PRACTICAL MECHANISM.

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PATTERN MAKING.

Those savans who have read our old earth's unwritten history in and from its strata tell us that, in ages far remote, men made tools and contrivances of bronze, which, being an alloy, necessitated the fusion and casting of the metal. This casting involves the use of patterns, and pattern making may therefore lay claim to the highest antiquity. But the modern idea of the division of labor has exalted it to be a distinctive art: in the last generation, for instance, a good machinist (or rather engineer or millwright, for those terms were then applied to builders of machinery) was required to be alike expert in working upon both wood and metal. He constructed his framing of wood, and made the patterns for his cast metal work; he was to-day a lathe hand, tomorrow a vise hand, and sometimes a blacksmith, and the next day a pattern maker or perhaps a wheelwright.

As, however, the present age of iron dawned, it became apparent that working in wood and in metal must be separated, not only because the handiwork could be more cheaply produced by reason of the increased skill arising from continuous practice, but also because the amount of knowledge, required to make an artisan skillful in either the manufacture of wood or of iron, was too great to be thoroughly mastered in the working lifetime of an ordinary or even an unusually expert workman. Hence modern intelligence soon discovered that better as well as cheaper work could be obtained by a practical education in one particular branch of usefulness, and hence pattern making has taken its place as a specialty. The field of usefulness of cast iron has developed to a remarkable extent during the last twenty years, and the same remark applies to cast steel during the last ten years: both of these materials are steadily encroaching upon the domain of usefulness of wrought iron, stone, and bricks and mortar. So that the field of application for pattern making is stretching outward and onward to the discomfiture of its rivals From these considerations, we may readily perceive that a real proficiency in pattern making will exercise to the utmost the skill of the workman, on account of the unceasing variety of the patterns, in form and in the purposes for which they are designed; and the advantage of a retentive memory is evident when we consider that years may elapse ere the same pattern maker may be called upon to exercise his skill upon the same or a similar piece of work. In this art, there are to be considered many details that are seldom or never shown in drawings: such, for instance, as the amount necessary to allow on the pattern for finishing certain parts of a casting, and on what part such allowance is required; and the method which has been proved by experience to be the safest and most expeditious in molding from a certain kind of pattern. But above all these considerations lies the fact that drawings merely show the shape which the finished pattern is required to have, leaving it entirely to the judgment of the pattern maker to elect in what way the various pieces of wood (of which the pattern is constructed) shall have the grain lie, and how they shall be fastened or held together. There is, it is true, an unwritten practice which has obtained universal observance in particular branches of pattern making; but in the newer fields into which the art has advanced and is advancing, this unwritten practice is merely in the process of formation, which state of things must continue so long as casting is discovered to have new arenas of application. A goodly store of well remembered experience is therefore invaluable to the pattern maker; and this being so, the quicker it is obtained the better. Hence the learner should always keep a record of the work which falls under his observation, in which record the sizes and proportions of the work, the method of putting it together, the time taken in its production, and (if possible) whether the castings were satisfactory, noting the defects in the latter, if any, together with suggestions for the remedy of those defects. A pen and ink sketch of the pattern made in the margin will add to the usefulness of the record, besides accustoming the hand to making correct sketches and elucidating the explanation. The operative's intelligence will be much exercised in the shaping and building-up of patterns, depending as this does on the strength of the material of which the casting is to be made, the strength of the pattern itself, and the desirability of its molding well. Dr. Andrews has well said (in the *English Mechanic*): "The correct forms to be given to the materials employed in the construction of tools or machinery depend entirely upon natural principles. Natural form consists in giving to each part the exact proportion that will enable it to fulfill its assigned duty with the smallest expenditure of material, and in placing each portion of the materials under the most favorable conditions of position that the circumstances will admit of. Such natural form is not only the most economical, but, strange to say, it is always correct in every respect, and is invariably beautiful and lovely in its outlines."

