly from the underground storage tank through the pump, thence to the reservoir of the automobile by specially prepared gasolene hose, which absolutely eliminates any possibility of gasolene vapors flowing into the garage.

As an illustration of how an underground gasolene system will withstand the action of flames, we

Fig. 2.

reproduce in Figure 2 a photograph showing the interior of a private garage at Brookline, Massachusetts, which was destroyed by fire March 26, 1909. In this particular instance the installation was a one-gallon self-measuring gasolene pump connected to a 10-bbl. underground storage tank, which was located approximately ten feet from the building. Upon examination of the ruins the pump was found to have been badly burned and unfit for further use. There was, however, no trouble experienced from the gallon of gasolene in the cylinder of this pump, the same having been found in good condition after the fire. The gasolene in the tank was in perfect condition and was used shortly after the fire. It goes to prove the adaptability of such an outfit during a raging fire, protecting life and property, the value of which is recognized and appreciated by the fire departments in all cities.

We would call attention to Figure 3, which shows the building. The gasolene is drawn by an approved pump within the garage, and can be drawn directly to

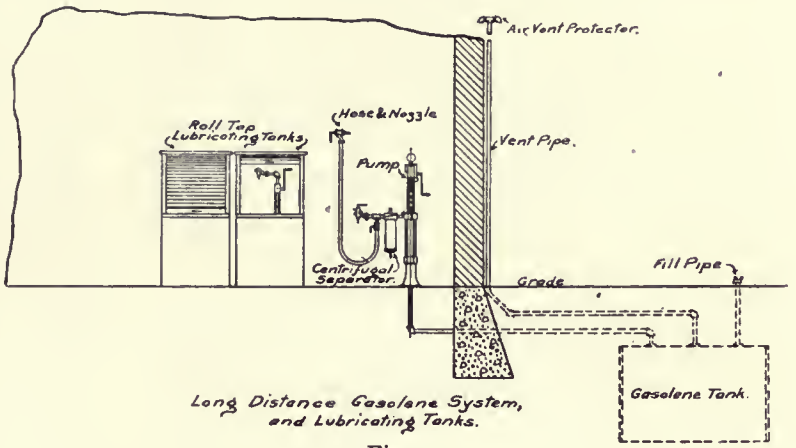


Fig. 3.

the car by use of the hose and nozzle. The venting of the tank is done by a separate vent pipe running up the outside of the building, and terminating in an air vent protector.

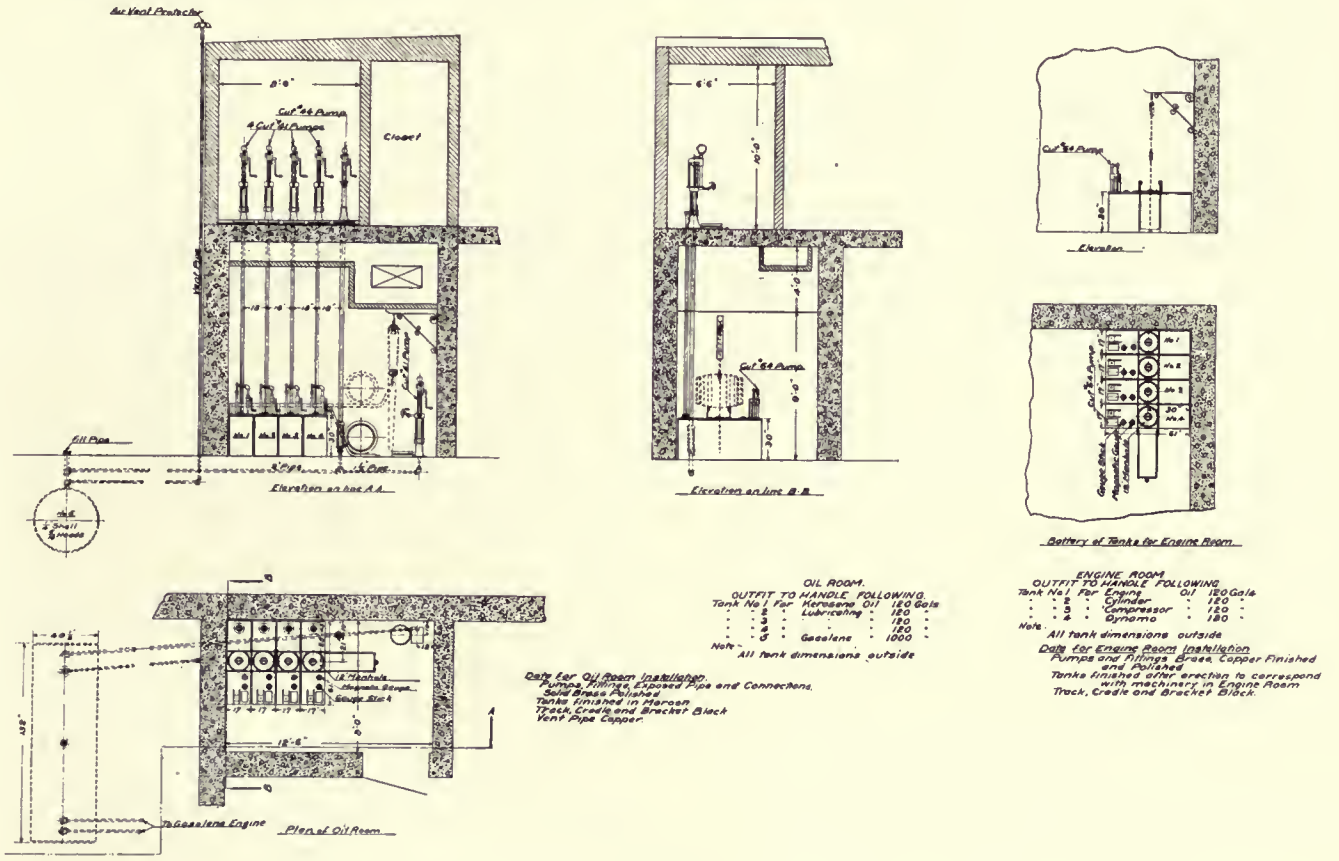


Fig. 4.

what can be accomplished in the way of safe and satisfactory gasolene underground storage for the private garage. The tank is located and filled from without

Another important feature to be considered by the automobile owner is the fact that installation of a standard equipment, such as is described above, meets

the approval of the insurance companies, due to its safety features and if an approved system is installed there is rarely any difficulty in obtaining satisfactory rates of insurance. In fact, the regulations of many of the largest Insurance Boards and Rating Companies in the country approve of equipment of the sort outlined. For example, we quote from permit used by the New England Insurance Company, Rules 3 and 4.

"Third: That there shall be no gasolene kept inside such building, its additions or connections, except that contained in said automobile, and not exceeding one gallon in the chamber of a measuring pump."

"Fourth: That a supply tank shall be at least ten feet from such building, its additions or connections, unless it is buried at least two feet below the level of the basement floor. All pipes for filling or ventilating the supply tank to be outside the building and piping to pump to be so laid as to drain toward the tank."

For use in conjunction with underground storage for gasolene we recommend for the motorist the use of proper storage equipment for his lubricating oils. This is a feature of garage equipment which we believe is overlooked in a great many cases, and the use of proper lubricants is just as essential for ease of operation and long life of the car as is the use of gasolene to furnish the propelling power.

This subject was handled in a very thorough and capable manner by Prof. W. C. Hosford, of the Boston Y. M. C. A. Automobile School, in a recent lecture. The following embodies to a great extent this lecture.

With the best interest of the automobile owner at heart, probably the most expensive item is repairs. It is safe to say that ninety per cent of the automobilists are ignorant of the fact that almost all of the repairs on an automobile are either due to insufficient or improper lubrication. From carefully prepared statistics and data obtained from repair shops, it has been found that, except in tire trouble and accidents, ninety-five per cent of the repairs can be unquestionably traced to this source. The deteriorating results are torn and mangled cylinders, warped and broken transmissions, differentials, etc., that are a common topic with the repair man. These conditions, together with many others, are due, principally, to poor or insufficient lubrication.

Let us consider the principle and theory of lubrication. Upon examination with a microscope, lubricating oil will present the appearance of minute globules held together by a light fluid. The latter fluid merely acts as an adhesive medium between the globules, which rotate on one another something after the fashion of a ball bearing. Now, when two moving elements, as for instance the shaft and bearing, are brought in contact, no matter how carefully the surfaces are ground and polished, the result is friction and heat. The amount of friction depends upon the compression and area of contacting surface, assuming that all other conditions are equal; that is, the material of the same quality and the surfaces ground and polished equally. Therefore, to reduce the friction to a minimum, the lubricant must be of such tenacity as to interpose between the moving elements a substance that will separate them from each other at a microscopic distance so that each independently works upon the globules of the oil.

It has been found that, while the surface of a lubricant tends to reduce friction and the surface tension is extremely high, there is also a very large amount of internal friction in oil—that is, an apparent magnetism presents itself in the form of tenacity in the interior of the liquid. This feature is commonly known as viscosity, although it means more than simply a viscous fluid. It is therefore obvious that a lubricant capable of withstanding a pressure of one hundred pounds per square inch would not satisfactorily withstand a pressure of five hundred pounds per square inch and lubricate properly on account of viscosity. For this reason it is very impractical to attempt to use light cylinder oil on a shaft and bearing where a very heavy oil should be used. Likewise, it would be very impractical to attempt to use a very heavy oil to lubricate a cylinder.

With the former thought in mind the automobile engineer has decided that at least four grades of lubricants are required to give an automobile proper and satisfactory lubrication; cylinder oil, gear case oil, light machine oil, and non-fluid oil. Let us first consider cylinder oil. Cylinder oil is used to reduce the friction between the cylinder and the piston as low as possible. On account of the fact that the oil is distributed over the internal surface of the cylinder the oil is present when explosion takes place, which is accompanied by high temperature and flame. Inasmuch as cylinder oil is a distillate of coal oil it contains more or less carbon. When the oil is burned by the heat and flame from the explosion in the cylinder, a deposit of carbon remains on the internal walls of the expansion chamber, cylinder and spark plugs. It offers great hindrance to the last, preventing regular sparking and, together with its adhering to the walls of the cylinder, makes a very noticeable decline in power. It has been the aim of the refiner to reduce the per cent of carbon in the cylinder to a minimum.

In the average car, each cylinder requires from five to ten drops per minute, which is fed by an automatic pump or by gravitation, the dropping being regulated by needle valves which are placed in sightfeed glasses in the dash board. Hence it follows that if the oil is not free from dirt and lint these feed pipes and needle valves will be choked, with the following results: As

the operator depends upon the number of drops per minute to determine whether or not his cylinders are receiving proper and sufficient lubrication, if dirt and lint should accumulate in the needle valve, it would of course diminish the number of drops per minute, and the operator assuming that his car is not receiving enough oil would increase the opening until the desired amount is obtained. The jolting of the car would be very apt to clear the feed pipes with the result that the engine would receive too much oil, resulting in excess carbonization in the cylinders. If by chance the operator does not see the diminished flow of oil, it would leave the cylinders without the proper supply and in a short time they would be overheated by friction and probably result in "freezing." If the amount of dirt in the oil is not sufficient to choke the feed pipes it is only a question of a short time before the cylinder and pistons are gouged and torn so that it is impossible to get compression, with the natural result that new cylinders and pistons must be obtained at the average cost of $100.00 per cylinder. Hence comes the stand made by many automobile engineers:

"It is ultimately as detrimental to feed an engine dirty oil as it is to give no oil at all, as in either case it spells destruction."

The results of gear case and light machine oil are incidental with that of cylinder oil, and it is hardly necessary to go into the minor details. A small bearing or cam in order to work properly has got to be right, and cannot be torn by dirt or have the temper drawn by overheating, for in either case it means rapid wearing of that part.

While the foregoing holds true as regards using clean lubricating oil, it is well to add that the same grade of cylinder oil should always be used. Many automobilists make the mistake of using various grades of cylinder oil in their engines. It is well that the automobilist should store in his garage a quantity of each kind of the several oils he uses in his car. This particularly applies to the use of cylinder oil, as the changing of the grades of cylinder oil in an engine means the loss of power and the shortening of its useful life.

If the automobile owner should know these facts, is it not reasonable to assume that he is willing to save himself hundreds of dollars annually on repair bills by keeping a supply and by properly storing his lubricating oil? By properly storing, we do not mean storing the oils in barrels, but storing them in a scientifically and properly made oil tank where details have been carried out to the end of giving him not only a dirt and dust proof storage, but protecting him from losses, as seepage, leakage and waste, and also to prevent him from endangering himself and property by fire. Although these last points are probably not as important as the former, it is surprising the amount of money that can be saved in this way.

In Figure 3 are shown two very practical outfits for the storage of lubricating oils. These outfits are of the roll top design, the purpose being to eliminate any and all dust and lint that may circulate through the garage and mix with the oil. They also present an adaptable place for keeping filling cans. These tanks are all metal and can be furnished in any capacity from ten gallons up to several barrels, and are considered fireproof.

Probably the most ideal installation of a private garage equipment in the country is shown in Figure 4. This garage is located in Newton, Mass., and is situated on the side of a hill so that the main entrance is on the second floor. On this floor are installed five long distance self measuring pumps for handling gasolene, three grades of lubricating oil, and kerosene oil. The lubricating and kerosene oil pumps draw the liquid from four 120 gallon tanks located directly below on the first floor. In these tanks are also placed four additional pumps, so that the oil can be drawn from the first floor. In order to facilitate the emptying of the barrels of oil into these tanks a track is placed on top of the tanks on the end of which is a swinging cradle. A barrel of oil is rolled on the cradle and then lifted by a chain hoist until the cradle becomes parallel with the track, when the barrel can then be rolled over the proper tank and emptied.

A gasolene storage tank of 1,000 gallon capacity is located under the ground at the rear of the garage and the suction pipe connects with two long distant self measuring pumps, one on the first floor and one on the second floor. The tank is also connected to the gasolene engine by means of a suction and return pipe. The venting of the tank is done by means of a vent running to the building, thence up the outside and projecting two feet above the eaves.

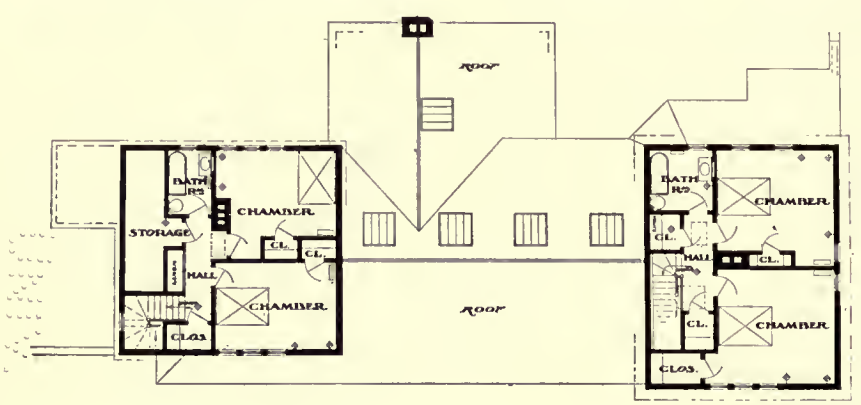
The five long distant pumps on the second floor and the long distant pump on the first floor are made of solid brass very highly polished, as well as are the fittings, exposed pipe and connections.

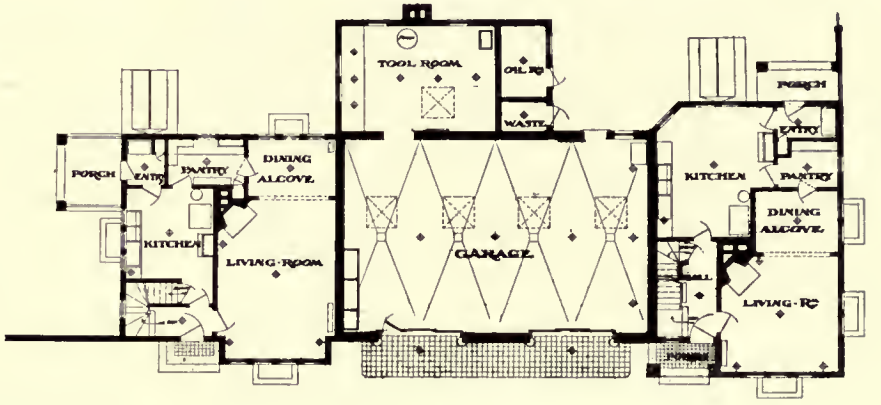
All of the long distance pumps are adjusted to measure an accurate gallon, half gallon, quart or pint.

In order to determine the amount of oil in any of the tanks a magnetic gauge has been installed which shows at a glance the exact quantity of oil contained.

In the engine room there have been installed four first floor tanks for handling engine oil, cylinder oil, compressor oil and machine oil. These tanks are 120 gallon capacity each, and pumps and fittings are of solid brass highly polished. The same methods of emptying the oil from the barrels into the tanks by means of the barrel track and swinging cradle are used as in the oil room.

