

MODERN METHOD OF MOULDING CANDLES.

## CANDLE-MAKING.

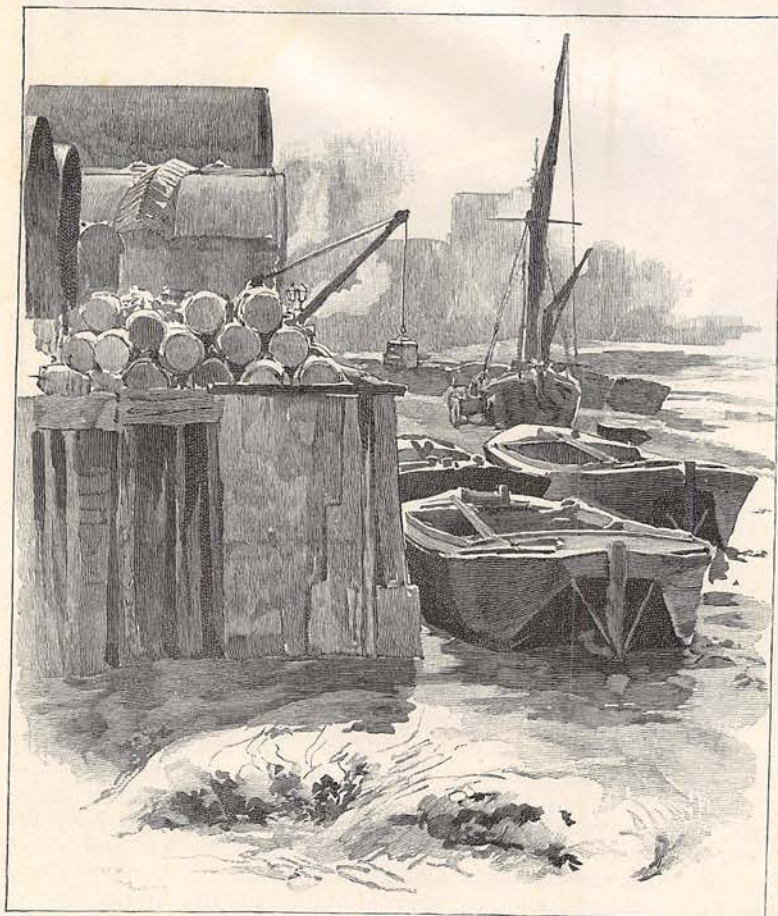
By JOSEPH HATTON.

Illustrated by W. H. MARGETSON.

AT Battersea the Thames lays aside its holiday attire to become a strictly business river. Here we are on the outskirts of the capital. The pleasure boat backs water at Kew. Villas with flower gardens dipping into the stream itself have disappeared. Loungers on Battersea Bridge do not pause to gaze upon gaily-decorated house-boats and festive wherries. Trade and commerce and busy life occupy both sides of the river. The penny steamer is fussing up and down stream. Lighters packed with merchandise and labouring barges lumber along with the yellow tide. Everything indicates approximation to the great city of which Battersea is a quaint, picturesque suburb that still makes a sturdy if ineffectual struggle against the money-making encroachments of the time. Invaded by manufacturers, noisy with tram-car and omnibus, cut up with streets of sombre brick and stucco, blackened with fuel for the factories, Battersea still preserves landmarks of ancient house and garden, of literary state and social dignity. Quiet nooks for learned ease and contemplative leisure are still to be found in the village, with its church and schools, its spreading cedars, and its other grave old trees that look down from their umbrageous heights upon the changing world below them. The picturesque of the Thames itself seems to survive even the severest form of "modernity" about which the "realists" have so much to say. At low tide barges moored upon the mud, rickety boat-houses, informal landing stages, untidy hostleries that loom across the reeking banks, with here and there a sail creeping over the shallows, make up many a fascinating study of form and colour; and the innate romance that belongs to the English character may be trusted to keep alive the historic traditions of even the most unpromising surroundings, an instance of which struck me forcibly during a recent visit to the factories of Price's Patent Candle Company that have been so often

mentioned in the scientific works of the day. Not attractive by reason of their tubular roofs and tall chimney stacks, the factory buildings are well known on the river. They cover an area of upwards of twelve acres, occupy two broad landing stages on the main stream, and have the advantage of being situated on both sides of a creek where the Company's lighters can ship and unship cargoes at their warehouse doors. Away on the Mersey at Bromborough pool the same firm have another extensive manufactory, but the variety of the operations at Battersea make the London works more interesting than those of Liverpool.

We were a little company of three, sometimes more ; for during our tour of the



THE MOUTH OF THE CREEK, LOW TIDE.

works we made occasional fresh acquaintances with chiefs of departments and other officials, Mr. John Calderwood, the managing director, himself having courteously and with some useful suggestions started us on our way. A more difficult, albeit interesting, subject for popular literary treatment and illustration could hardly be selected than the manufacture of candles as it is carried on at Battersea, with an activity of experimental and practical science that exemplifies in a notable way the energy and skill necessary in these days to keep pace with competition, let alone the maintenance of a distinct supremacy in any art or manufacture.

