

## CHAPTER XXIV.

RULES FOR DISCOVERING NEW IMPROVEMENTS; EXEMPLIFIED IN IMPROVING THE ART OF CLEANING AND HULLING RICE, WARMING ROOMS, VENTING SMOKE BY CHIMNEYS, &c.\*

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*The true Path to Inventions.*

NECESSITY is called the mother of invention, but, upon inquiry, we shall find that Reason and Experiment bring it forth; for almost all inventions have resulted from such steps as the following:—

I. To investigate the fundamental principles of the theory, and process of the art, or manufacture, we wish to improve.

II. To consider what is the best plan, in theory, that can be deduced from, or founded on, those principles, to produce the effect we desire.

III. To inquire whether the theory be already put in practice to the best advantage; and what are the imperfections or disadvantages of the common process, and what plans are likely to succeed better.

IV. To make experiments in practice, upon any plans that these speculative reasonings may suggest, or lead to. Any ingenious artist, taking the foregoing steps, will probably be led to improvement on his own art: for we see, by daily experience, that every art may be improved. It will, however, be in vain to attempt improvements, unless the mind be freed from prejudice in favour of established plans.

## EXAMPLE I.

*On the Art of cleaning Grain by Wind.*

I. What are the principles on which the art is founded? When bodies fall through resisting mediums, their velo-

\* The rules and observations, which formed an appendix to the former editions of this work, contain some suggestions which are worthy of attention. Since they were written, many improvements have been made, in the processes to which they refer; but the path is still open, and perhaps the remarks made by Mr. Evans, may yet lead to useful results; with this hope, they have, with some modifications been retained.

cities are as their specific gravities, and the surface they expose to the medium; consequently, when light and heavy articles are mixed together, the farther they fall, the greater will be their distance apart: on this principle a separation can be effected.

II. What is the best plan in theory? First, make a current of air, as deep as possible, for the grain to fall through; the lightest will then be carried farthest, and the separation be more complete at the end of the fall. Secondly, cause the grain, with the chaff, &c., to fall in a narrow line across the current, that the light parts may meet no obstruction from the heavy, in being carried forward. Thirdly, fix a movable board edgewise to separate between the good clean, and the light grain, &c. Fourthly, cause the same blast to blow the grain several times, and thereby effect a complete separation at one operation.

III. Is this theory in practice already? what are the disadvantages of the common process? We find that the farmers' common fans drop the grain in a line 15 inches wide, to fall through a current of air about 8 inches deep, instead of falling in a line half an inch wide, through a current three feet deep; so that it requires a very strong blast even to blow out the chaff; but garlic, light grains, &c., cannot be thus removed, as they meet so much obstruction from the heavy grains; the grain has, therefore, to undergo two or three such operations, so that the practice appears absurd, when tried by the scale of reason.

IV. The fourth step is to construct a fan to put the theory in practice, by experiment. (See Art. 83.)

## EXAMPLE II.

### *The Art of Distillation.*

I. The principles on which this art is founded, are evaporation and condensation. When liquid is heated, the spirit it contains, being more volatile than the watery part, evaporates, before it, into steam, which being condensed again into a liquid, by cold, is obtained in a separate state.

II. The best plan, in theory, for effecting this, appears to be as follows: the fire should be applied to the still, so as to spend the greatest possible part of its heat to heat the liquid. Secondly, the steam should be conveyed into a metallic vessel of any suitable form, and this should be immersed in cold water, to condense the steam; in order to keep the condenser cold, there should be a stream of cold water continually entering the bottom and flowing over the top of the condensing tub; the steam should have no free passage out of the condenser, else the strongest part of the liquor will escape.

III. Is this theory already put in practice, and what are the disadvantages of the common process?—1st, A great part of the heat escapes up the chimney. 2dly, It is almost impossible to keep the grounds from burning in the still. 3dly, The fire cannot be regulated to keep the still from boiling over; we are, therefore, obliged to run the spirit off very slowly; how are we to remedy these disadvantages?—First, to lessen the fuel, apply the fire as much to the surface of the still as possible; enclose the fire by a wall of clay that will not convey the heat away so fast as stone; let in no more air than is necessary to keep the fire burning, for the surplus air carries away the heat of the fire. Secondly, to keep the grounds from burning, immerse the still, with the contained liquor, in a vessel of water, joining their tops together; then, by applying the fire to heat the water in the outside vessel, the grounds will not burn, and by regulating the heat of the outside vessel the still may be kept from boiling over.

IV. A still to be heated through the medium of water, was made, some years ago, by Colonel Alexander Anderson, of Philadelphia, and the experiment tried; but the outside vessel being open, the water in it boiled away, and carried off the heat, and the liquor in the still could not be made to boil—this appeared to defeat the scheme. But, by enclosing the water in a tight vessel, so that the steam could not escape, and that the heat might be increased, it now passed to the liquor in the still, which boiled as well as if the fire had been immediately applied to it. By fixing a valve to be loaded so as to let the

steam escape, when it has arrived to such a degree of heat as to require it, all danger of explosion is avoided, and all boiling over prevented.

### EXAMPLE III.

#### *The Art of venting Smoke from Rooms by Chimneys.*

I. The principles are:—Heat, by repelling the particles of air to a greater distance than when cold, renders it lighter than cold air, and it will rise above it, forming a current upwards, with a velocity proportional to the degree of heat, and the size of the tube or funnel of the chimney, through which it ascends, and with a power proportional to its perpendicular height; which power to ascend will always be equal to the difference of the weight of a column of rarefied air of the size of the smallest part of the chimney, and a column of common air of equal size.

II. What is the best plan, in theory, for venting smoke, that can be founded on these principles?

1st. The size of the chimney must be proportioned to the size and closeness of the room and to the fire; because, if the chimney be immensely large, and the fire small, there will be little current upwards. And again, if the fire be large, and the chimney too small, the smoke cannot be all vented by it: more air being necessary to supply the fire, than can find vent up the chimney, it must spread in the room again, which air, after passing through the fire, is rendered deleterious.

2dly. The narrowest place in the chimney must be next the fire, and in front of it, so that the smoke would have to pass under it to get into the room; the current will there be greatest, and will draw up the smoke briskly.

3dly. The chimney must be perfectly tight, so as to admit no air but at the bottom.

III. The errors in chimneys in common practice, are,  
1st. In making them widest at bottom.

2dly. Too large for the size and closeness of the room.

3dly. In not building them high enough, so that the wind, whirling over the tops of houses, blows down them.