I may now mention the qualifications necessary to enable an artisan to become a good pattern maker: First. As the idea of the size and contour of the article or work required will be conveyed to him by drawings, it is necessary that he should be conversant with the principles of mechanical and architectural drawing; and it may be of great advantage to him, though it is not absolutely necessary, to be able to make such drawings. It is too often the case that the apprentice pattern maker gains his knowledge of drawing from the drawings from which he operates, which, being simple in the first case and becoming complicated only after the lapse of two or three years, makes the acquisition of a knowledge of drawing possible without either study or application; but the result is that, so soon as he is called upon in a new field of action, upon a description of work different from that to which he has been accustomed, he becomes timid, gets confused, finds it necessary to ask many questions upon and concerning various parts of the drawings, and then does not obtain credit for the amount of ability to which his skill in handling his tools perhaps entitles him. Furthermore, a knowledge of drawing will enable him to learn his trade in a comparatively short space of time, and give him confidence in, and a retention of, that which he has already learned. Secondly. He should be perfectly familiar with the operations of the brass and iron founder, as it is by him that patterns will be used to produce the required forms. The pattern must be so made that a mold can be made from it, and that it may be made in the most expeditious manner. The pattern maker, it must be remembered, determines how the molder is to mold the pattern, so that the latter is controlled in his operations by the former. For the benefit of those who have been unable to devote sufficient time to the work of the foundery, it will be necessary, as we proceed, to explain the operations of molding different kinds of patterns, selecting those which will best serve as a key to the whole. Thirdly. The pattern maker must be acquainted with some, at least, of the properties of the metals of which the castings from his patterns are to be made: such, for instance, as how they behave in passing from the fluid to the solid state, the strains to which a casting is subject during this transition, to what extent those strains may be modified by alterations of proportion or shape in the pattern, the shrinkage of castings, and the alteration in form which takes place in the cooling of castings of various sizes and shapes. Fourthly. He should, if possible, add to the above qualifications a general knowledge of the manner of fitting up the different kinds of work for which patterns are used.

With regard to the first requirement, it is not my purpose to enter into the subject of mechanical drawing, which will be found in a series of articles, written by Professor MacCord, and now being published in the SCIENTIFIC AMERICAN SUPPLEMENT. With regard to the second, I shall, as already stated, refer to it hereafter. The third I shall consider after I have treated upon timber and tools, and the fourth can only be obtained by watchfulness on the part of the student as to what is being done in the workshop in which he is engaged. This latter may seem a trivial matter; but I have on several occasions, by watching where certain castings required to be most operated upon in the machine or vise, had a pattern altered, making it apparently of an incorrect form, with the result that the time necessary to fit the work was reduced by one half. This subject, however, will be treated upon in its proper place.

Checking the Fire Fiend.

The amount of worry and anxiety, and consequent discomfort of living and the shortening of the term of life, caused by the apprehension of danger from fire, is enough to make every one search diligently for safeguards. The danger of loss of property is of course very great, and even the moderate chance of loss of life should not be disregarded.

When the communists tried to burn Paris, they failed, not because the fires were put out by engines of any kind, but because the city was so built that it would not burn. What must be the fate of an American city under similar circumstances is easily foretold. We build fire traps, and protect them by insurance. But money, though a great soother at times, can never pay us for loss of peace of mind. It cannot even pay us for the loss of those articles of daily use to which we have become attached by long associations; the many pictures and books which seem to us like old friends, and, far dearer than these, the mother's old arm chair or the dead child's playthings. We cannot reconcile ourselves to the loss of these, and we all long at times for a home in which they can be made reasonably secure to us. We do not ask for absolute safety. The world can seldom give that. We ask to have our treacherous enemy checked and retarded, to give time, at least, to get our priceless treasures beyond his reach.

Much has been said and written on fireproof construction, and most of it ends with advice to employ cumbersome and expensive work of iron, brick, and tiles. But little has been told to show how a comparatively cheap house can be built so that it will never burn quickly, and so that the chances of saving it altogether can be increased a hundredfold.

Before showing how this can be done, it may be well to transcribe, for the benefit of those whose houses are already built, a few suggestions from the London *Builder* with reference to the prevention of fires.

"Keep matches in metal boxes, and out of the reach of children; wax matches are particularly dangerous, and should be kept out of the way of rats and mice. Be careful in making fires with shavings and other light kindlings. Do not deposit ashes in a wooden vessel, and be sure that burning cinders are extinguished before they are deposited. Never put firewood upon the stove to dry, and never put ashes or a light under a staircase. Fill fluid or spirit (or kerosene) lamps only by daylight, and never near a fire or light. Do not leave a candle burning on a bureau or chest. Always be cautious about extinguishing matches or other lighters before throwing them away. Never throw a cigar stump upon the floor, or into a spit box containing sawdust or trash, without being certain that it contains no fire. After blowing out a candle, never put it away until sure that the snuff has gone entirely out. A lighted candle ought not to be stuck up against a frame wall, or placed upon any portion of the woodwork in a stable, manufactory, shop, or any other place. Never enter a barn or stable at night with an uncovered light. Never take an open light to examine a gas meter. Do not put gas or other lights near curtains. Never take a light into a closet. Do not read in bed.