Plates





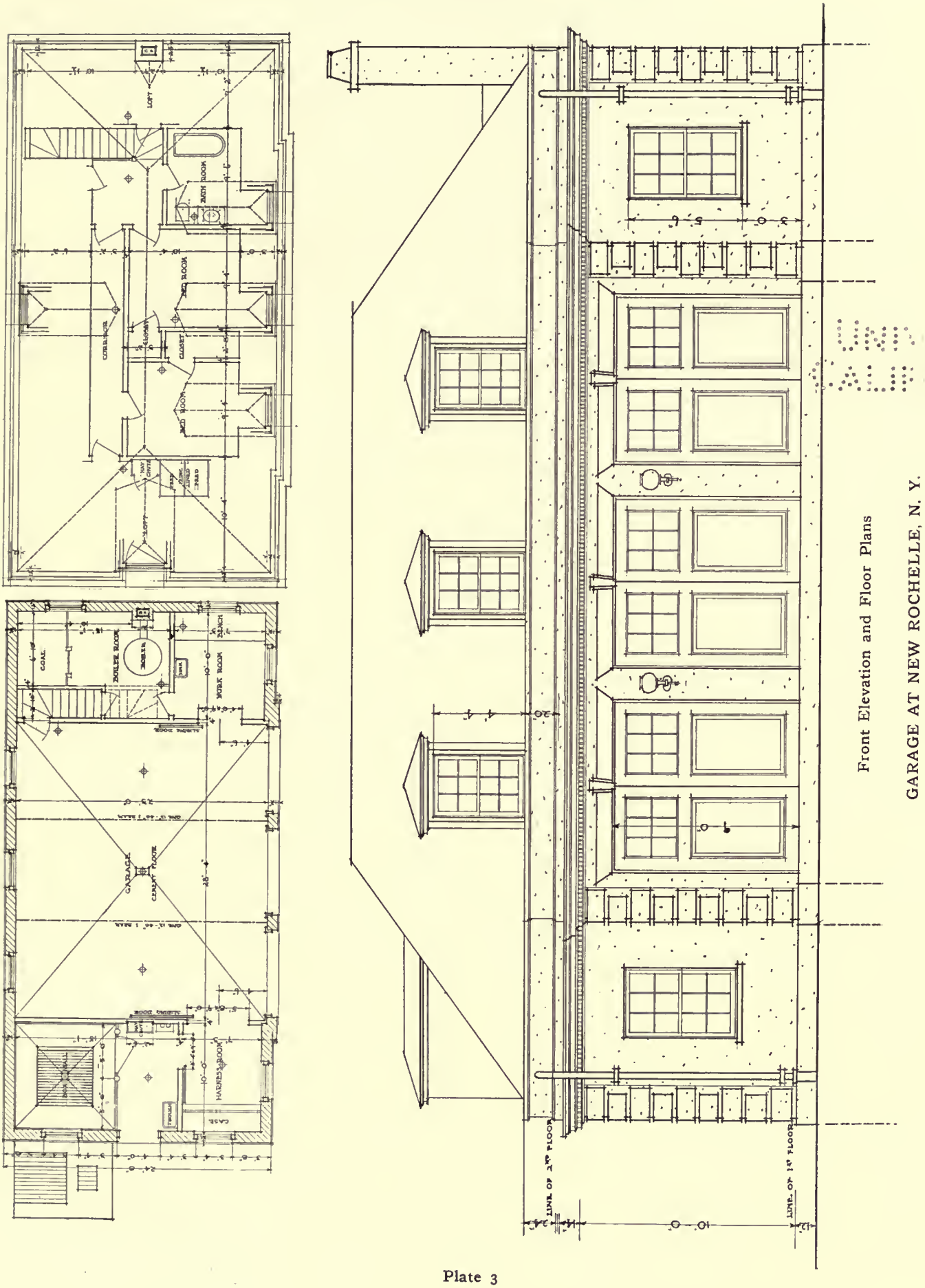
GARAGE AT BRISTOL, R. I.

Kilham & Hopkins, Architects

The buildings comprise a fireproof garage located between a dwelling for the coachman and one for the chauffeur. The walls are of plaster and the roofs of slate to match the mansion house of the estate

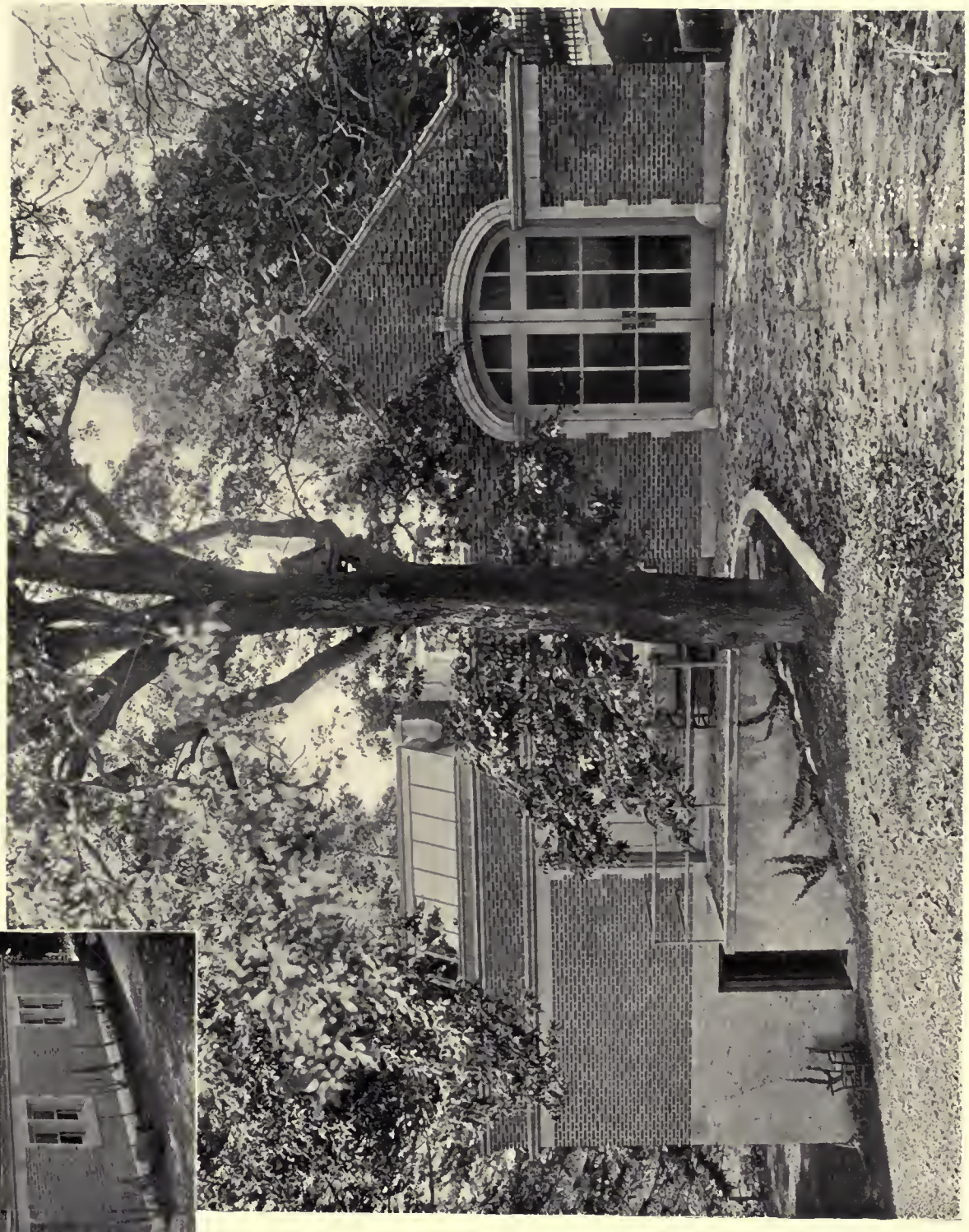
GARAGE AT NEW ROCHELLE, N. Y.
Oswald C. Hering, Architect

Plate 2

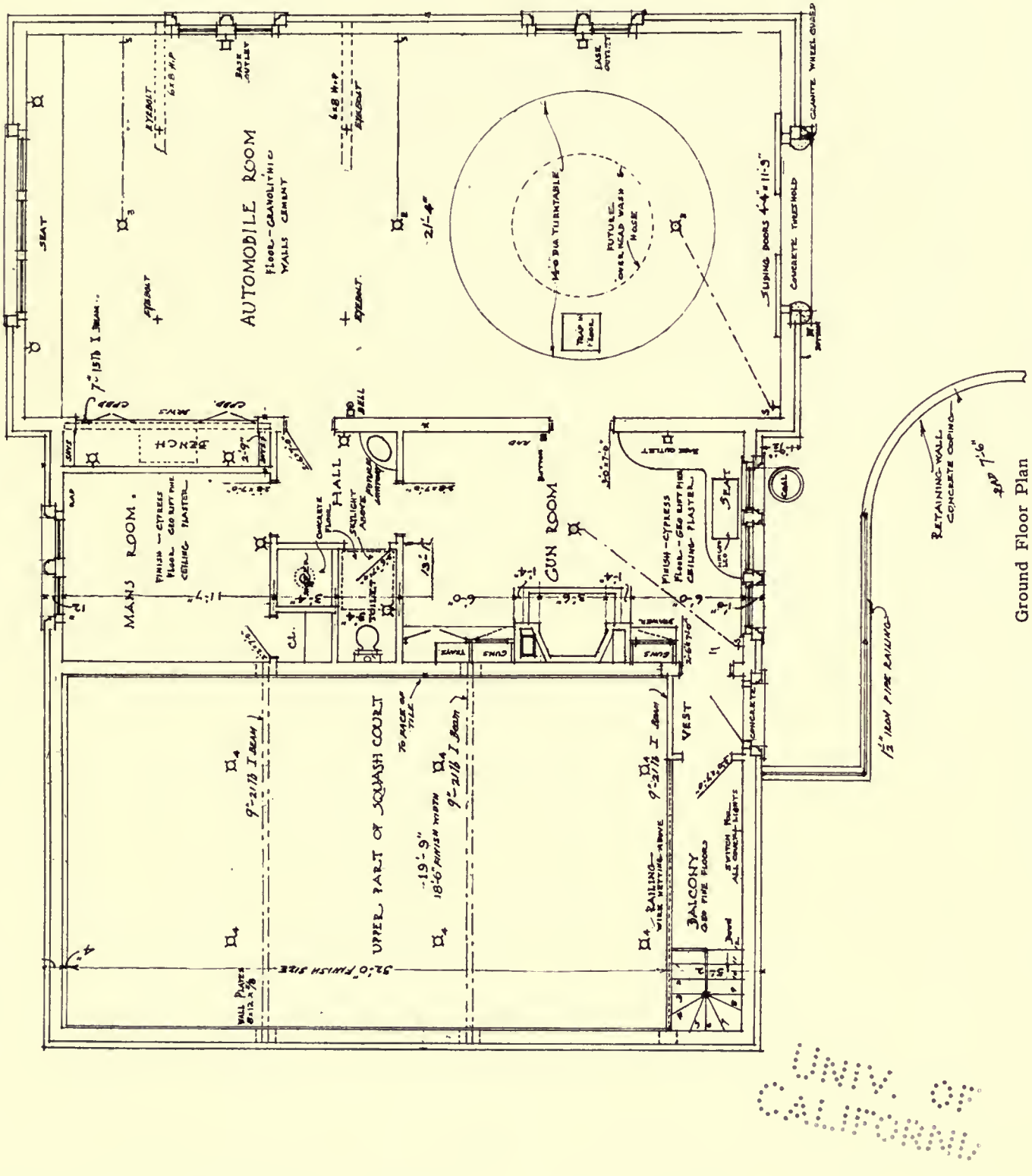


Front Elevation and Floor Plans

GARAGE AT NEW ROCHELLE, N. Y.
Oswald C. Hering, Architect



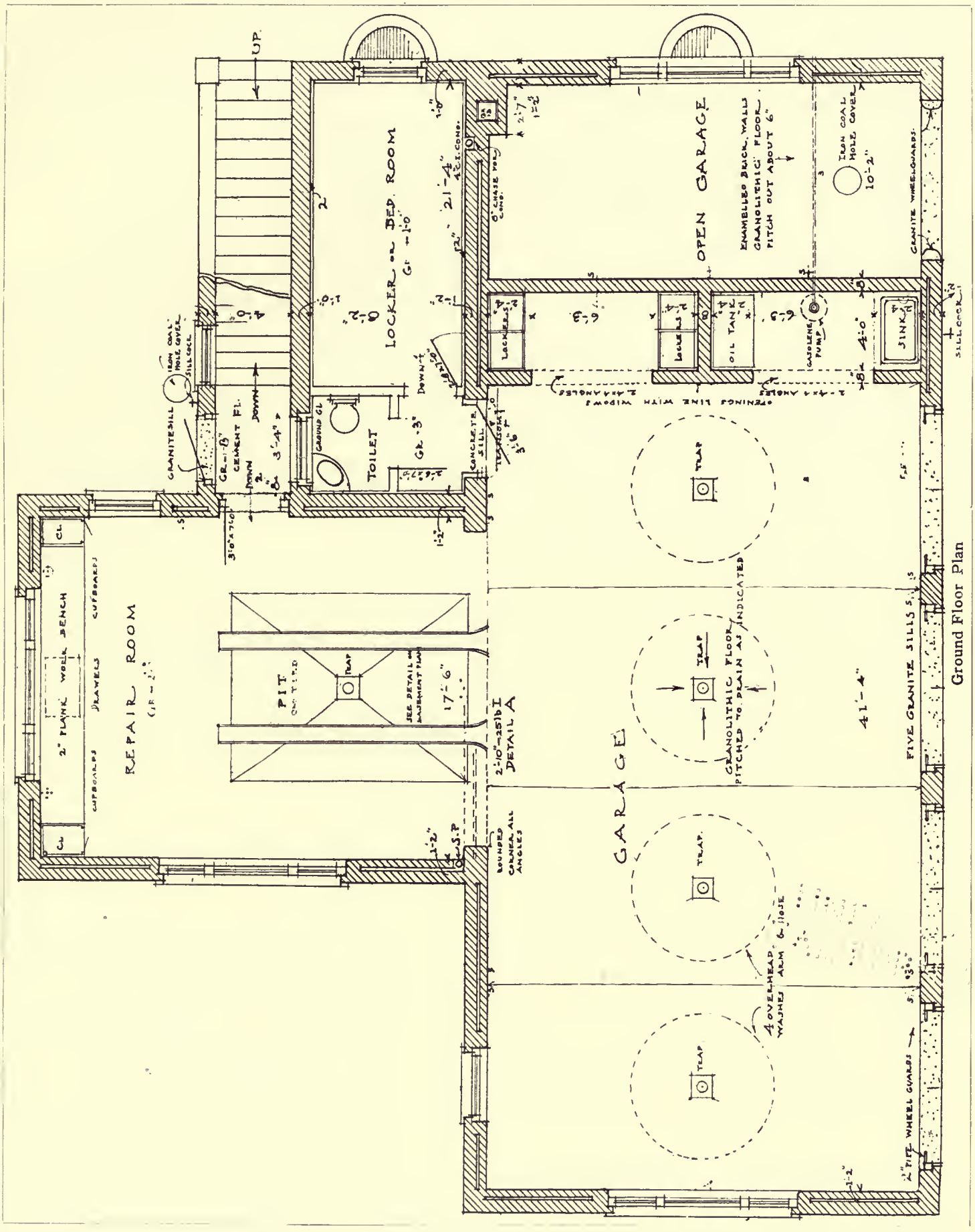
GARAGE AT BROOKLINE, MASS.
Putnam & Cox, Architects



Ground Floor Plan

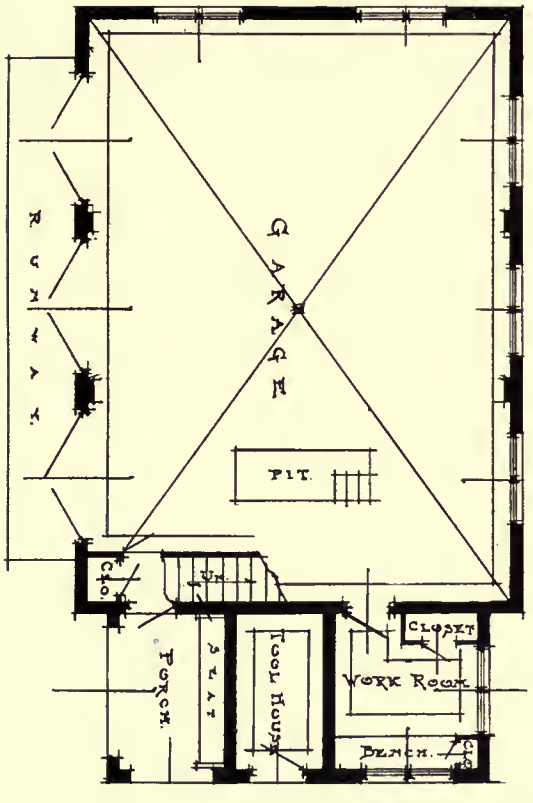
GARAGE AND SQUASH COURT AT BROOKLINE, MASS.
Putnam & Cox, Architects

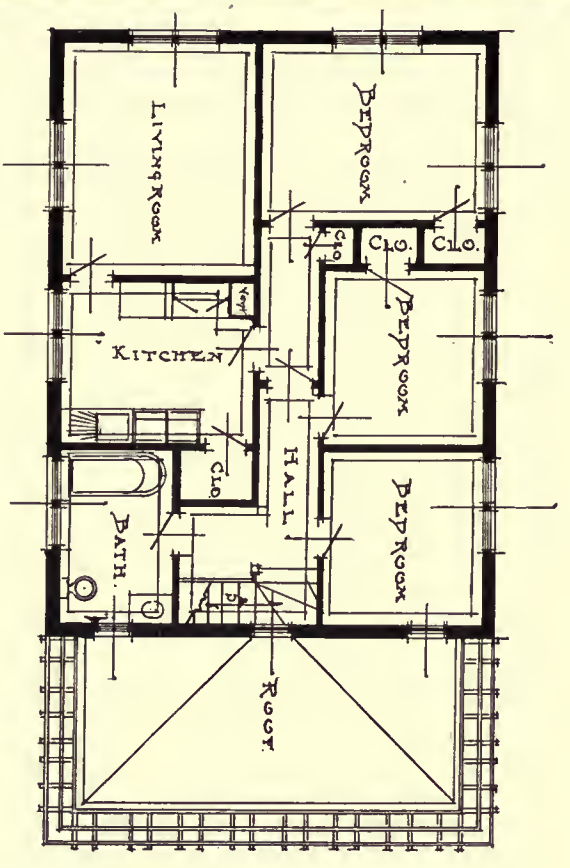
GARAGE AT IPSWICH, MASS.
Putnam & Cox, Architects