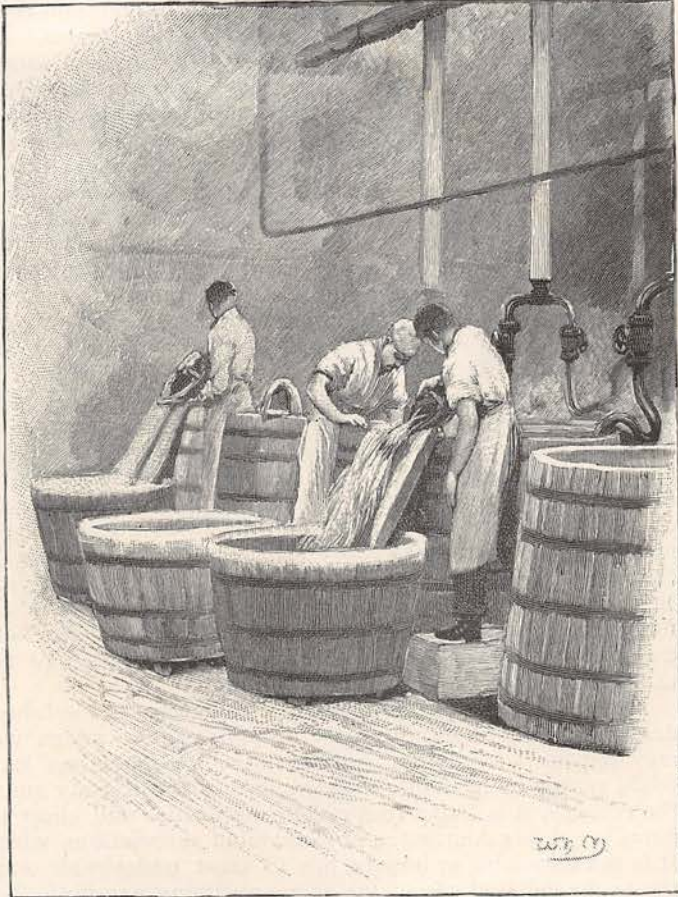
The history of candles is the history of religion. The story of candle-making is a record of chemical and scientific progress. Candlemas Day originated with the Romans. They burnt candles in honour of the Goddess Februa, the mother of Mars. Pope Sergius, deeming it unwise to prohibit a practice of so long standing, made of it a Christian festival by enjoining a similar offering to the Virgin : hence Candlemas Day. An order in council under Queen Elizabeth prohibited this ceremony in the English Church. One who should sit down to fill in the details of the world's story between then and now would find himself engaged for a lifetime. It is bewildering to think of the varied illuminations that candles would shed upon his romantic and controversial pages.

On the other hand a volume might be compiled relating to the superstitions connected with candles. This would take us back to the once almost universal worship of the sun and fire. The splutter and "swealing" of candles, the curious process of combustion that goes on in the most primitive wicks, have given the

world signs and omens from the earliest ages. A portion of the tallow rising up against the wick is still to many an omen of death ; they call it a winding sheet. A disturbance of the flame without apparent cause is a sure harbinger of windy weather. The "corpse-candle" of the Welsh is, however, not a candle at all, but a gaseous exhalation that is said to start up from the earth, traversing without any visible agency the road upon which a man, whose death it presages, is walking.

When one thinks of "the good old days," so called, even the home-made rushlight that shed a glow upon the hearthstones of Gilbert White's classic village of Selborne

is a star of the first magnitude compared with the smoky pine and reed torches and flambeaux with which palace and castle were illuminated in the middle ages. Small wax tapers were used in churches as early as the fourteenth century, "but," says Dr. John Yeats in his *Technical History of Commerce*, "they were considered even by princes as very costly." There were candles nevertheless in the thirteenth century, not equal to these clerical tapers but something of the character of the dip made by the old housewives of Selborne. The trade of the "tallow-chandler" is first mentioned in the reign of Edward I. By "the ancient laws" of gallant little Wales "the candle-bearer to royalty was allowed a piece of candle as long as the breadth of his hand and was entitled to the fragments, and enjoyed the delectable privilege of claiming all the tops on condition that he



BLENDING.

bit them off." In our own time a fortune that rose to the peerage began with the perquisite of candle-ends in a great official office. Travellers on the Continent even to-day have reason to know that large sums of money are made by foreign bonifaces out of *bougies*. I know a man, the soul of generosity in most things, who used to come home from his annual trip to France with a portmanteau full of candles, many of which had not been lighted, all of them having, however, been duly charged for in the bills at the highest possible rates. Gas and the electric light make no more difference to the Continental landlord touching that old tradition of *bougies* than they appear to make in respect of the general use of the light, which the Romans dedicated to Februa and Sergius rescued from heathenism to give artistic distinction to the altar and the sacred procession. One might have been forgiven for thinking that what the age of gas did not do in the destruction of the candle the new era of electricity would have completed. Not at all. The candle is still supreme. It has met competition with a remarkable power both of light and form. It has annexed in the way of manufacture the genius of the inventor and the art of the mechanical expert. It has appealed to the art-taste of the æsthetè, and won the sympathy of the

housekeeper. It has ceased to splutter; it has given up the gruesome habit of suggesting shrouds and coffins; it does not sweat; it gives a steady light; it is made in every size and shape. House-proud folk who love pictures, and cherish the colour of articles of *virtu*, have banished gas in favour of the candle, which is still to be seen in these days lighting the daintiest drawing-rooms, in cluster of sconce and chandelier. It would seem as if the more people use gas and electric lamps the more they require candles. This is no hap-hazard statement, no paradox thrown down in the course of a common-place essay: it is a fact attested by the severest statistics.

