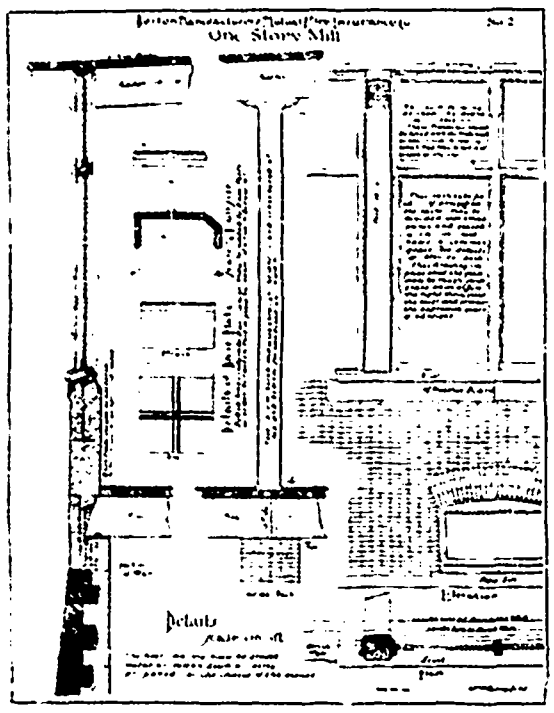
wall, the width of the mill might be carried to ninety feet; then to a little over one hundred feet.

Until now in England, where the light is less intense than in this country, cotton-mills have been built five or six stories in height and one, one hundred and twenty-eight feet wide, that being the width in which certain kinds of machinery can be most economically placed and operated,—with six feet of window space to four feet of wall, the tops of the window panes being absolutely flush with the ceiling between the beams, and the window caps placed opposite the floors. Of late, however, the mutual underwriters, having discovered the great danger of high buildings as compared with those of wide, low construction, began to ask their members who were about to build mills to be operated by steam power in the open country, "Why do you follow this inherited and bad type of building? A mill of two or three stories in height can be constructed at less cost per square foot of floor than a mill of any greater number of stories; if you have room enough, even a one-storey mill properly constructed may be built at as low cost per square foot of floor as the mill of four or five stories, while it will be as warm in winter, cooler in summer, and lighter and better ventilated all the year round than any other type of mill can possibly be." Since that suggestion was made a large number of factories of only one storey in height, covered in with three-inch pine roofs, protected outside with gravel roofing, tin, or with cotton duck properly prepared, and lighted with what are known as monitors,



DETAIL OF ONE STOREY MILL No. 2.

have been constructed in many parts of New England, ranging from half an acre to three and a half acres in size; a very common type being a mill of sixty thousand feet on the main floor, constructed on a moderate slope so as to give a basement under one-third of the mill for wet work or for other subsidiary purposes. Such one-storey buildings are best adapted to weaving, and are often built in connection with spinning-mills of two or three stories in height.

In one instance, in a case where the machinery is very heavy and is subject to great vibration, a one-story mill of this sort was substituted for one of two four-story factories which had been burned; the owners were advised to reconstruct a one-story mill in place of the burned mill, but to make it large enough to accommodate all the machinery then in the other four-story mill which had not been destroyed. They were warned that the new mill would bankrupt the old one on account of the greater economy of the work and the better conditions for its operation. The prophecy has proved true; sixty-seven men accomplished the work in the new one-story mill on the same machinery which required one hundred men in the old four-story mill; therefore that old mill has been taken down in order to make way for the extension of the one storey factory, and the old material has been put together in a better form.