Ground Floor Plan

GARAGE AT IPSWICH, MASS.
Putnam & Cox, Architects

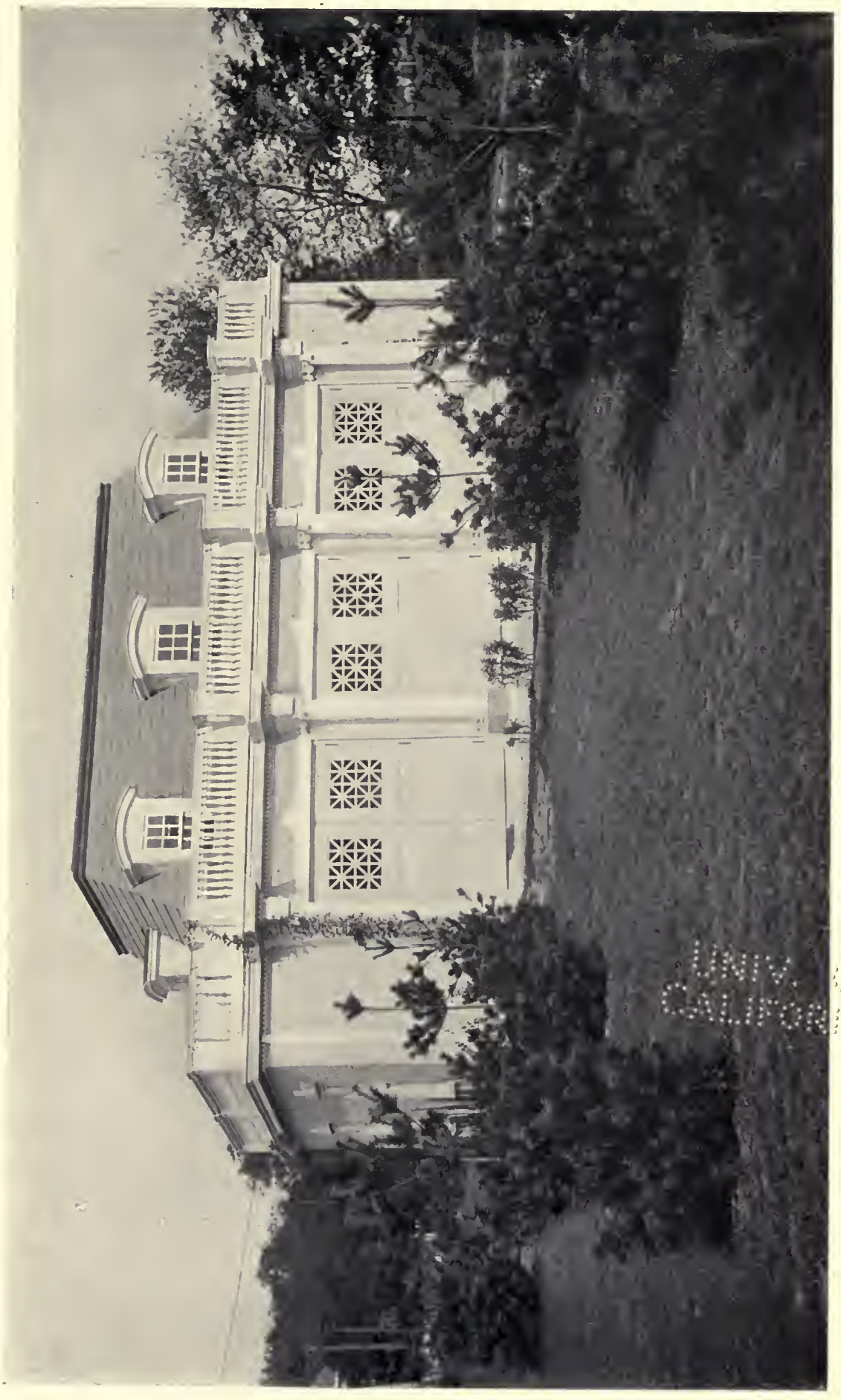




GARAGE AND HANGAR OF MR. A. B. GAINES, ENGLEWOOD, N. J.
Messrs. Davis, McGrath & Kiessling, Architects

INTERIOR OF A GARAGE AT BROOKLINE, MASS., SHOWING TURNTABLE
Putnam & Cox, Architects

INTERIOR OF GARAGE AT ENGLEWOOD, N. J., SHOWING WORKBENCH, PIT, OVERHEAD WASHER AND TRAVELING HOIST
Messrs. Davis, McGrath & Kiessling, Architects



GARAGE AT CARLISLE, PA.
Oswald C. Hering, Architect

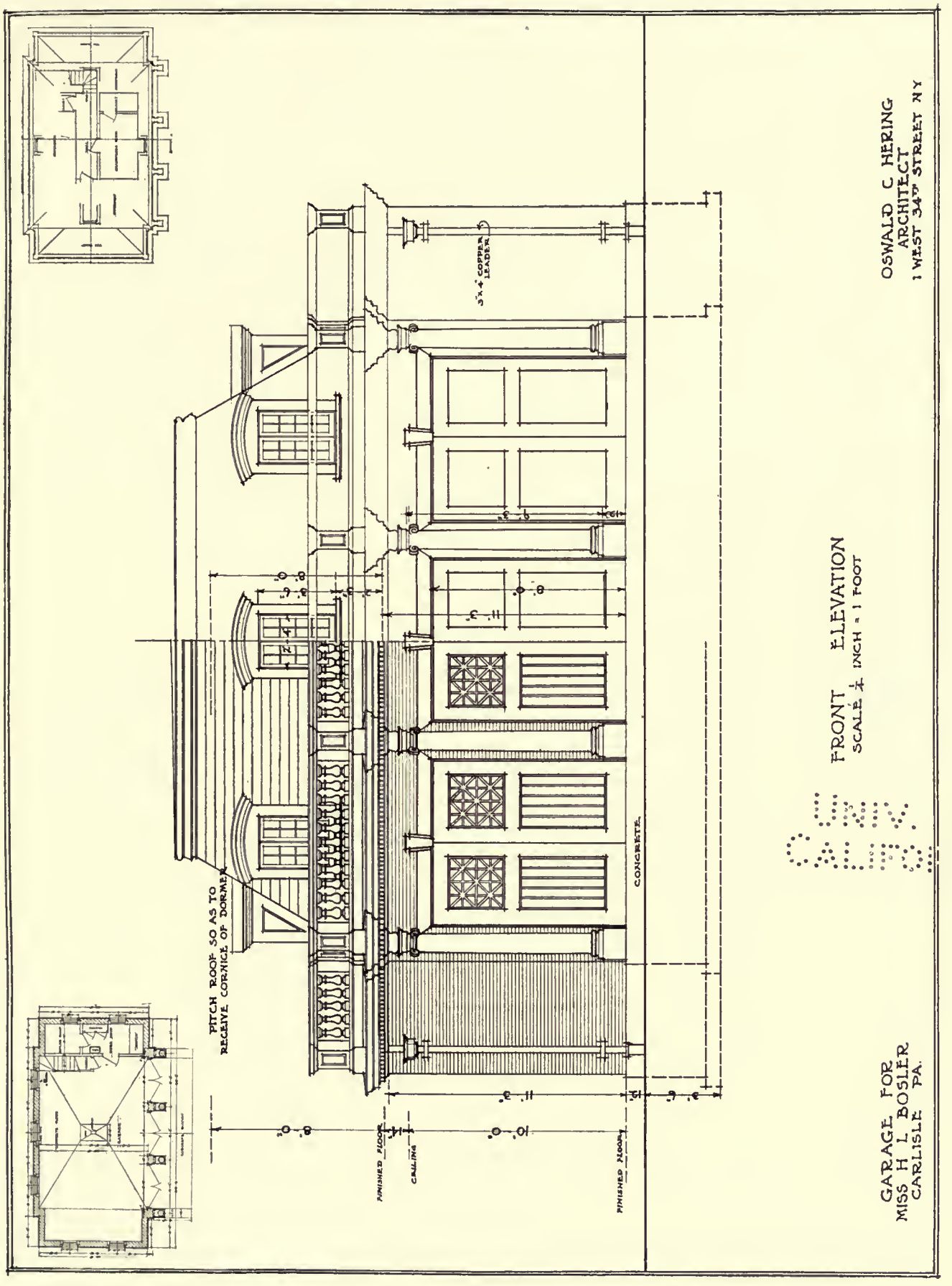
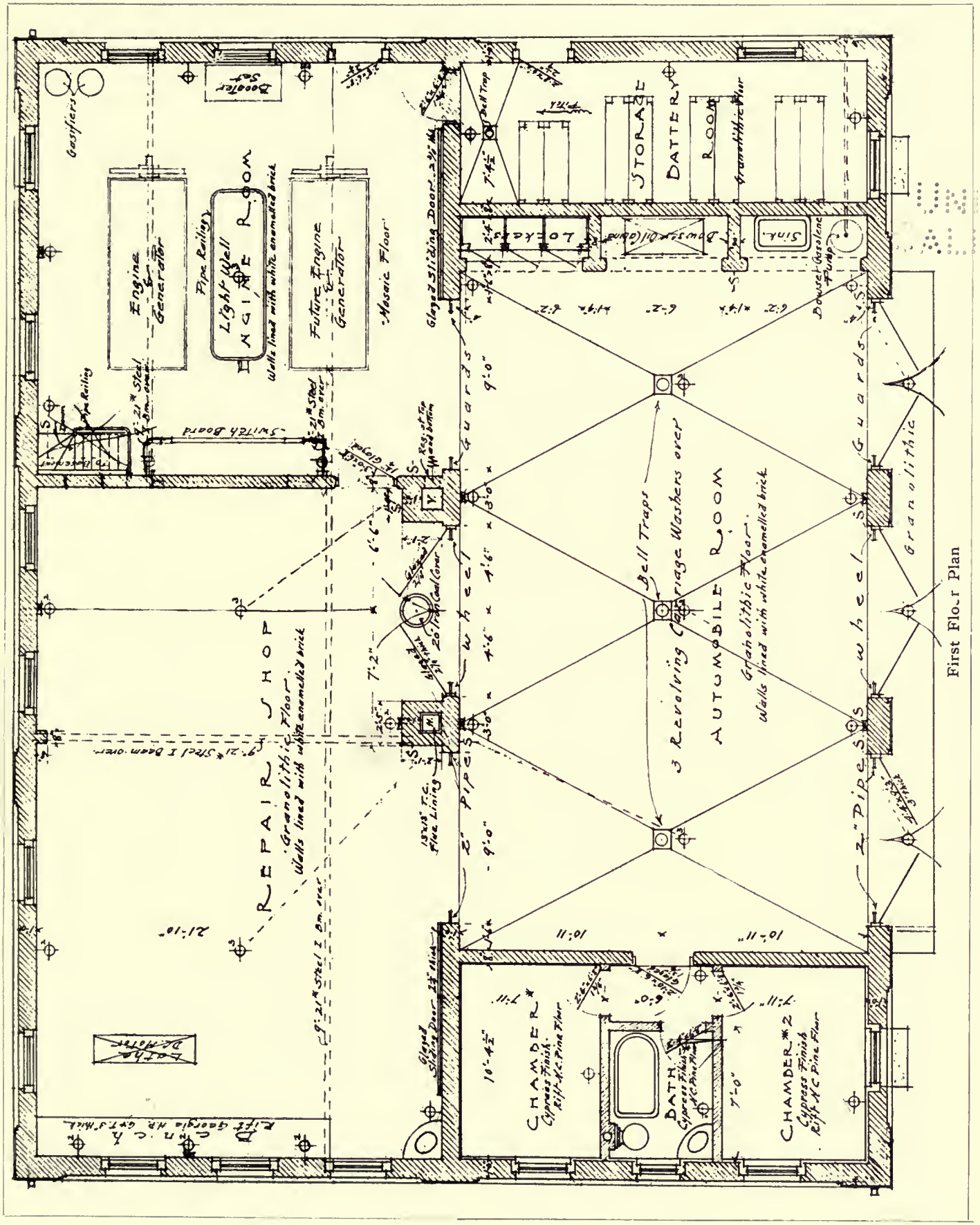

OSWALD C HERING
ARCHITECT
1 WEST 34TH STREET NY
FRONT ELEVATION
SCALE ¼ INCH = 1 FOOT
GARAGE FOR
MISS H L BOSLER
CARLISLE PA.
PITCH ROOF SO AS TO
RECEIVE CORNICE OF DORMER
3"x4" COPPER
LEADER
CONCRETE
FINISHED FLOOR
CEILING
FINISHED FLOOR

Plate 11

GARAGE AT TOPSFIELD, MASS.
Putnam & Cox, Architects

GARAGE AT NEWTON, MASS.
Putnam & Cox, Architects



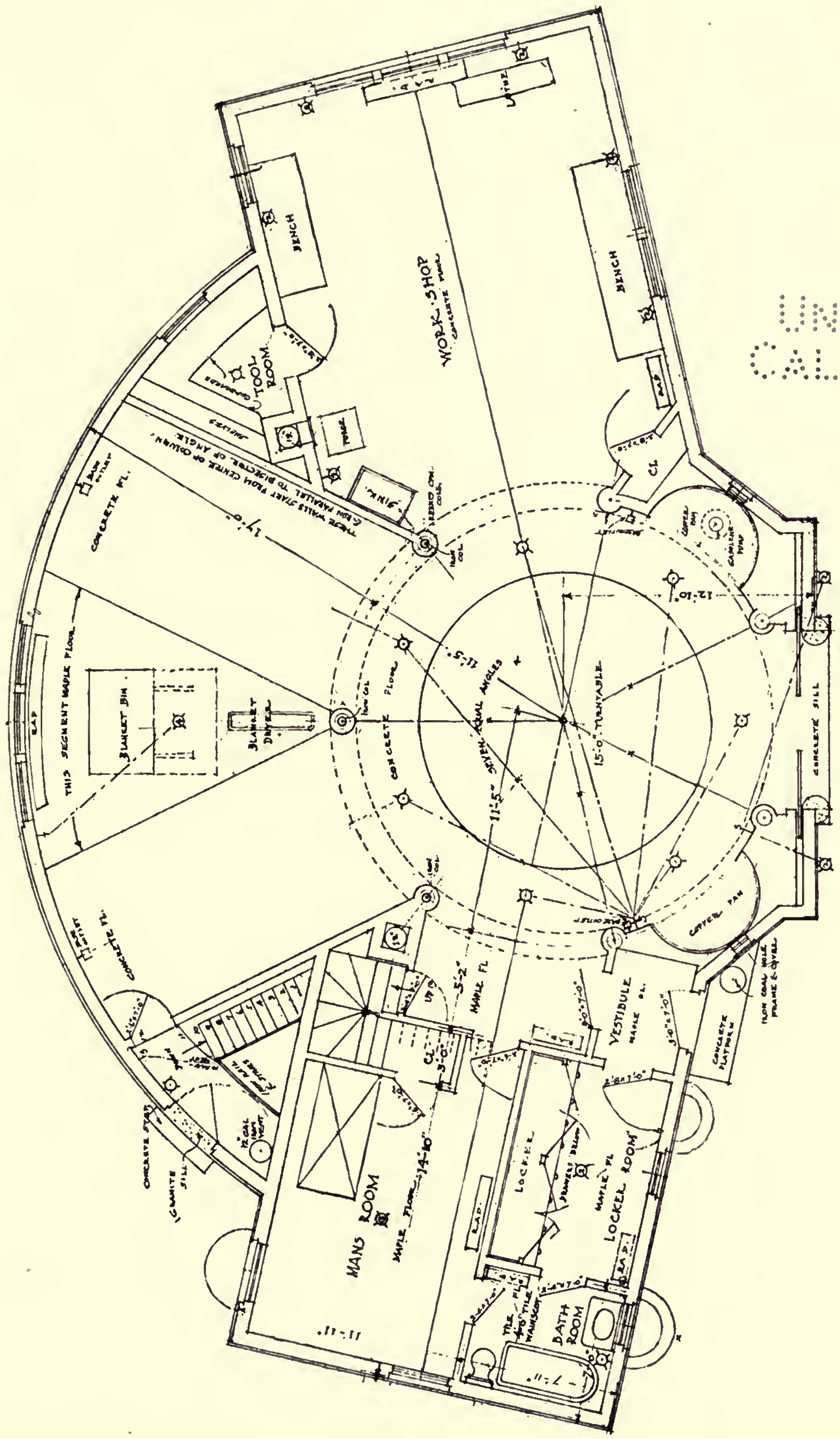
First Floor Plan

GARAGE AND POWER HOUSE FOR THOS. E. PROCTOR, TOPSFIELD, MASS.
Putnam & Cox, Architects

INTERIOR VIEWS OF GARAGE AND POWER HOUSE AT TOPSFIELD, MASS.
Putnam & Cox, Architects

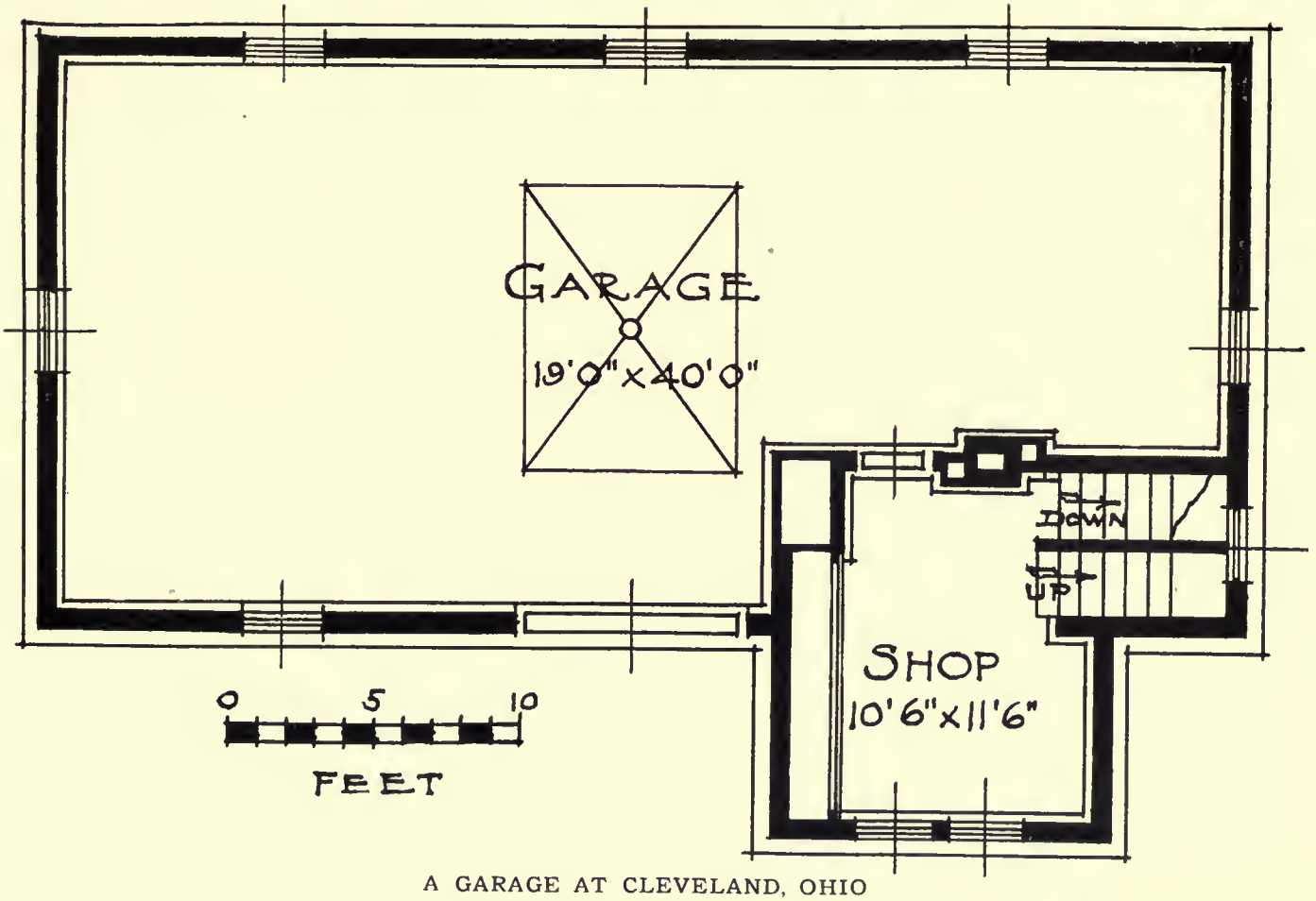
INTERIOR OF A GARAGE AT IPSWICH, MASS.
Putnam & Cox, Architects
The glazed brick walls and large window and door openings make a light interior

