How To Build
A WIND-PROOF Gothic Barn

By A. W. HOLT

I HAVE just returned from examining the first "balloon frame" barn I ever heard of; and, incidently, it is the first one built near Spicer, Minnesota, where my father was the "lumberman." That was in 1902 and I can almost see dad now as he referred to the old *American Builder,* where he first learned of that construction, while he discussed it with the carpenter who did the building later on. Both agreed that this "trussed-rafter" construction should be much stronger than the old timber-frame that was customary then.

That barn was very similar to the braced-rafter construction illustrated by Fig. 1, which is reproduced from my barn book, "ABC Barn Cost-rates." It is just as plumb and true today as it was 33 years ago. Yet I can recall the farmer-owner telling about another carpenter, who tried to get the job, coming out to see it during its construction and saying, "After the first wind storm you'll be after me to build one of *MY* barns from the wreckage." The next year that dubious carpenter was building this new "open hay mow" barn himself.

After considering my wind-proof gothic barn some readers will likely say the same about this construction. But I venture the assertion that they will be building them in the near future too. Remember, I do not claim it is tornado proof. I cannot conceive of anything that could withstand a real twister. But its stream-lined, hug-the-ground design, plus its scientific bracing makes it as wind-proof as is practically possible. And high winds wreck more barns than do the funnel-shaped clouds.

After engineers at the University Farm of St. Paul and the Iowa State College of Agriculture of Ames had approved my original ideas of construction and suggested a change of the gable bracing that greatly enhanced its strength at no more cost, the Architectural Department of Northwestern Lumbermen's Association of Minneapolis prepared plans for this barn for the four widths of 32, 34, 36 and 38 feet. Construction details for the 36 foot width are reproduced on the opposite page. Refer to these plans as you read on.

Of first importance, the height from grade to ridge of a gothic barn should never exceed the width of the barn; and the rafters should ALWAYS start at the joists. After examining dozens of "sway-backed" gothics and consulting many dealers and carpenters who have been most successful in building gothic barns, I would say most emphatically that the wall framing should not extend above the joists. Bracing the walls to the joist is not effective when there is no hay load to hold the joists down. If the walls spread the roof is sure to sag. If greater hay capacity is desired, the rafters can extend straight for two or three feet by raising the axis above the top of the joists. However, it will cost but very little more to build the barn wider.

Fig. 2 explains why a gothic barn resists wind from the side better than the gambrel roof. To have equal hay capacity, the walls of a gambrel barn must be about 15 percent of its width higher than for a gothic design, as represented by X of Fig. 2. This means almost 6 feet on a 36 foot barn.

Opinion varies as to the proper radius for gothic roofs. At one time I favored the two-thirds-of-width basis but after seeing one built at a radius equal to three-quarters or 75 percent of the width I changed for two reasons: The rafters are straighter so less is sawed off, thereby making them considerable stronger at no extra cost; the ridge is about 10 percent higher for ¾ radius than for ⅔ radius, thereby lowering the walls without losing hay capacity to speak of. Furthermore, the design was more pleasing to me and most others I consulted. Accordingly, these plans show radius equal to 75 percent of the width of the barn with axis on top of the joist.

As to the cornice, many will prefer a wider roof projection with open cornice or exposed rafters. My preference for the cornice as detailed is based on economy and efficiency. Open cornice greatly increases the cost of painting and harbors bird nests, especially swallows. It is much cheaper to use a 12 inch board for a plancher than to have the siding or barn boards extend to the