What, then, is the slow-burning construction? It consists simply in consolidating wooden material in frame, floor, and roof in such a way that a fire can be held long enough in any room in which it may originate for a fairly competent fire department, public or private, to get it under control, or where it may be extinguished or held in check by sprinklers. The timbers used may be solid or may be cut in two parts to be bolted together. The latter is perhaps the better way, in order that the air may reach the centre of the timber and season it, great care also being taken in mill practice not to paint, oil, or varnish the outside of any heavy timber for at least three years after it has been placed in the building, lest what is called dry rot should occur from the fermentation of the sap in the green timber. Where an outside finish is required some architects use the timber in two parts bolted together with an air space between, each timber being also bored through the centre lengthwise for ventilation. This latter plan is the customary

CONSTRUCTION OF FACTORY DEVISED BY EDWARD ATKINSON, THE PURPOSE BEING TO CONSTRUCT THE ALLEYWAYS SO THAT THEY SHALL BECOME HORIZONTAL TRUSSES, TO PREVENT THE VIBRATION OF THE STRUCTURE.

method with posts when wood is used for supports, a crossway hole being also bored near the top and bottom, connecting with the centre. Upon these heavy timbers—which are commonly placed eight or ten feet on centres resting directly on properly adjusted posts without the interposition of any girders lengthwise of the building, in lengths or spans from eighteen to twenty-two feet—the floors are laid of plank not less than three inches thick when the beams are eight feet on the centers. If the beams are ten feet or even twelve feet apart on centers, ordinary weights will be carried by floors consisting of four-inch or five-inch plank; the timbers themselves may be from fifteen to not exceeding twenty-two feet in length from wall to post and from post to post, for ordinary factory loads. If provision is required for extraordinary loads, a special computation should be made to meet the case. If a fine finish is desired, sheathing may be placed underneath between the timbers, nailed close to the under side of the plank; if the most absolute security against fire is called for, the finish may consist of plastering laid on wire lathing close against the plank. This plastering may be carried around the outside of the timber on the line of the timbers, provided no skim coat of lime putty is put upon the plastering, thereby cutting off the air from the timber. The top floor may be laid directly upon the plank, or a layer of mortar may be laid between the plank and the top floor; in some cases asbestos paper has been interposed. The layer of mortar offers great security in preventing the passage of fire downward. The roof which has been described corresponds substantially to