VIEW OF A PART OF THE INTERIOR OF A GARAGE AT NEWTON, MASS.
Putnam & Cox, Architects
Showing Turntable, gasoline pump and workroom

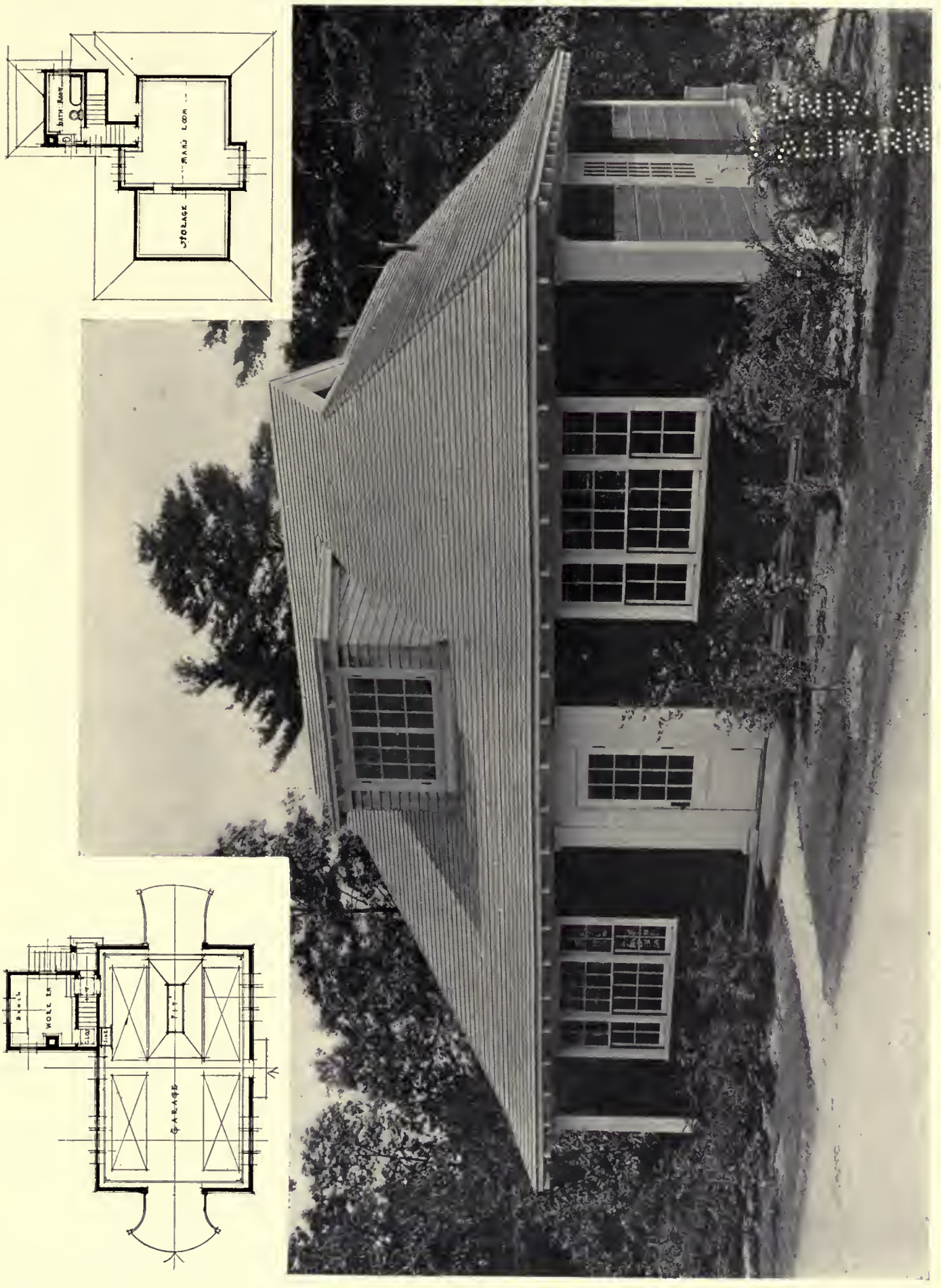


Ground Floor Plan

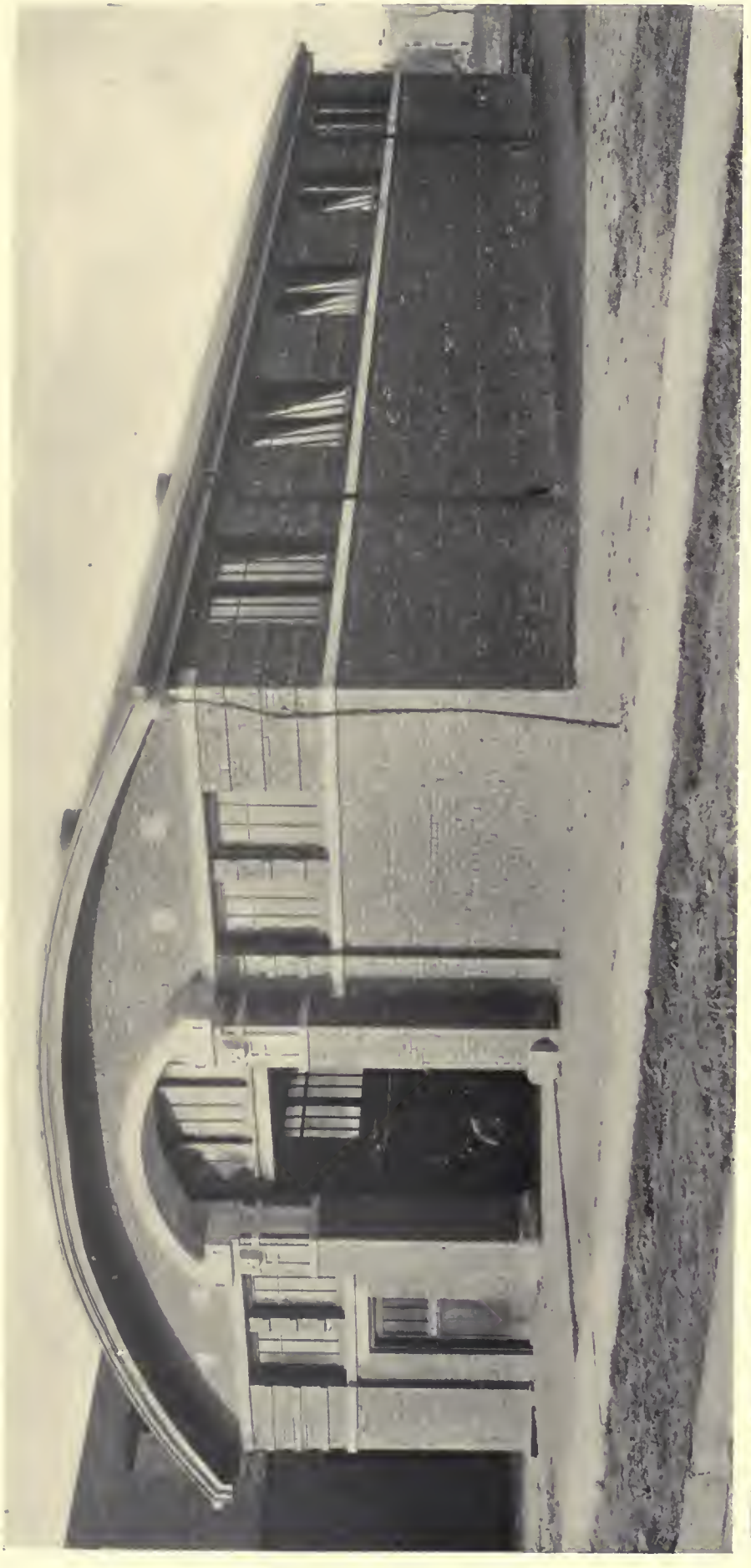
GARAGE AT CHESTNUT HILL, MASS.
Putnam & Cox, Architects



A GARAGE AT CLEVELAND, OHIO
Bohnard & Parsson, Architects



A GARAGE AT NORTH EASTON, MASS.
S. B. Parker, Architect



GARAGE FOR MESSRS. SEARS, ROEBUCK & CO.
CHICAGO, ILL.
Nimmons & Fellows, Architects

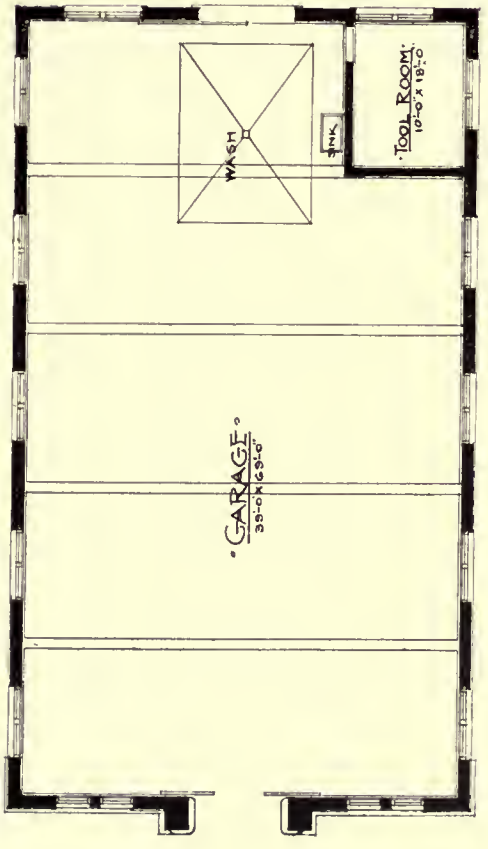
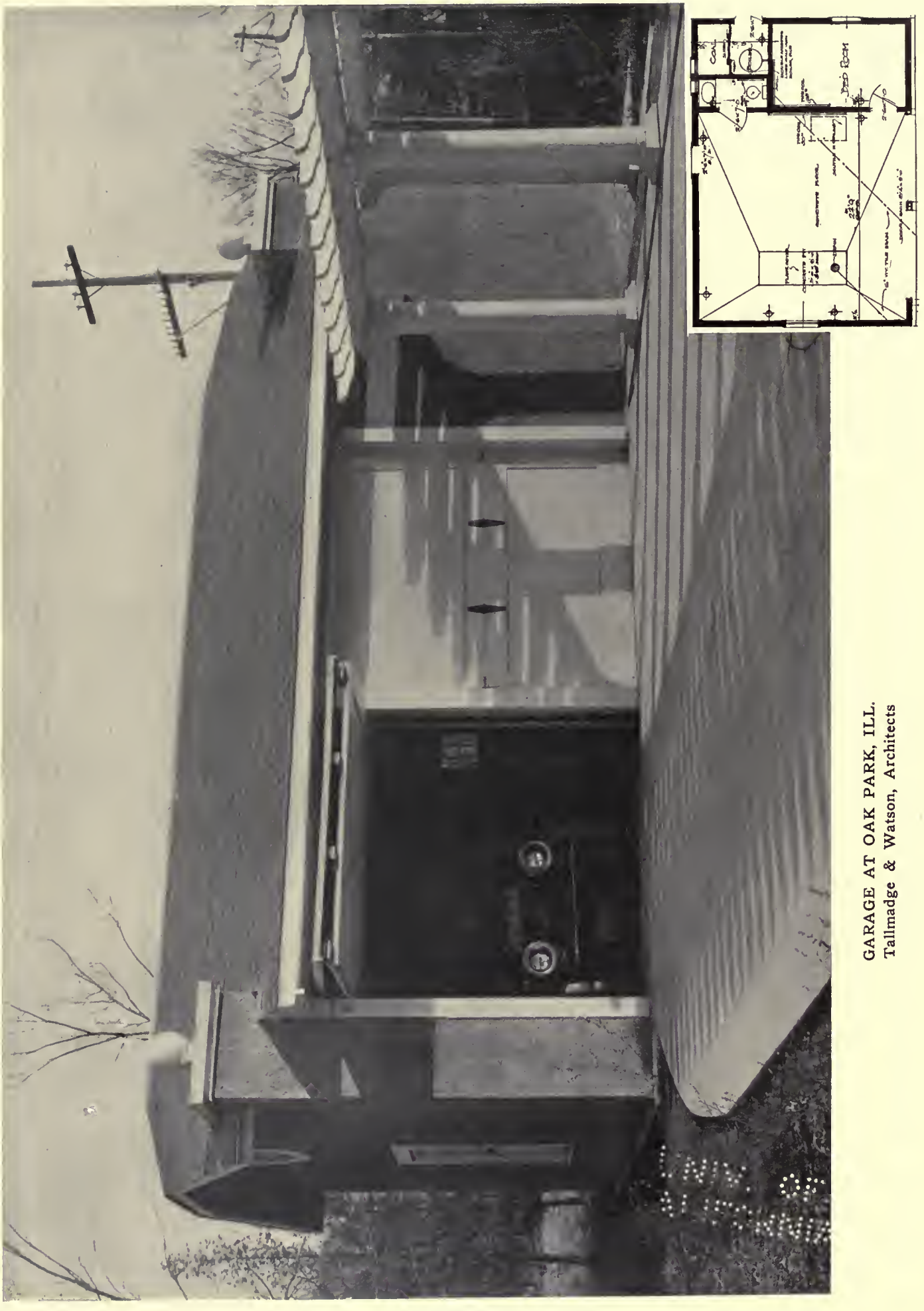
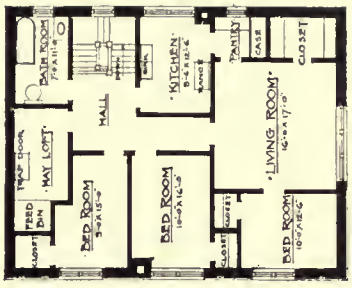


Plate 19

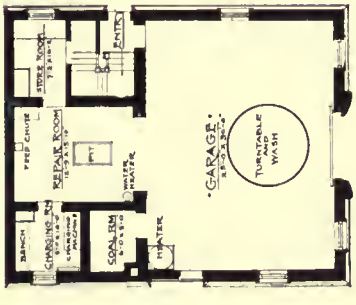


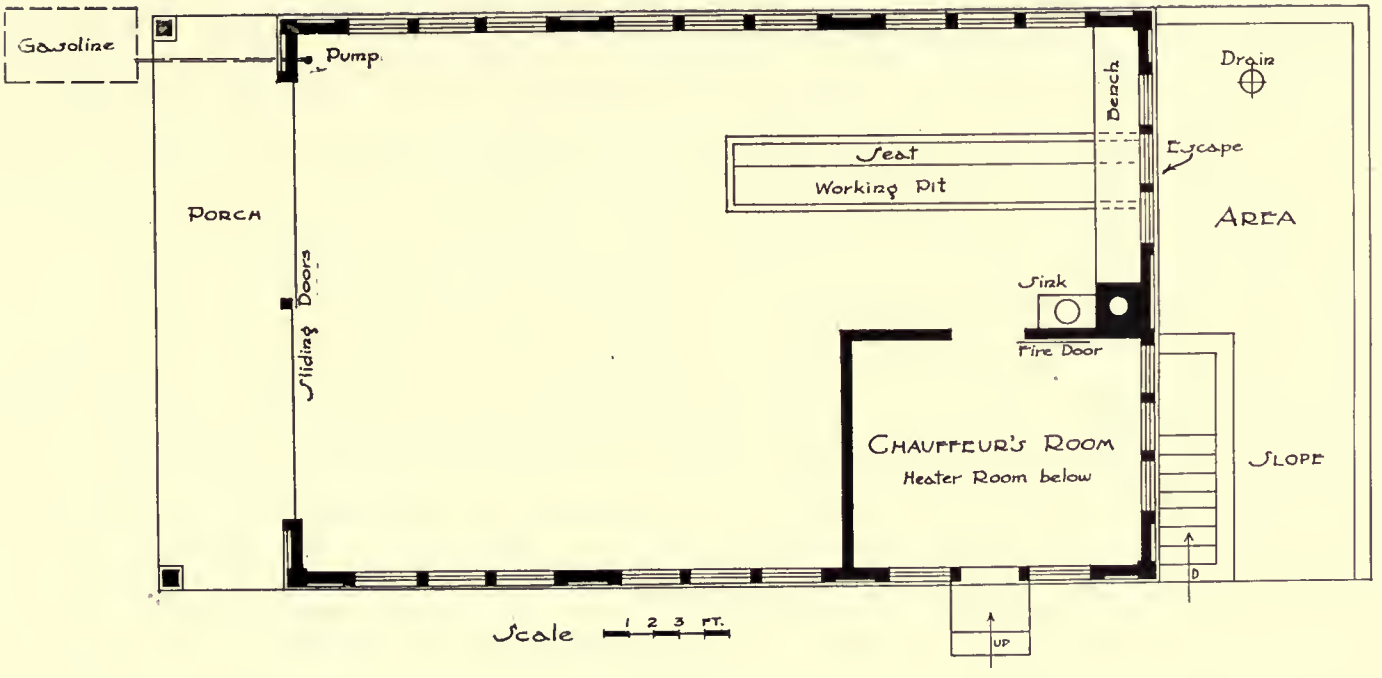
GARAGE AT OAK PARK, ILL.
Tallmadge & Watson, Architects



GARAGE OF W. V. KELLEY, ESQ.
CHICAGO, ILL.