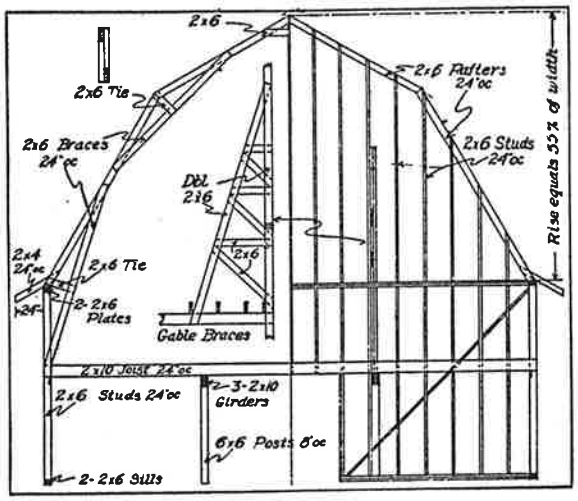


Figure 1

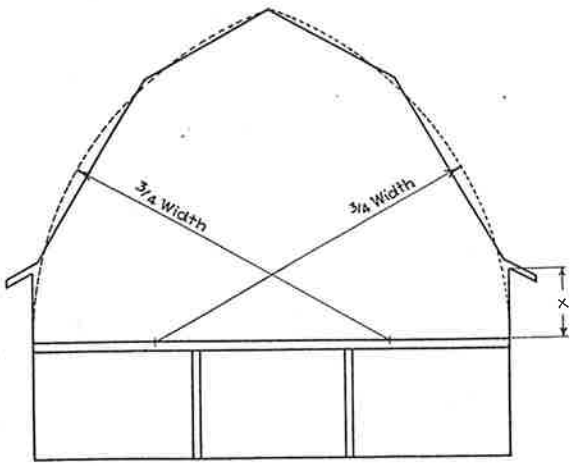