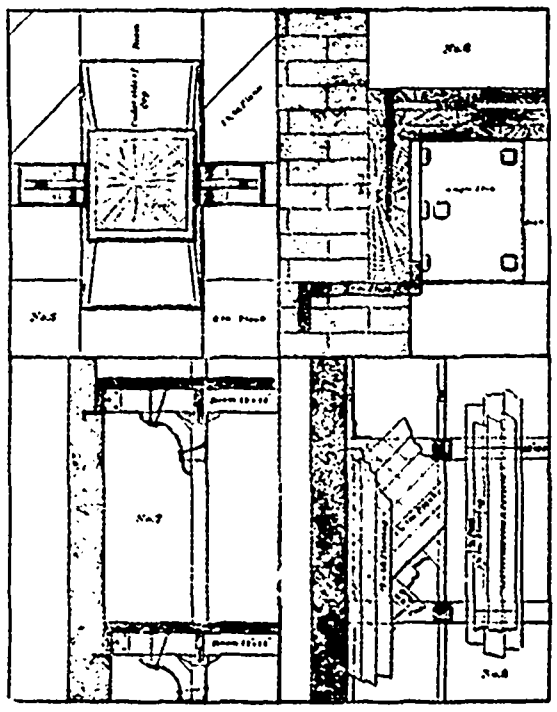


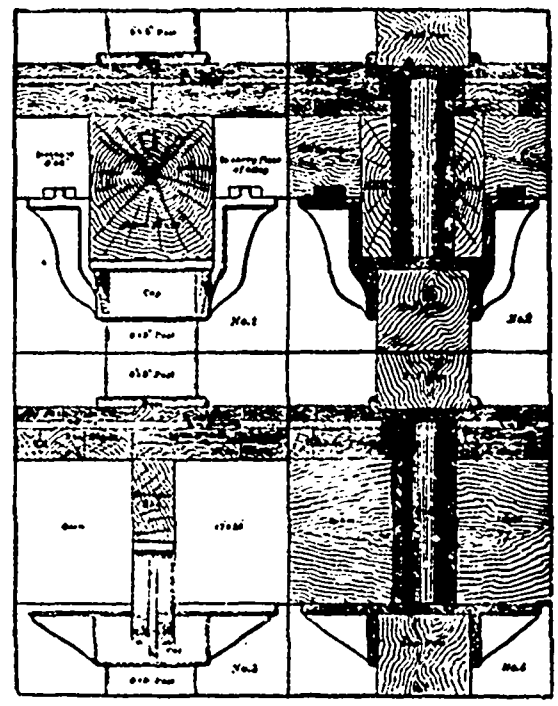
DIAGRAM SHOWING THE OUTER LINE OF POSTS (HORIZONTAL TRUSSES OR ALLEYWAYS) AND OUTER WALLS, SO ADJUSTED THAT THE FLOORS INSIDE THIS LINE OF POSTS MAY FALL FROM THEM WITHOUT STRAINING THE POSTS OR THE WALLS IN ANY CUSTOMARY METHOD. THESE POSTS SHOULD BE FIRE-PROOF.

the floor, to wit; three-inch plank laid upon the timbers, one-inch sheathing on the under side if desired, and sometimes one-inch boarding on the plank; then the ordinary outer covering of whatever kind may be adopted. If the roof is exposed to great humidity within, as in the machine-room of a paper-mill, one inch of mortar may be interposed between the roof boards and the plank. This latter roof proves to be impervious to cold or heat, and with proper means of ventilation gives security against any possible condensation of moisture from the atmosphere within.

An alternative plan consists in setting the first line of posts at the right distance from the wall to make a passage-way, the floor of the alley being laid of two thicknesses of plank crossed—the posts being fitted with hackmatack knees. This form of horizontal truss braced to wall and post gives great stability to the building.

If the building is over one story in height the stairways ought to be placed either in separate towers outside the building proper, or else in the corners of the building surrounded by brick walls, the doorways being protected by adequate fire-doors consisting of wood encased in tin, iron being one of the most treacherous materials customarily made use of for the protection of doorways in party walls. In such a factory no cornice is required or permitted, and no sheathing within set off by furrings from the wall can be tolerated. No concealed space is allowed anywhere in which a fire can pass from room to room or from cellar to attic. Every part of the building must be open, so that water from bucket or hose can be thrown anywhere.

If these plans and specifications are compared with the ordinary method of combustible architecture, the



POSTS, PINTLES AND CAPS CUSTOMARILY ADOPTED IN MILL CONSTRUCTION.

reason will be apparent why textile factories, paper-mills, and other works are better fire risks and are insured at less cost than the average so-called stone church, brick hospital or asylum, or iron warehouse, although the nature of the work done carries with it almost every cause of fire hazard from ignition, friction, or spontaneous combustion, while in many cases the material used is almost explosive.

The builders of factories in city or in country may perhaps derive some useful information from this description of slow-burning construction, for the reason that if carried out consistently and economically it will cost less than the ordinary method of combustible architecture.

It may be interesting to add that a mill building of from three to five stories in height can now be constructed in New England in accordance with these plans at a cost above the foundation varying from sixty to seventy-five cents per square foot of floor, counting every floor, but not counting the basement unless it is a high basement to be made use of in the same way that the other floors are used. The cost per square foot of floor will vary somewhat according to the position, and according to the interior finish required with respect to sheathing and other matters. A mill two stories in height, *i. e.*, of two floors for use, can be constructed at somewhat less cost, as the walls may be lighter in proportion to the area.

Under ordinary conditions a mill of one story in height can be constructed at about the same cost per square foot of floor as the four or five story mill if the ground is level and the subsoil is such as not to require any excessive expenditure in the foundation. A lighter frame work and less expensive methods have been adopted in some cases in one-story construction, so that the cost of the building per square foot of floor has been considerably less than the sum named—even as low as