Messrs. Nimmons & Fellows, Architects

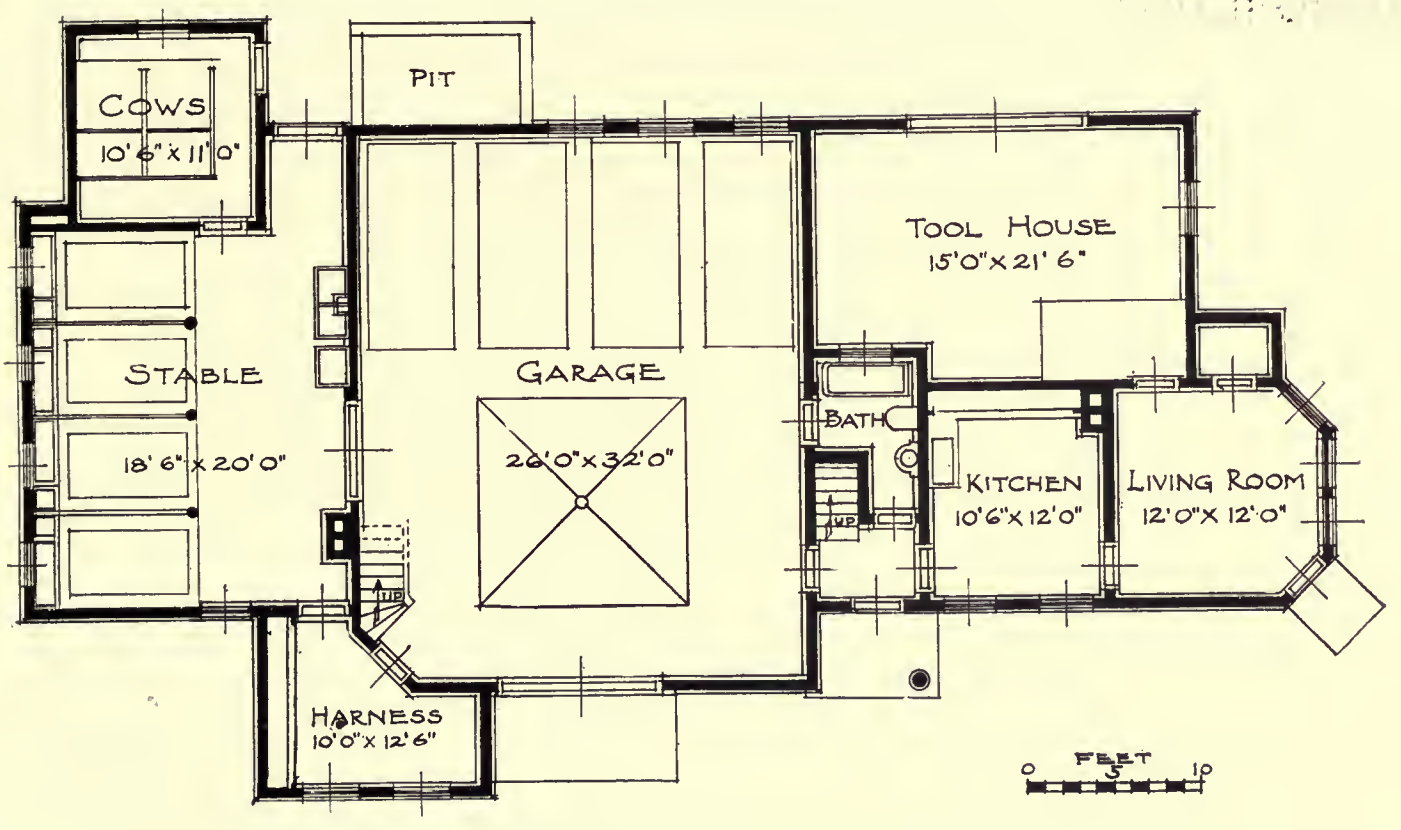




A GARAGE AT SYRACUSE, N. Y.

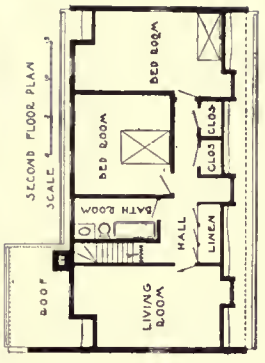
Alfred T. Taylor, Architect

Plate 22

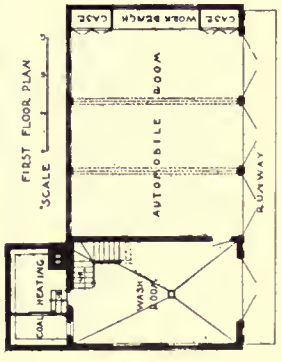


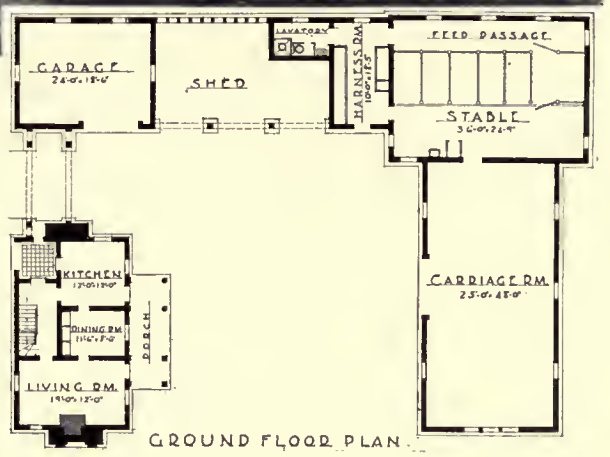
STABLE AND GARAGE AT WILLOUGHBY, OHIO

Bohnard & Parsson, Architects



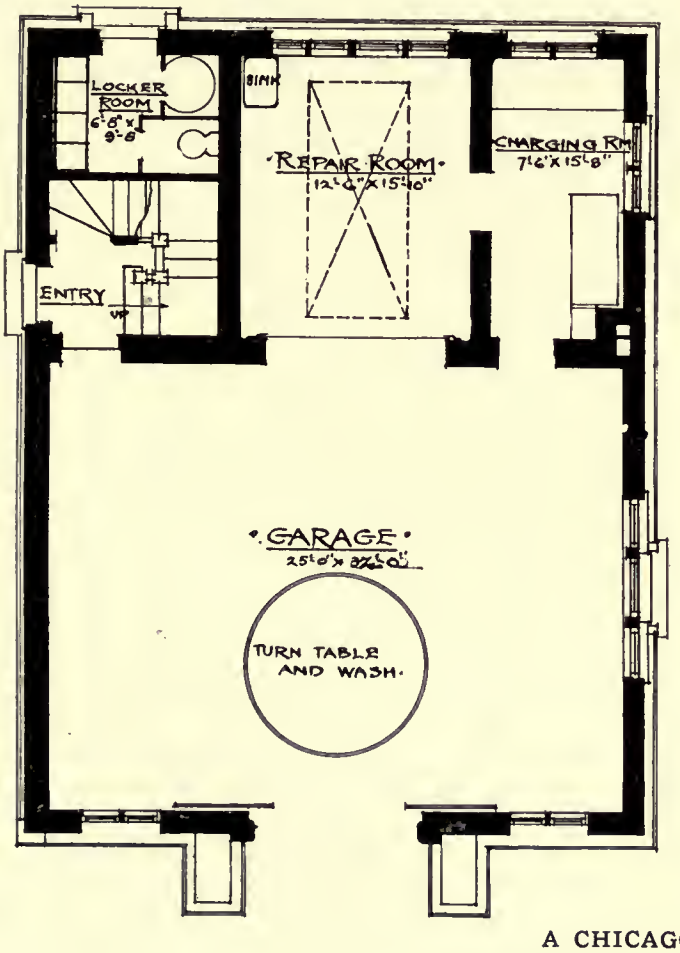
GARAGE OF R. W. BIRD, ESQ.
BROOKLINE, MASS.
J. Lavelle, Architect

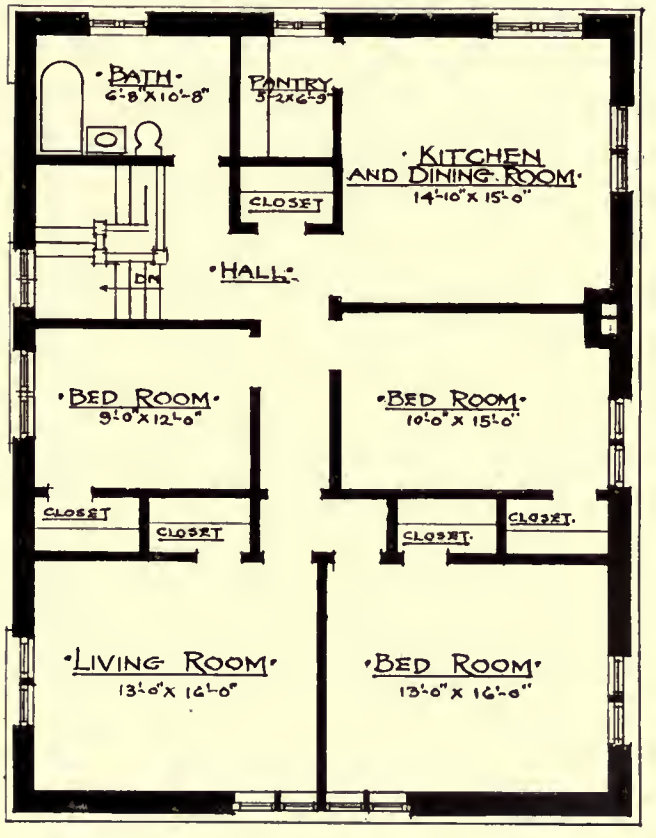




GARDENER'S COTTAGE AND GARAGE AT KENNEBUNKPORT, ME.

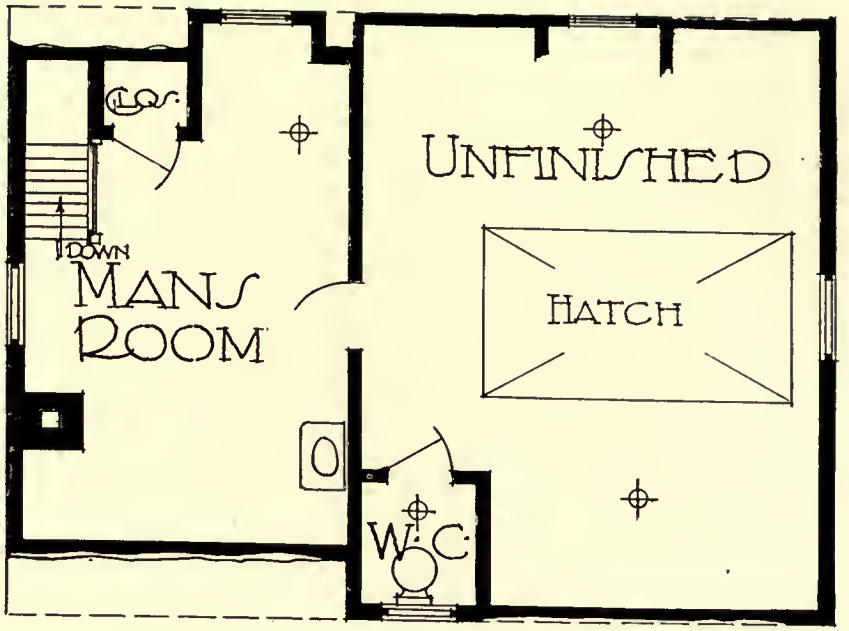
Green & Wicks, Architects

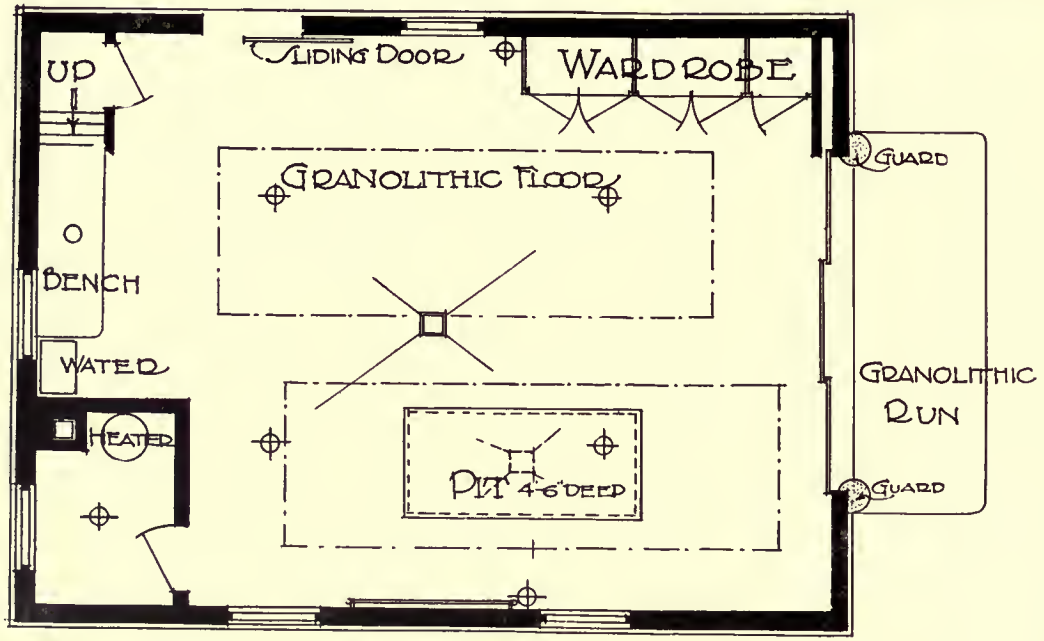




A CHICAGO GARAGE

Messrs. Nimmons & Fellows, Architects

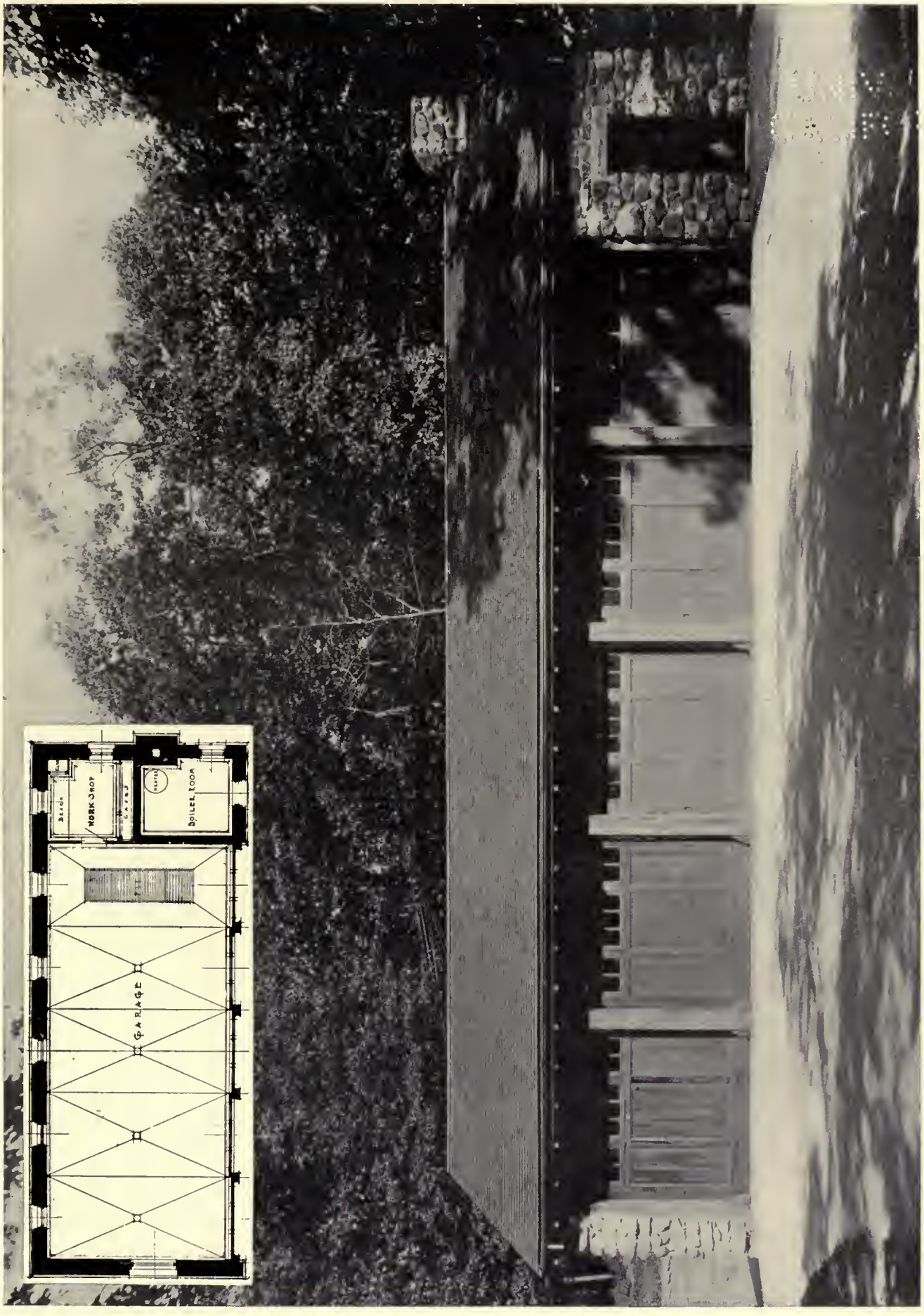




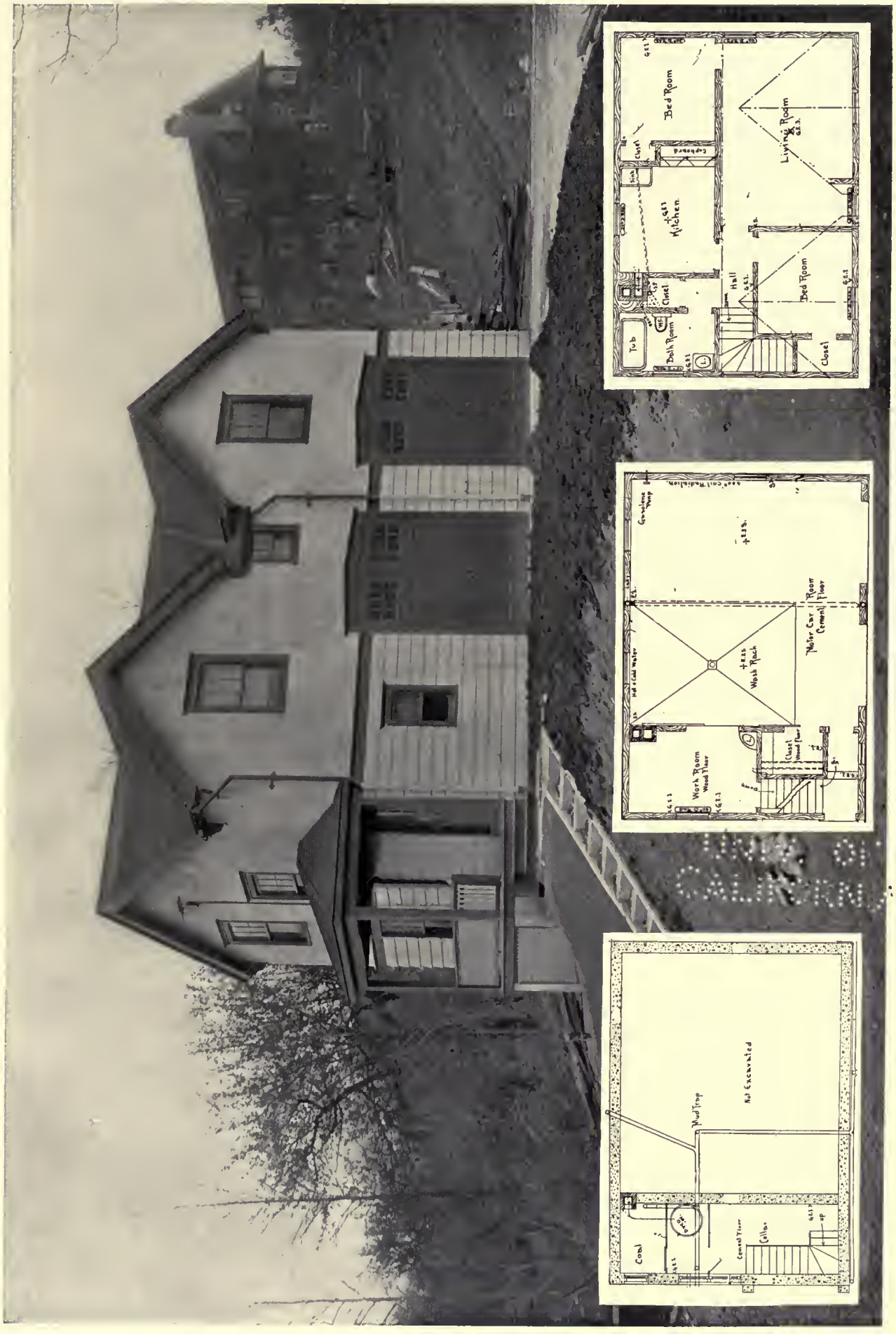
GARAGE AT BEVERLY, MASS.