"The principal register of a furnace should always be fastened open. Stove pipes should be at least four inches from woodwork, and well guarded by tin or zinc; rags ought never to be stuffed into stove pipe holes: openings into chimney flues for stove pipes which are not used ought always to be securely protected by metallic coverings. Never close up a place of business in the evening without looking well to the extinguishment of lights and the proper security of the fires. When retiring to bed at night, always see that there is no danger from your fires, and be sure that your lights are safe."

To these good rules might be added: Never keep or leave oiled rags or oiled cotton waste in any place where their burning could do any harm. They are more dangerous than gunpowder. Always have an ax, one or more buckets of water, and a small hand pump available at all times to put out a fire in its beginning. Do not allow accumulation of combustible rubbish about, especially in out of the-way corners. These directions may prove of use to those whose houses are already built. Those who have yet to build need to be shown how to use their material properly. The great danger in our present system of construction lies in the inflammable nature of our building materials, and in the opportunity given by the arrangement of partition walls and floors, unchecked, unseen, and out of reach. It is best, if possible, to build outer walls of brick, and with judicious treatment and at moderate expense they can be made to look attractive even in the country. By making a projection or offset inside at each floor, an effectual stop can be put to any passage of fire up the inside surfaces; or if hollow or vaulted walls are used, the plaster can be put directly on the brick without using any wood. But if the outside walls are of wood, the spread of fire can be greatly checked by filling them full, between the joints and against the outside boarding, with brick and mortar or concrete, or any such incombustible material; or if that expense is too great, they may be filled at each floor, and for a short distance above. Then, by treating the partitions in the same way, there will be an unobstructed channel or flue for flame only one story high, and stopped tight at top and bottom. The wood will hold well and burn very slowly, even when only partially protected in this way. In war times, soldiers used to build chimneys with a cob house construction, of small sticks plastered inside and out with clay; and these frail structures would endure the heat of roaring wood fires, simply because the flame could not reach to envelop the wood. Protect a piece of joist on two sides with plaster, and it will be very hard to make the exposed flat surface burn long, and the charred wood soon furnishes a sort of check to further combustion. And this is the correct principle to apply to the protection of wooden houses. Cover the wood as far as possible with mortar, and stop all circulation of air. Having pugged the walls and partitions thoroughly, and treated the stairway in a similar manner by filling in between the supporting stringers or carriages with coarse mortar, we must next make the opening around each chimney tight, where it passes through the floor, by a filling-in of mortar, or by turning trimmer arches against the surrounding timbers on the four sides.

The next vulnerable point is the floor. In France, it is often the custom to cross-lathe the ceilings with lathes considerably thicker than ours, and then to put a flat surface of rough boards a short distance below the under surface of these lathes (supporting it by a staging), and to pour in from above a mixture of plaster of Paris, which hardens into a solid mass between the floor timbers and above and below the lathing. When the whole is sufficiently set, the staging is removed and the ceiling smooth finished from below. Plaster of Paris is at present too expensive here for us to follow this method in ordinary cases, but we have a very good substitute in wire lathing. This is simply what is commonly known as coarse wire netting, which is nailed to the furring strips of a ceiling, and may have coarse mortar spread upon it from above and between the floor timbers. The mortar is to be well worked up with a trowel against the sides of the sticks, and then the under side of the wire may be plastered in the ordinary manner from below. This method unfortunately costs about double what ordinary lath and plaster do, besides occupying more time in construction. Another and less expensive safeguard, which it is well to use in connection with this, or which may be made a partial substitute for it, is to cover the rough boarding of the floor with about an inch in thickness of ordinary plasterer's mortar, smoothed over, between inch square battens nailed to every other floor timber, to furnish a solid ground on which to nail the upper floors. These battens are sometimes taken out after the plaster is hard, and their places filled by fresh plaster, the whole surface covered with sheathing paper, and the upper floors nailed over this. The roofs may also be treated with a coat of plaster or cement, in which the slates should be firmly bedded while it is wet.

All these precautions against fire are also useful to make the house warmer, to deaden sound, and to help to stop leaks. And they are all in one sense economical, they may save expense in insurance. It is a good maxim in war to do what your enemy least wishes you to do. The fire fiend craves light woodwork, loosely arranged and full of draft channels. Let him find everything pugged solid with mortar. Make him dig for every inch of wood he seeks to devour; check him, hold him, worry him, cramp him in close quarters. Then with a little presence of mind, a strong arm or two, and a few homely weapons, you can drive him to a corner and finally destroy him altogether.—*J. A. F., in the Boston Journal of Chemistry.*