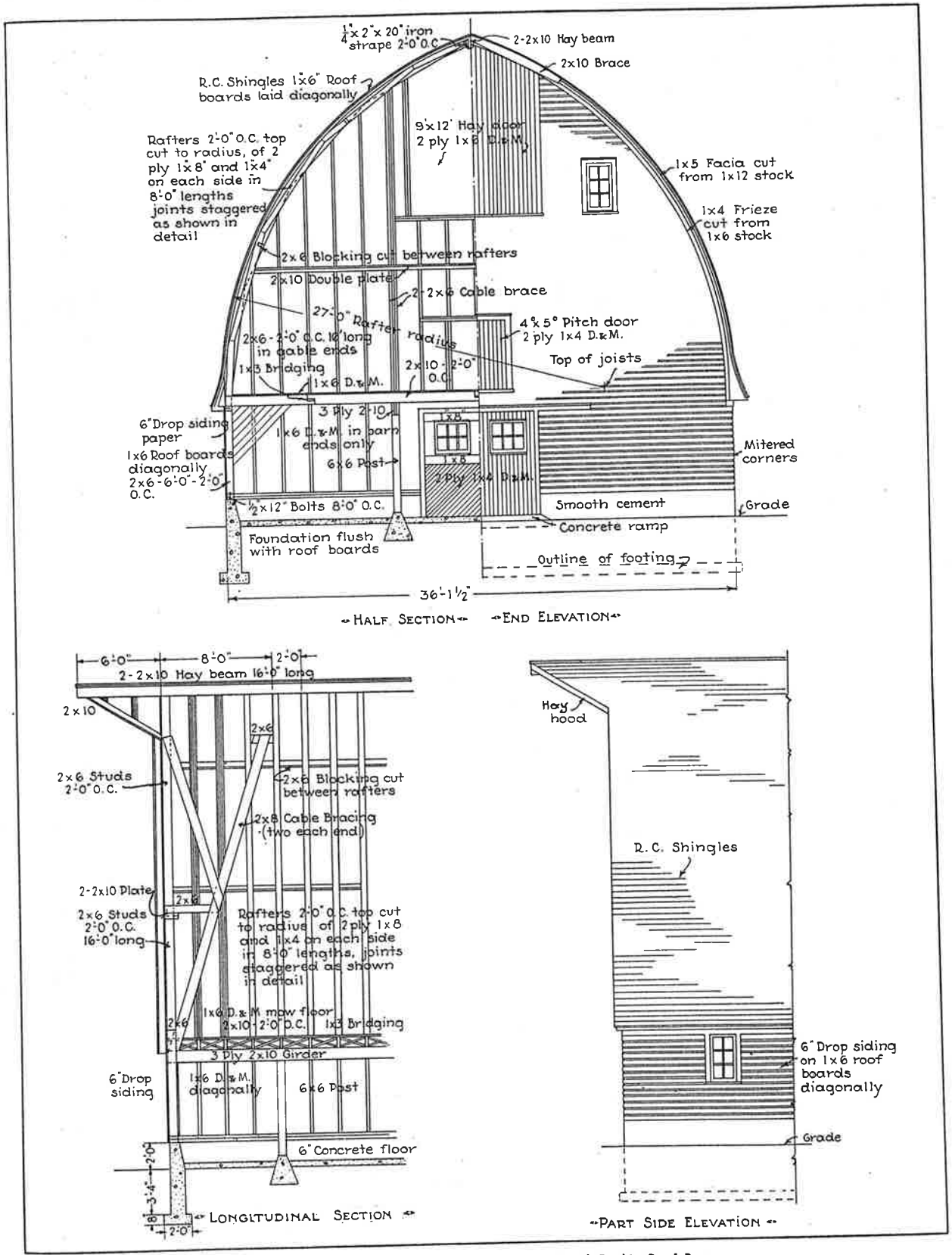
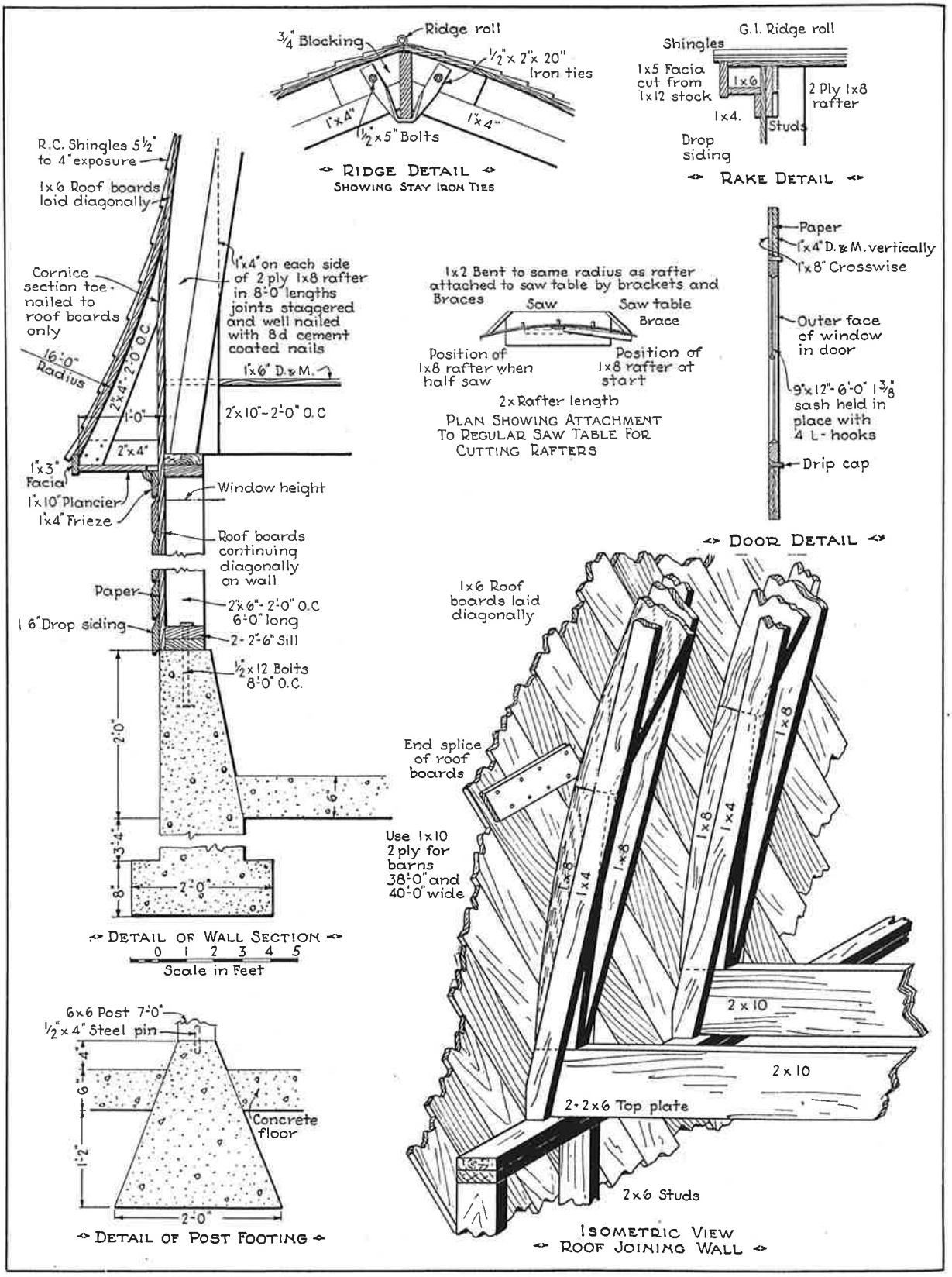