Kilham & Hopkins, Architects.

This garage has a concrete foundation to the height of the window sill, forming a curve with the floor slabs. Above concrete the walls are of frame, wire lathed, both sides. The roof is of red slate to match the other buildings on the estate.

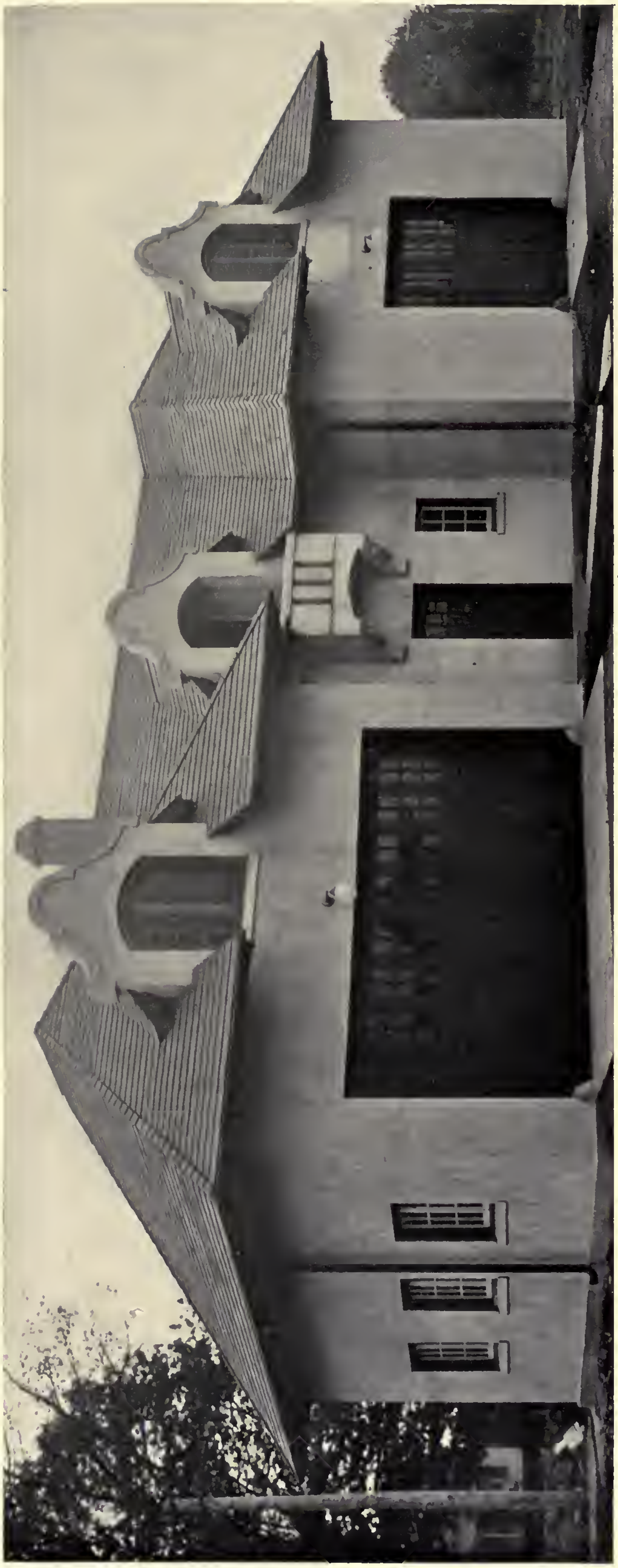


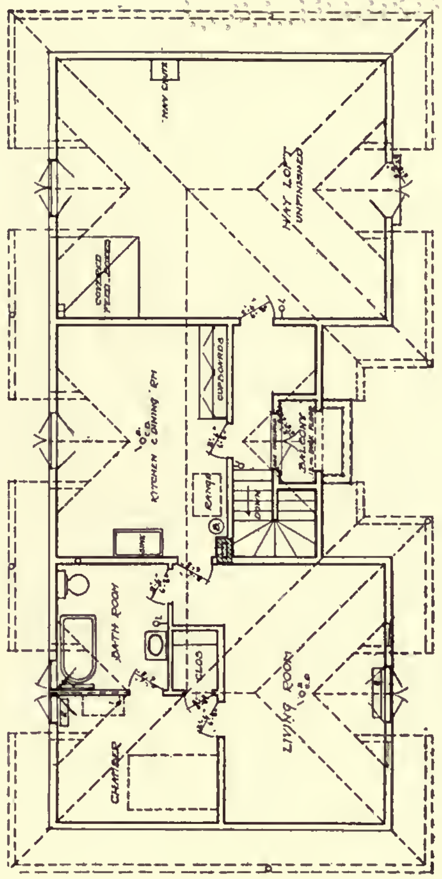
A GARAGE AT NORTH EASTON, MASS.
S. B. Parker, Architect.

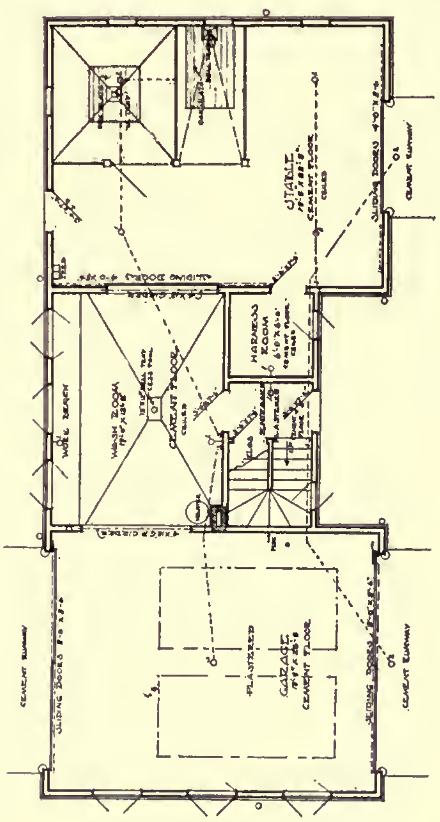


GARAGE AT ROCHESTER, N. Y.

James R. Tyler, Architect



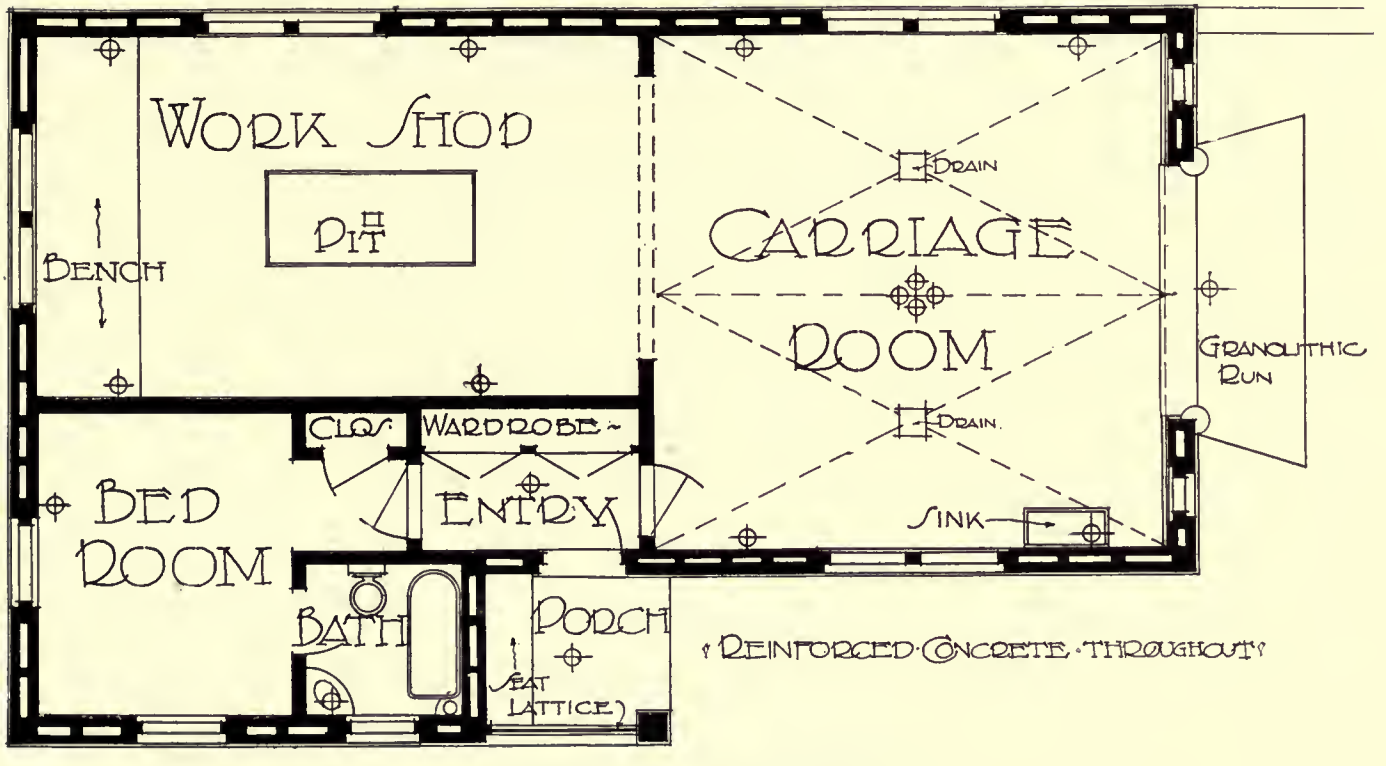




GARAGE FOR MR. CHARLES STERN, EAST AVE., ROCHESTER, N. Y.

Foote & Headley, Architects

Plate 30

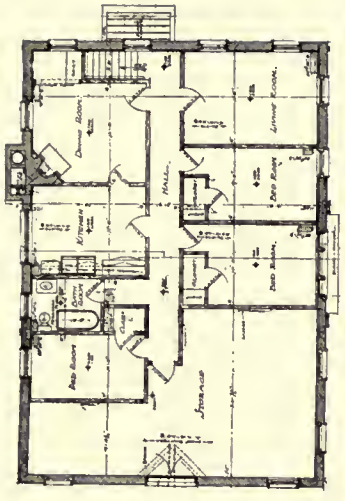


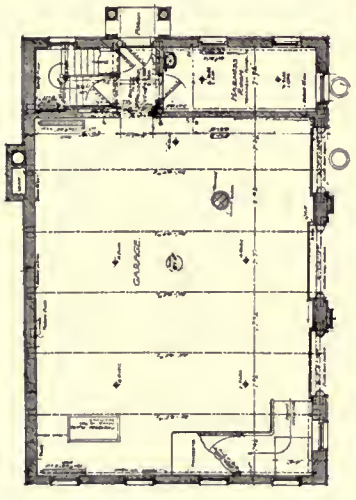
A GARAGE AT COHASSET, MASS.

Kilham & Hopkins, Architects

Plate 31

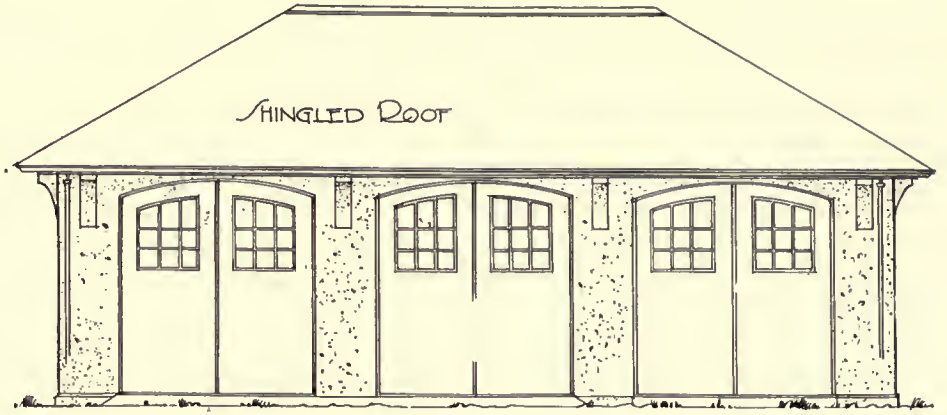
GARAGE OF MRS. CHARLES HIGBEE
DOVER, MASS.
Cummings & Howard, Architects

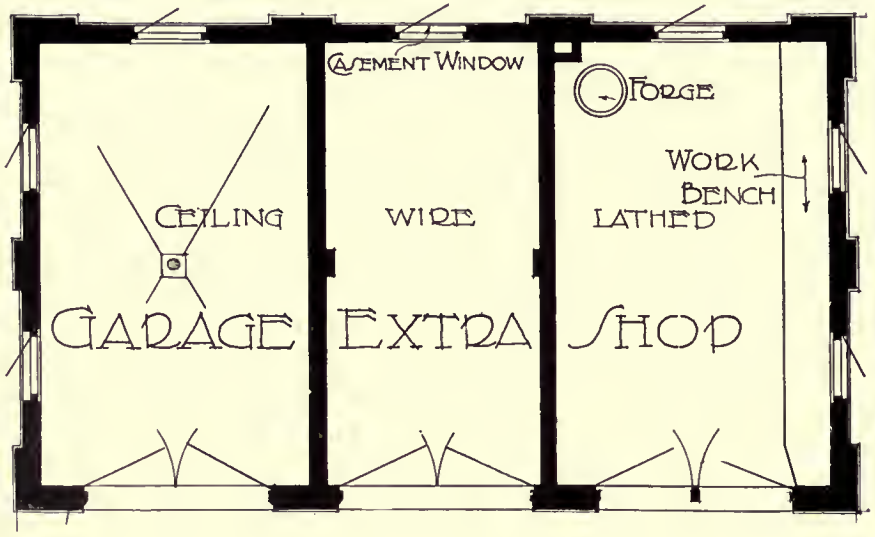




GARAGE FOR MR. W. K. JACKSON
BUFFALO, N. Y.
McCreary, Wood & Bradney, Architects

GARAGE NEAR BOSTON, MASS.
J. A. Schweinfurth, Architect

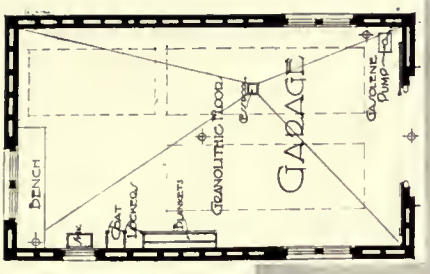




GARAGE OF J. C. HOPKINS, ESQ., DOVER, MASS.

Kilham & Hopkins, Architects

Built of brick, with walls plastered outside



GARAGE OF A. C. LAWRENCE, ESQ.
MARBLEHEAD NECK, MASS.

Kilham & Hopkins, Architects

Built of mass concrete, reinforced at openings

CONCRETE GARAGE OVERLOOKING LAKE NEAR WINCHESTER, MASS.

GARAGE OF FIELD STONE WITH SHINGLE ROOF AT LAWRENCE PARK, BRONXVILLE, N. Y.

Wm. A. Baker, Architect

Plate 37

CEMENT GARAGE WITH PERGOLA, AT GLEN RIDGE, N. J.
Davis, McGrath & Kiessling, Architects

A CEMENT GARAGE WITH PERGOLA, AT MONTCLAIR, N. J.
This garage is built on a hillside corner lot. Road runs through the building, so that car may enter at one end and leave at the other

GARAGE OF CHARLES BEYERLE, ESQ., CAIRO, EGYPT
Carlo Prampolini, Architect

Plate 39

ONE-CAR CEMENT GARAGE AT BROOKLINE, MASS.
Charles E. Barnes, Architect

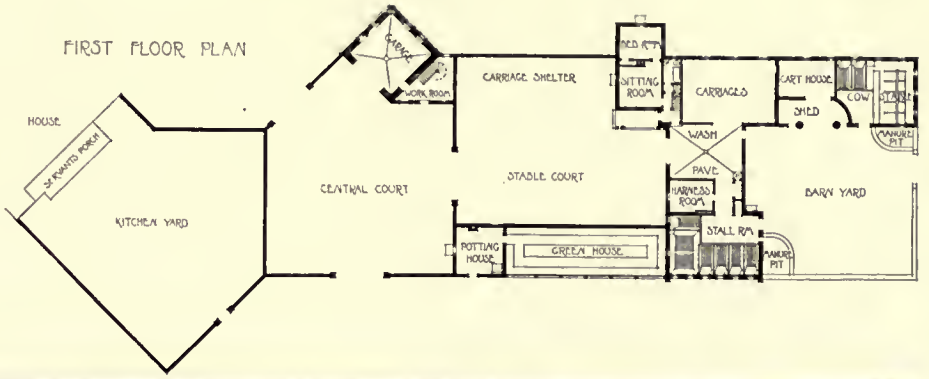
A GARAGE BUILT OF CONCRETE BLOCKS AT ENGLEWOOD, N. J.
Davis, McGrath & Kiessling, Architects

GARAGE AT ROSEMONT, PA.
Built of local stone, with shingle roof

A SHINGLED GARAGE AT MARION, MASS.
Chauffeur's bedroom and shower bath at right

A SYMMETRICAL GROUP OF BUILDINGS WITH GARAGE IN FOREGROUND NEAR RADNOR, DELAWARE CO., PA.

George Bispham Page, Architect

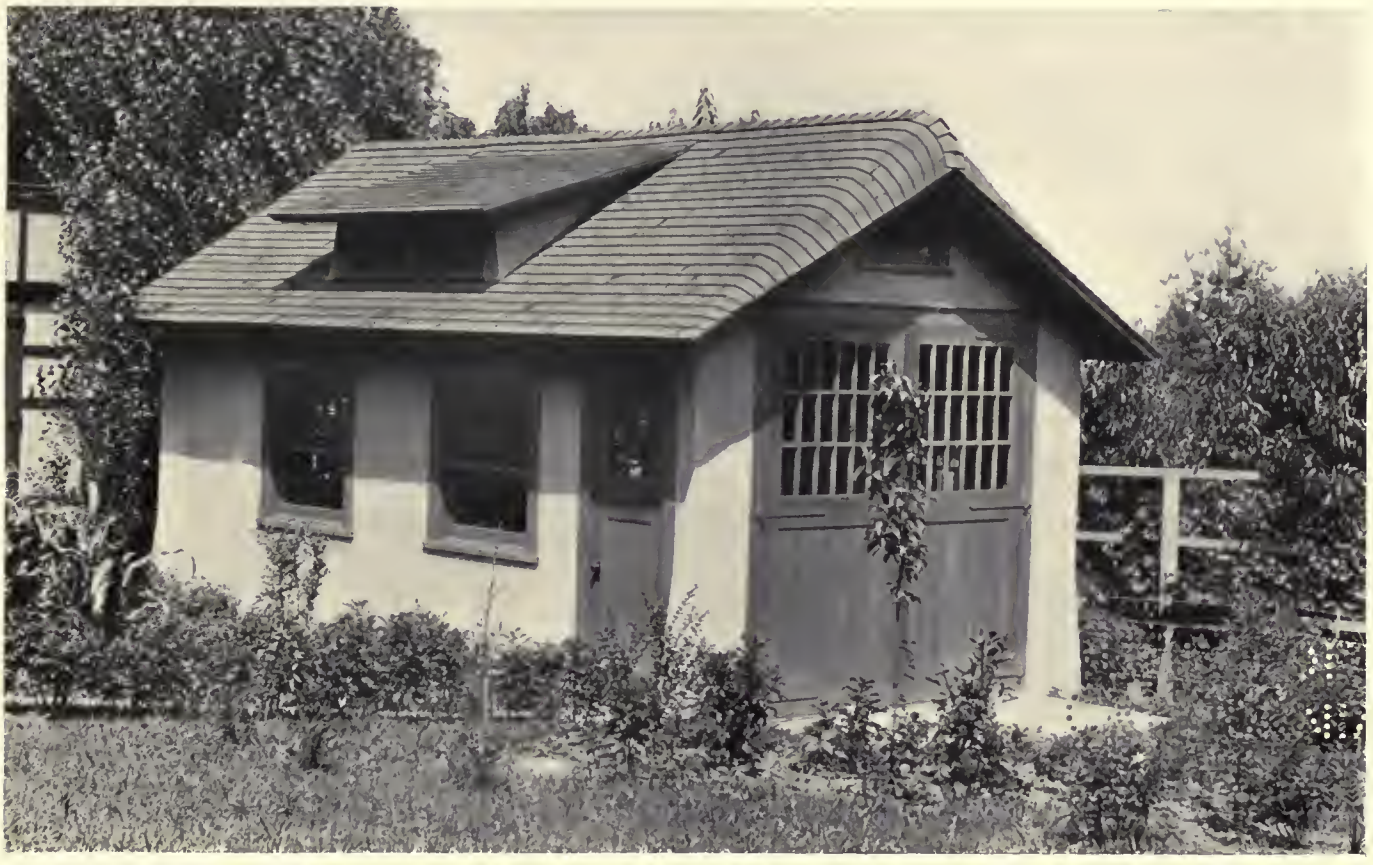


STONE, CARPENTER & WILSON, Architects

FRONT AND REAR VIEWS
OF A GARAGE AT
CHAPINVILLE, CONN.

SHINGLED ONE-CAR GARAGE, MARION, MASS.
Wm. G. Preston, Architect

A CIRCULAR GARAGE AT SOUTH ORANGE, N. J.
George W. Maher, Architect



A ONE-CAR GARAGE ON ROCKLEDGE ROAD, MONTCLAIR, N. J.

GARAGE AT ROSEMONT, PA.

Alex. M. Adams, Architect

Plate 45

GARAGE AND STABLE AT COLLEGE HILL, CINCINNATI, O.
Gamble & Rogers, Architects

BRICK AND HALF-TIMBER GARAGE AT ROLAND PARK, BALTIMORE, MD.
Alfred H. Taylor, Architect
Plate 47

GARAGE FOR TWO OR MORE CARS, WITH CHAUFFEURS' ROOMS ABOVE

A GARAGE AT ENGLEWOOD, N. J.

Donn Barber, Architect

This building has accommodations on second floor for gardener and chauffeur

GARAGE BUILT OF LOCAL STONE, AT MOUNT AIRY, PHILADELPHIA, PA.

Billiard room in second story

Photo, copyright by Atlas Portland Cement Co.

A CEMENT GARAGE IN THE SUBURBS OF NEW YORK

Photo, copyright by Atlas Portland Cement Co.

A SOLID CONCRETE GARAGE FOR TWO CARS AT WASHINGTON, D. C.

STREET FRONT AND REAR VIEW OF A "ROUGH COAT" GARAGE ON RIDGEWOOD AVENUE, GLENRIDGE, N. J.

Photo. copyright by Atlas Portland Cement Co.

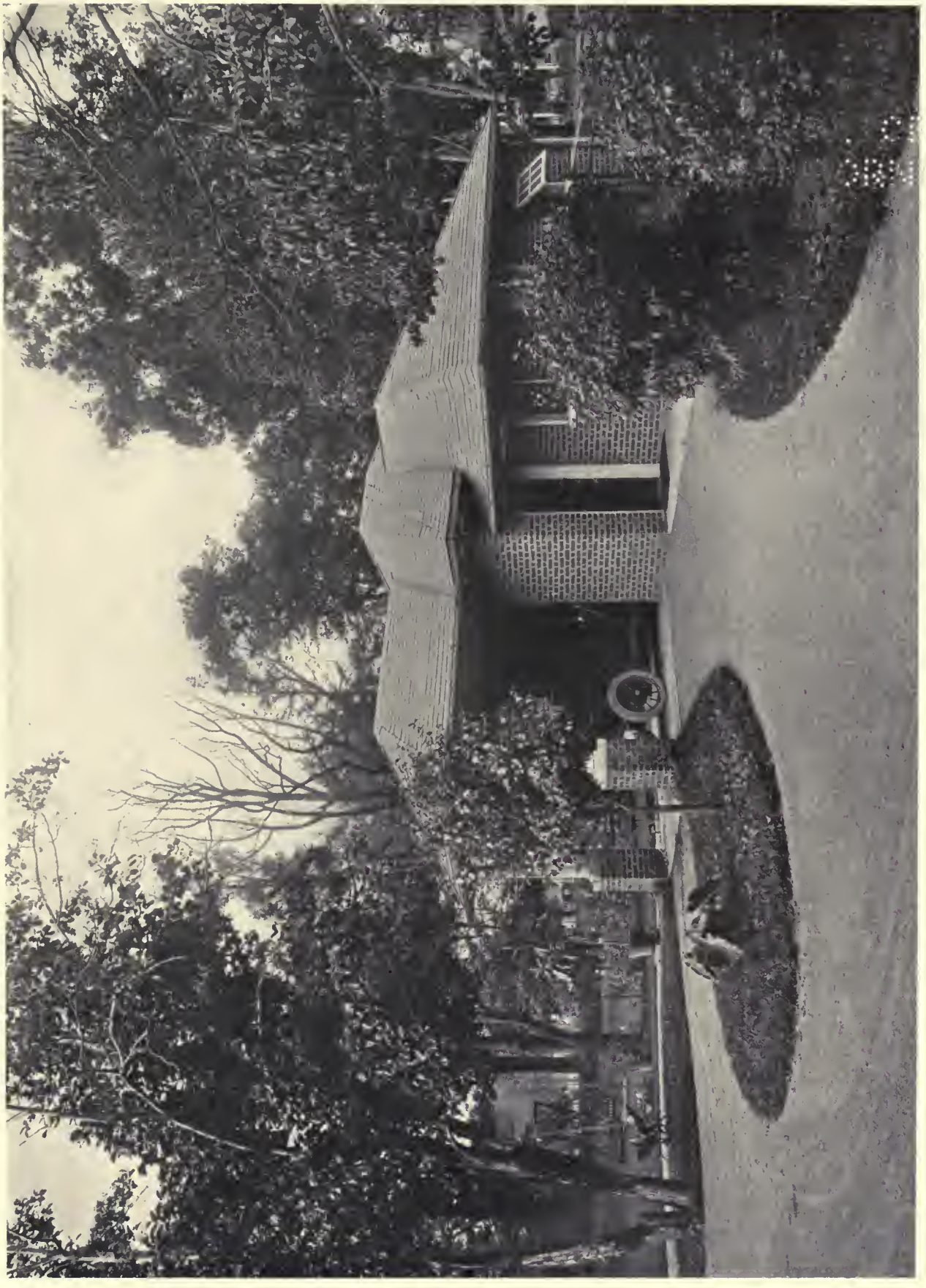
CEMENT GARAGE ON THE "NORTH SHORE," NEAR BOSTON, MASS.

Arthur Huen, Architect

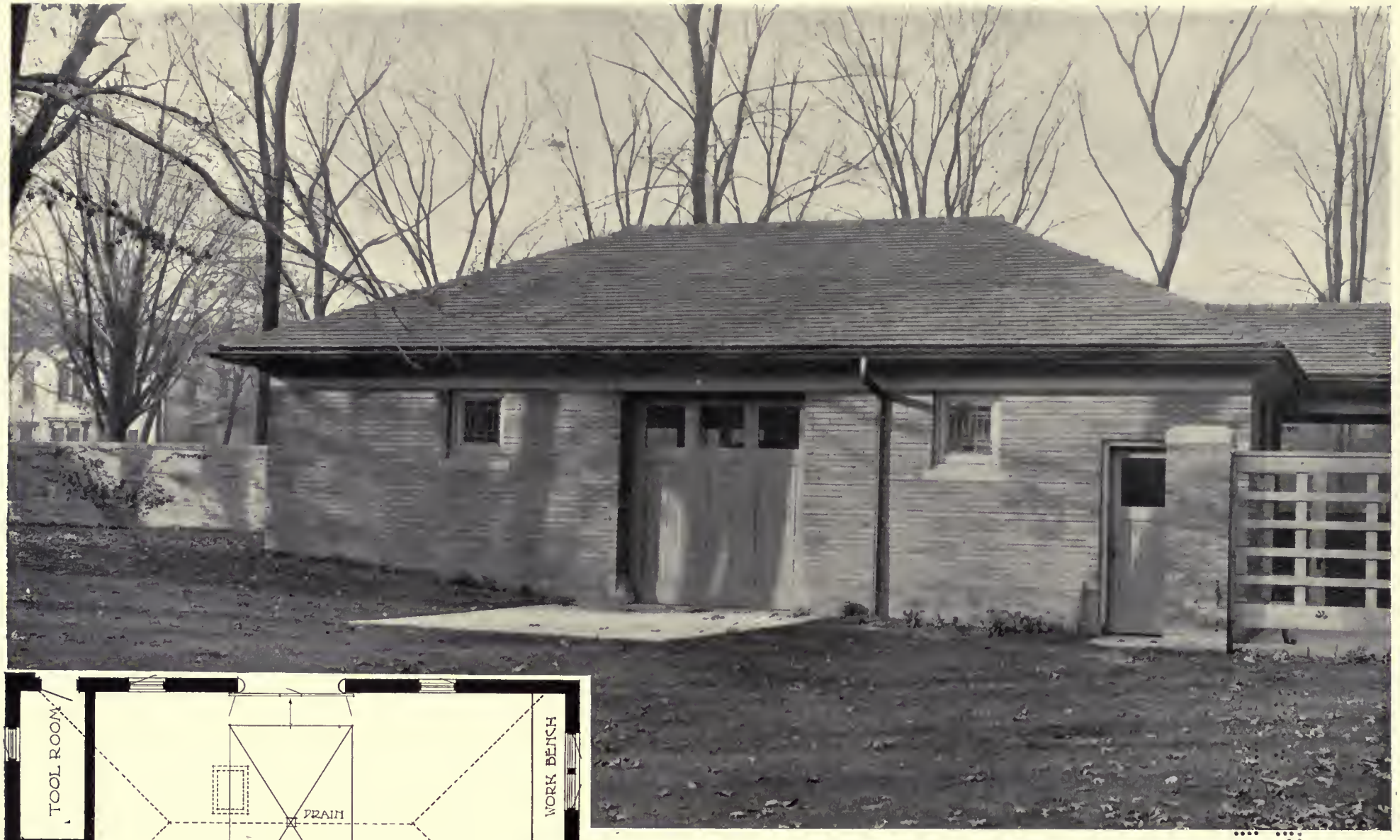
A SHINGLED ONE-CAR GARAGE, WINCHESTER, MASS.

Edwin R. Blaikie, Architect

GARAGE AND STABLE AT WATERBURY, CONN.
E. E. Benedict, Architect
Stable in Basement, Garage above, Garden on Roof



A BRICK GARAGE WITH SHINGLE ROOF AT MOUNT AIRY, PA.



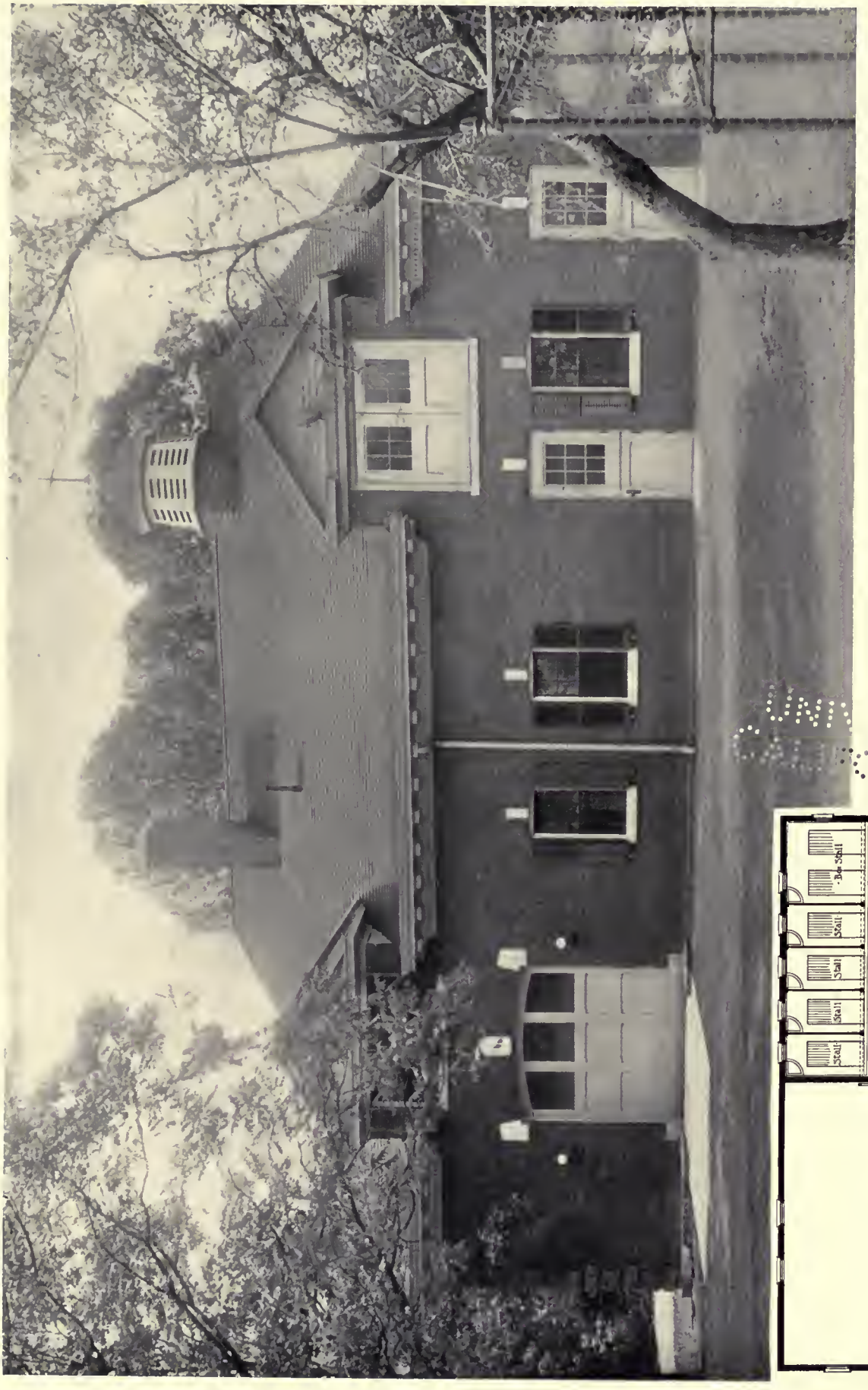
GARAGE FOR MR. E. W. McCREADY, OAK PARK, ILL.
Spencer & Powers, Architects

ONE-CAR GARAGE AT NEWPORT, R. I.
Edward P. Whitman, Architect

Photo. copyright by Atlas Portland Cement Co.