Figure 2



Construction Details of A. W. Holt's Wind-Proof Gothic Roof Barn



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junction of the roof and wall lines. Wider cornice must be constructed to resist greater wind pressure. The only objection I see to this closed cornice is the fact that it makes a convenient runway for rats and mice. This can be easily cured by scattering poisoned grain in them or turning a couple cats in this "varmin cage" occasionally.

The main feature of this wind-proof gothic barn is the diagonal sheathing, continuous from the sills (which are securely bolted to the foundation) over the roof to the ridge. The cornice framing is nailed on over the sheathing. If desired this can be built in sections on the ground and hoisted up into place. By omitting about half of the roof boards it can be securely nailed through the roof sheathing into the rafters.

This diagonal sheathing ties the roof to the wall and eliminates the weak point of toe-nailing the rafters to the floor or saving the cost of tieing rafters to joists. But the main advantage of this diagonal sheathing is:— *Every piece of roof sheathing is a semi-rafter and CHEAPER to apply than horizontal sheathing.*

That "cheaper" claim is the one that practically everyone questions; so I will explain this, first by reference to Fig. 3 which is self-explanatory from the nailing standpoint. As to splicing, the isometric view shown by the plans shows that any length boards can be easily spliced between the rafters by securing the floating ends to a scrap piece of lumber and nailing it to the adjoining pieces of sheathing. This can be done as quickly as a piece of horizontal sheathing can be sawed to center on a rafter, which is necessary unless end-trimmed material is used.

If desired, end-matched material can be used for the wall below the joist, for greater insulating value, with joints staggered from the floor line to about 8 feet above to securely tie the roof to the walls. Also, roof sheathing above can be spaced if desired by using narrower material. And a piece of roof sheathing can be omitted every three or four feet to provide a place to stand in while applying the sheathing above it and as a ladder for ascending and descending on the roof, as is the usual practice with horizontal sheathing. It's not much harder to work diagonally on a roof than horizontally if three or four men apply the sheathing. The only tool needed to apply this sheathing is a hammer, except at the ridge and ends of the roof. Anyone can apply it CHEAPER than horizontal sheathing.

Every piece of horizontal sheathing imposes more weight on the rafters, whereas, every piece of diagonal sheathing not only sustains its own weight but helps to support the rafters. The Forest Products Laboratory at Madison, Wisconsin, has proved by test that diagonal sheathing will resist four times as much SIDE pressure as horizontal sheathing. Until such time as they can make a comparative test of sections of barn roofs, all I can say is that this diagonal sheathing greatly strengthens the roof framing and braces the whole barn against end pressure. That should be quite obvious to everyone.

Regardless of the roof framing used, diagonal sheathing will enhance its strength. Many barn builders prefer sawed rafters of 3 pieces of 1x8. This requires the same amount of material as the rafters shown by the plan. The weak point of any built-up rafter is the joint. If 3 pieces of 1x8 are used, there will be at least two pieces equal to 16 sq. in. at each joint, which is the same as shown by the plans if no two joints are opposite. Therefore, break all joints when building gothic rafters.

Laminated rafters, such as 6 pieces 1x3, 5 pieces 1x4 or any other size materials bent to the desired radius and nailed or bolted together to retain the bow, ARE NOT RECOMMENDED by the Iowa State College of Agriculture. This confirms my investigation of many

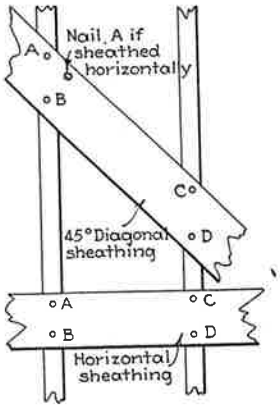

Fig 3. Proof that diagonal sheathing requires 30% less nails than horizontal sheathing. Note that nails AB and CD are spaced farther apart on the rafter, or, that nails AC or BD are farther apart on the board if sheathed diagonally than would be required for horizontal sheathing.

sway-backed gothic barns. Unless these laminated rafters are glued or extra well bolted, the pieces will slip and the roof will fail. Avoid laminated rafters that depend on nails to prevent slippage and straightening out.

The truss-girt-rib gothic framing has proved very efficient. The first gothic I built was from plans shown in the *American Builder* in 1915. It was a barn 44'x80' with rafters starting at the mow floor, constructed as follows: Master rafters of three pieces of 2x10, securely bolted, were spaced 8' 0" oc; girts were 2x6 between these master rafters over which double 1x4 ribs were bent every two feet. That barn is still standing true and plumb after 20 years on the Montana prairies where it IS windy. But, regardless of the framing use diagonal sheathing.

Although the plans show dropsiding over the diagonal sheathing with paper between, at the sides boards and battens or bevel siding can be used equally well. This is largely a matter of personal choice. The extra cost of the double sheathing below the floor of a barn 36'x50' is only a matter of $50.00 using $40.00 material plus about 20 hours of labor. Most of this extra cost should be saved by 30 percent reduction in nails and nailing of roof sheathing so the extra bracing and greater insulating value of double sheathing cannot cost enough more to be of any consequence to a farmer who wants a barn that will stand.

Note that this diagonal sheathing is applied inside of the studs in the ends, so the outside sheathing need not be furred out above the floor line. Of main importance, however, do not place windows in the ends of this diagonally sheathed wall because doing so will reduce its strength about 40 percent according to tests of wall panels conducted by Forest Products Laboratory and given by bulletin, "Stronger Frame Walls" issued by National Lumber Manufacturers Association and available to any lumber dealer. Ask your lumber dealer to get that bulletin if he does not have it on file.

Special attention is called to the gable braces. These are "up-side-down" to what I had been advocating (see Fig. 1) and which most carpenters seemed to prefer, until engineers at several agricultural colleges pointed out the merits of this brace, as follows:

1. Hay pressure cannot break this brace.
2. A sagging girder cannot pull the gables in.
3. Wind pressure on the leeward side cannot pull the girders up when the hay loft is empty.
4. This brace braces the barn longitudinally.

Therefore, if you have been bracing gables from the gable to the girder, as shown in Fig. 1, turn them up-side-down and have a brace that is scientifically correct.

The plans show a double 2x10 plate across the gables.

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This distributes pressure to the gable braces and ends of roof. THIS IS MUCH STRONGER than a six-foot splice of 2x6 end studs and requires about the same amount of material because a 4x10-2′ contains 6.67 board feet as compared to 6 bd. ft. for the 6 foot splice. Without this double plate, the gable studs should be 2x8. By all means follow this gable framing shown by the plans.

Note that the stiles, rails and braces are omitted on the outside of all doors. Time has proved that these only retain moisture and promote rot. If used instead of the diagonal backing, all braces, stiles and rails should be on the inside of the door and, preferably, the door hung on the inside of the walls.

Farmers are like all other human beings in that they want the most value they can get for their money. And they don't object to investing a few dollars more if they can get a barn that will be standing when the wind storm has subsided. Barn builders cannot go wrong by featuring this wind-proof gothic. To be convinced, ASK YOUR LUMBER DEALER about its cost. Most dealers have been supplied with a detailed list of material for this barn of any size through the courtesy of Merchandising Council of Retail Lumber Dealer Associations. Such a dealer can quickly figure the cost of the diagonal sheathing that makes a double wall below the mow floor. This will be the only extra cost of this wind-proof gothic as compared to a gothic as ordinarily constructed. And gothic barns cost little or no more than gambrel barns that are properly constructed. Don't sell 1902 model barns in 1935. Ask your lumber dealer for further particulars.