A GARAGE AT "GRASSLANDS," EAST VIEW, N. Y.
Built of field stone with concrete roof

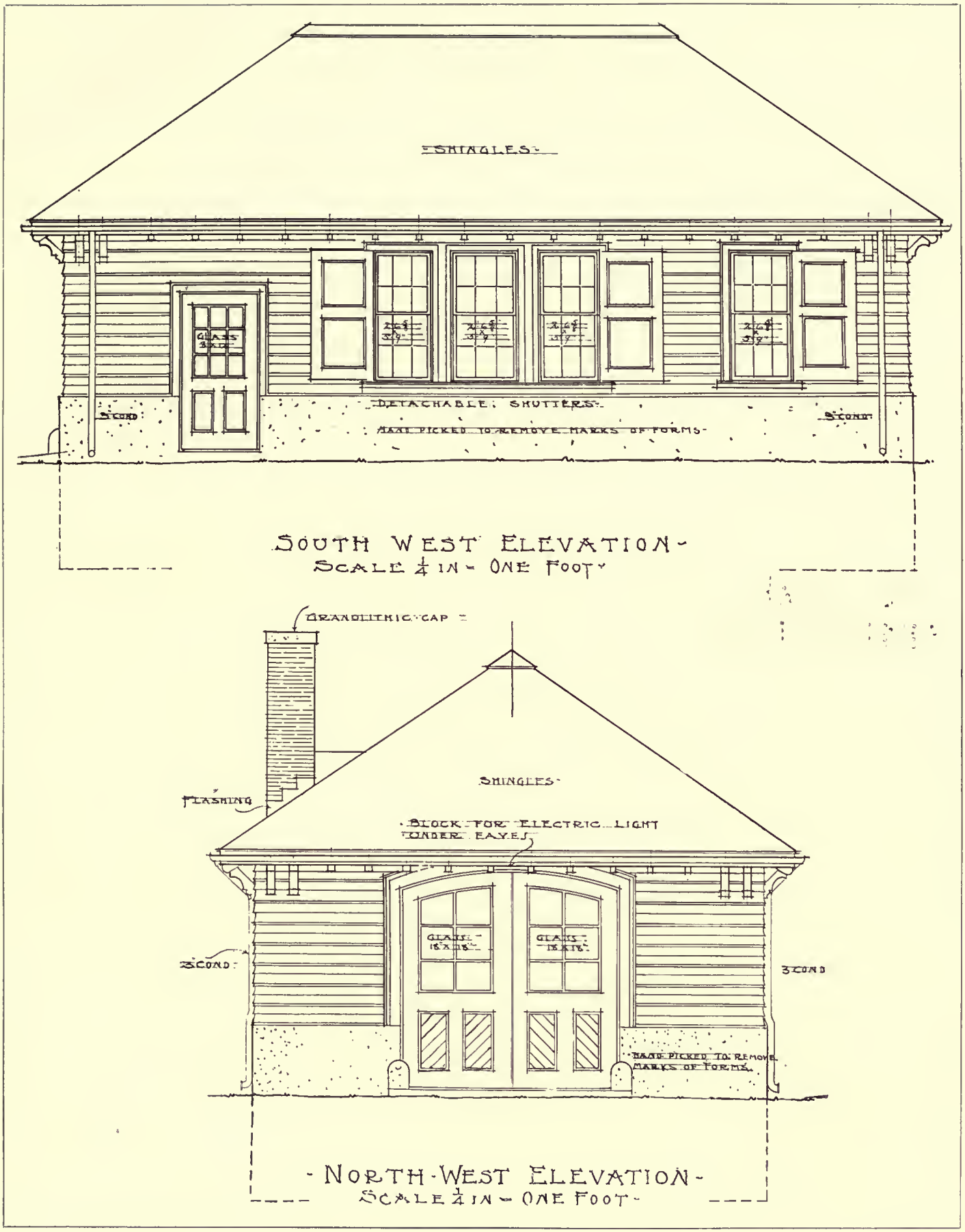
GARAGE AT ELKINS PARK, PA.
C. E. Schermerhorn, Architect



GARAGE FOR MR. JOHN TAYLOR
MILBURN, N. J.
Ernest Greene, Architect

GARAGE AT OVERBROOK, PA.
Horace Wells Sellers, Architect

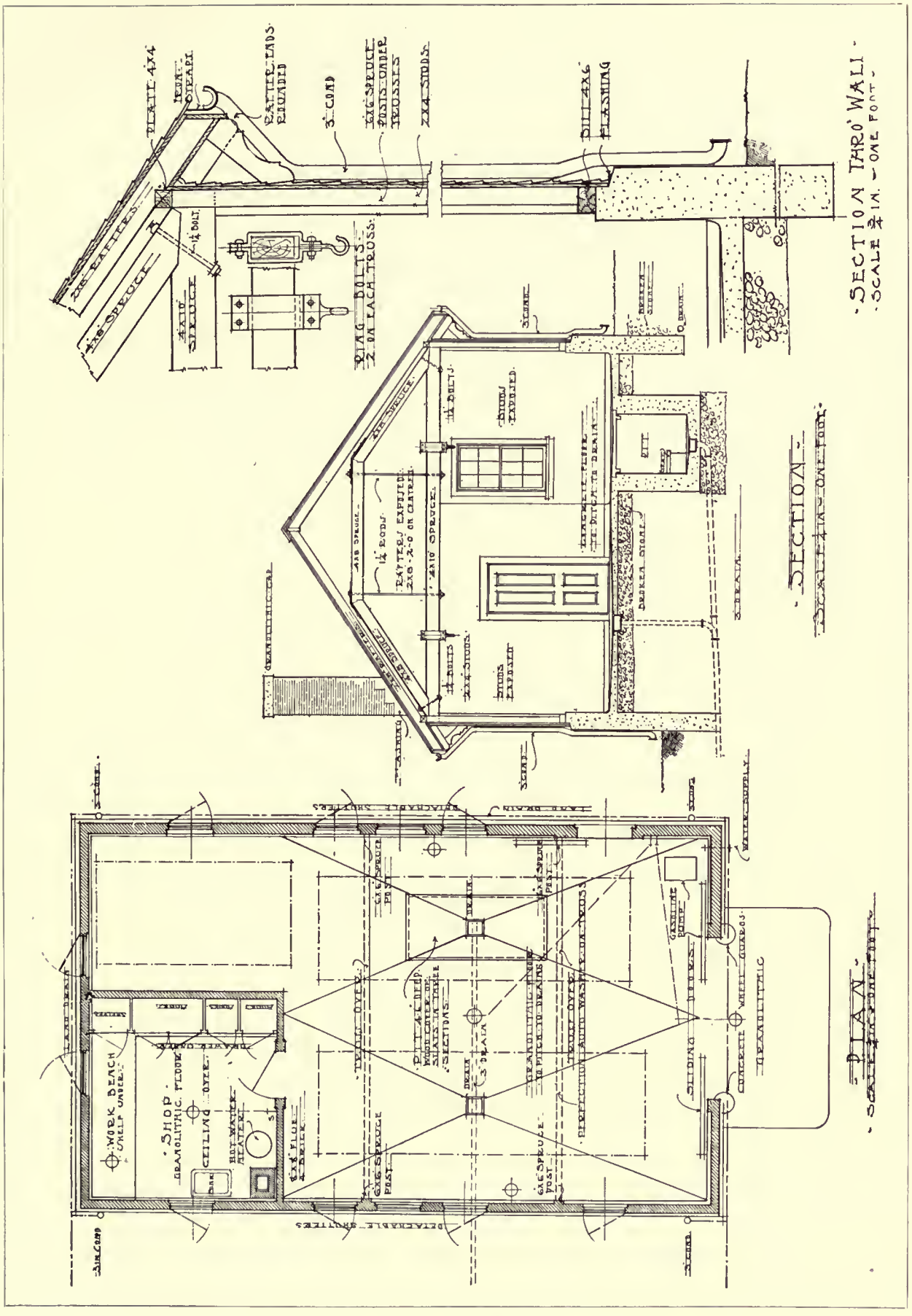
GARAGE IN BASEMENT OF HOUSE AT BROOKLINE, MASS.
Charles A. Platt, Architect



GARAGE AT BEVERLY FARMS, MASS.

Messrs. Kilham & Hopkins, Architects

Illustrates an economical form of construction, described on page 3. The walls are built of concrete to height of window sills, and rounded to meet floor. Above concrete walls are of frame, shingled outside

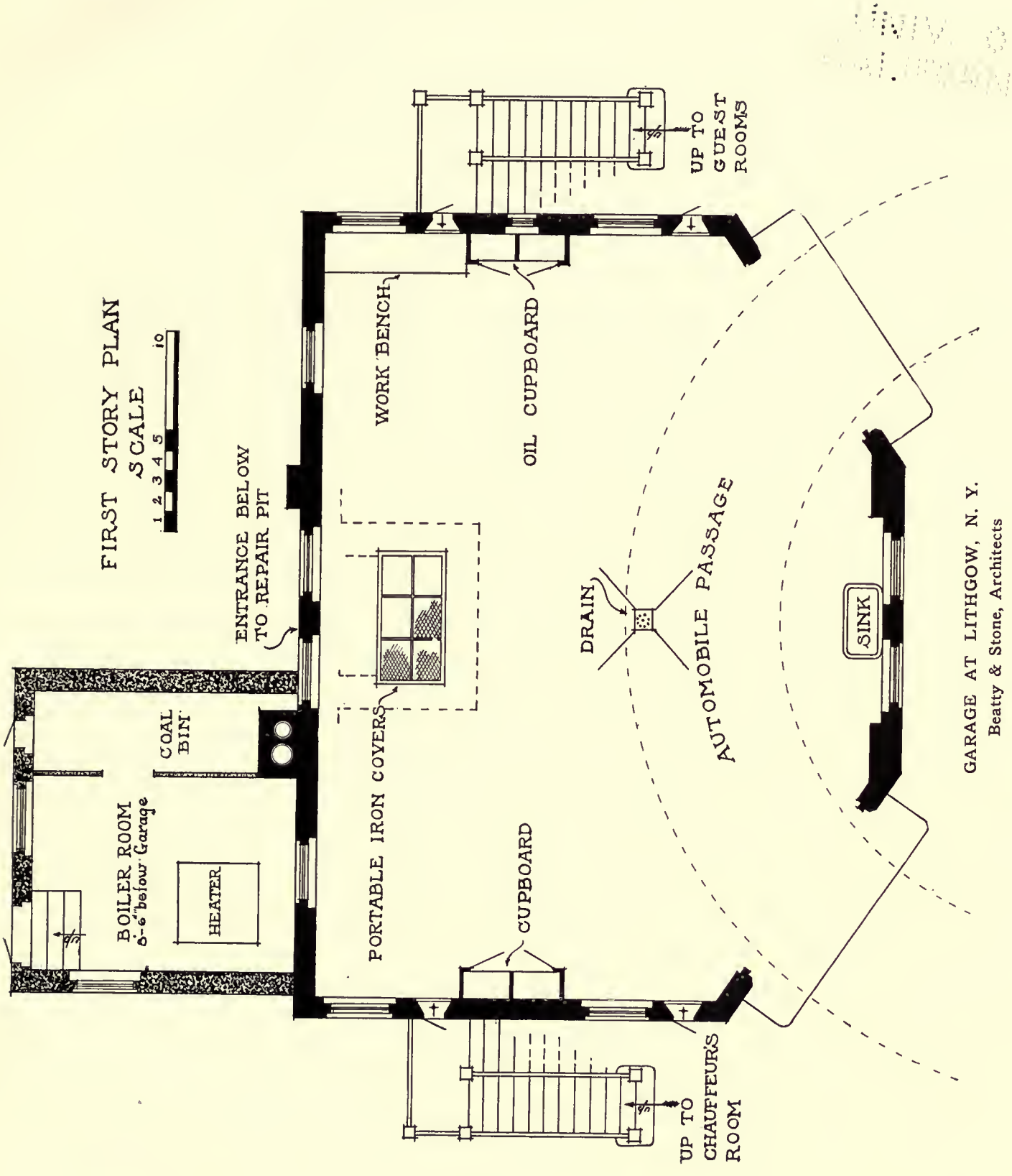


PLANS AND DETAILS OF A GARAGE AT BEVERLY FARMS, MASS.

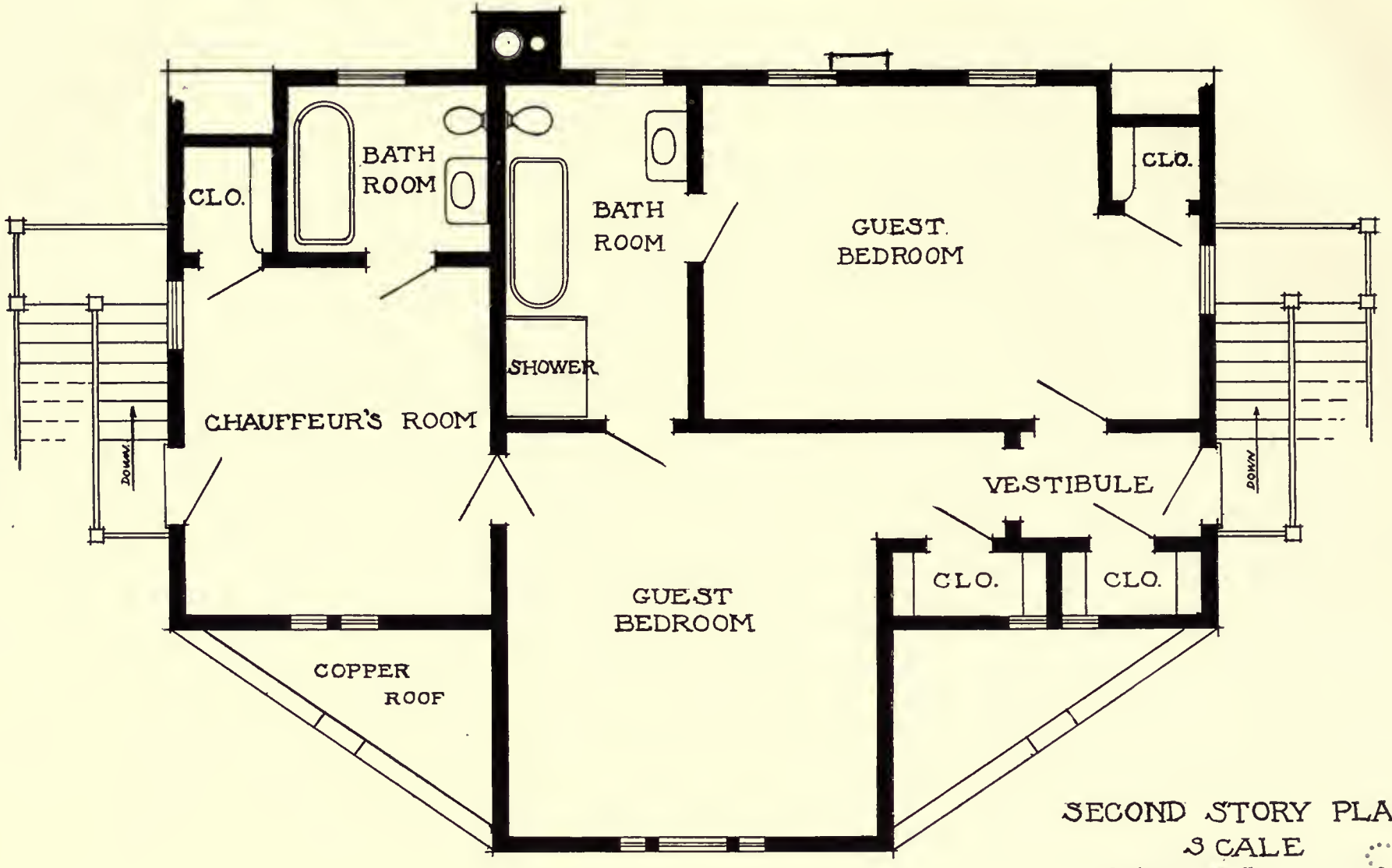
Messrs. Kilham & Hopkins, Architects

Illustrating an economical and highly serviceable form of construction. The concrete walls are easy to keep clean and not readily injured

GARAGE AT LITHGOW, N. Y.
Beatty & Stone, Architects



GARAGE AT LITHGOW, N. Y.
Beatty & Stone, Architects



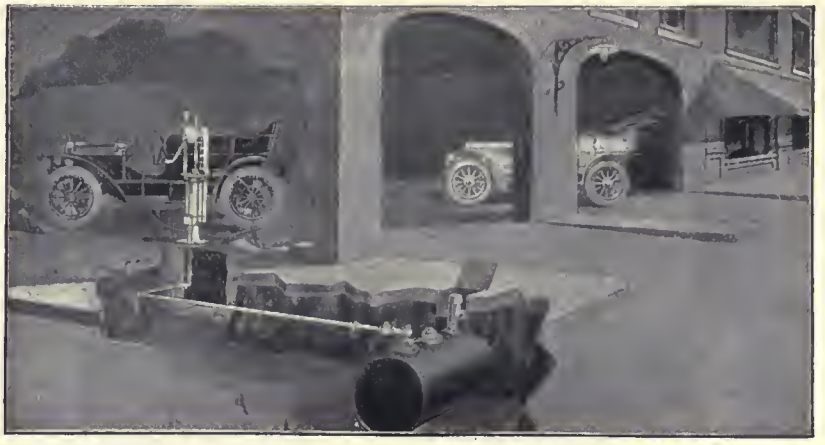
SECOND STORY PLAN

SCALE

0 1 2 3 4 5 10

GARAGE AT LITHGOW, N. Y.

Beatty & Stone, Architects



Mr. Architect:

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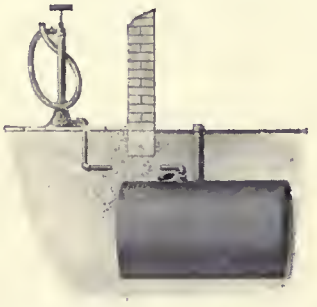

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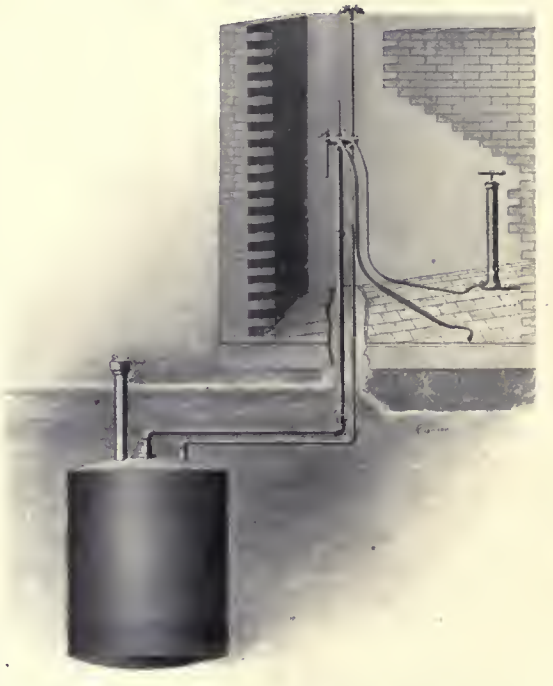

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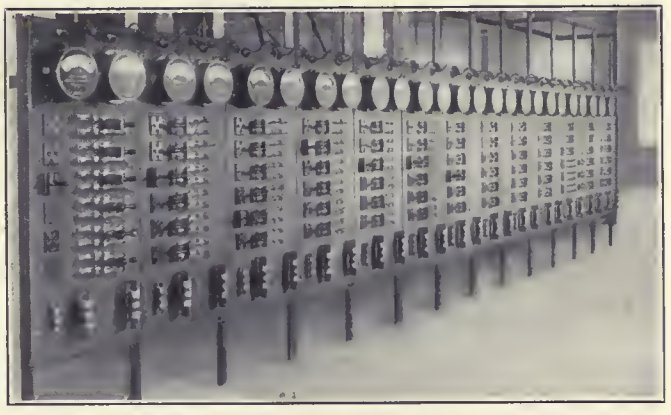

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