No firm in the world has done so much to maintain the popularity of the candle as that of Price's Patent Candle Company at Battersea. It is thirty years since Dr. Andrew Wynter in his *Social Bees* described candle-making at these works as "one of the most interesting sights in London." During that period the scientific production of candles had advanced as considerably as the demand for this varied class of manufacture, which now embraces between three and four hundred different kinds and sizes of lights, from the primitive dip to the finest hand-decorated wax.

Passing by busy shops where the firm's machines are made, taking no note of cooperages and box factories, turning his back upon stores of various kinds, and paying no heed to the steady rattle of printing machinery, our guide pilots us to the wharf where the paraffin is unloaded. It is brought from the docks by the company's lighters. Most notable are the barrels of crude yellow shale chiefly from America. It is of a light yellow colour, and contains about two to four per cent. of oil. From the quay the barrels go into the works, are broken open and the contents emptied into underground tanks that are heated by steam. When melted it is pumped into elevated tanks, and thence by pipes into the crystallising room. Here it is run into shallow pans and allowed to cool and crystallise. After crystallisation it is subjected to "the sweating process" (the only "sweating" the writer has yet encountered in his agreeable task of describing the national industries), invented by Mr. John Hodges, the foreman of this important department, and which is now generally adopted. The trays of crystallized blocks of paraffin are placed in steam-heated ovens. Here, packed in mats of cocoa-nut fibre, they are left to drain. The liquid that contains oil and colouring matter falls into underground tanks. The ovens are kept at a moderate temperature. Opened you see layers of cakes that are literally sweating through their fibrous packings, whitening and hardening. The liquid is carried off for further treatment, and the solid or purified paraffin is taken to the refinery, a great hall of tanks and retorts and mysterious pipes.

Here comes in one of those little romances of the laboratory that in works of this description must be continually cropping up to adorn what to the casual observer may appear very prosaic proceedings. Science has its fairy tales, and Battersea could supply more than one new subject for the ready and fanciful writer. Arrived at the refinery, it is found that certain impurities still cling to the seemingly regenerate paraffin; it has contracted objectionable associations which refuse to be shaken off. It is not allowable in human life to treat undesirable acquaintances as the chemist treats the debased associates of his purifying paraffin. To get rid of them the aid of certain chemical agents and allies are called in. They make short work of the intruder. But like the hired assassins of melodrama they seek to take advantage of their employers, and have, in turn, to be dealt with, and the fight is full of curious interest.

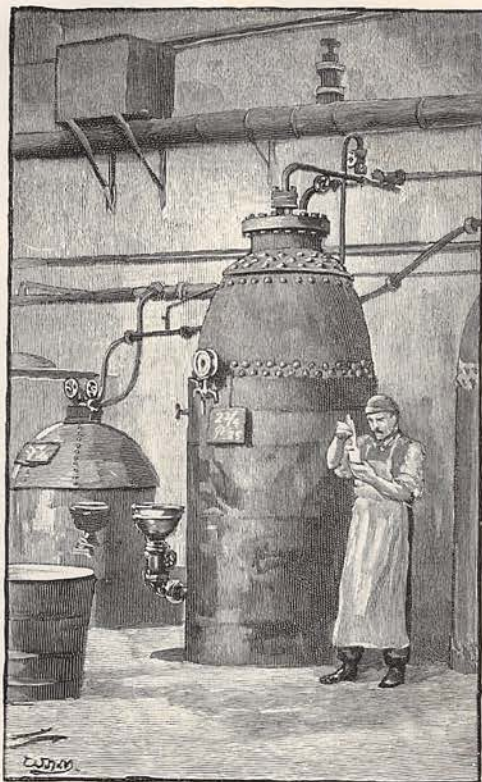
Passing on through what seem to us to be miles of sweating-rooms and refineries one after the other, we come to the blocking-room, where the finished paraffin is stacked in its great square pans ready for the candle-maker. The drainings from the sweating-room pass over to what is called the press-room, from the many elevated tanks of which department it flows into trays as before, but instead of being heated it is treated with cold air and submitted to hydraulic pressure. The residuary oil is now used for lubricating purposes. Both the paraffin and the oil are improved by these repeated processes of sweating and pressure. For the present this is the end of the paraffin process. We shall meet with the resultant cakes of purified and refined wax by and by, on its final introduction to candleland.

The machine oil department now intervenes between the paraffin factory and the neutral and fatty acid works. Here we are literally in a little world of oil. It is stored in tanks above us, it is collected in tanks beneath. It is being pumped hither and thither. The very floors are slippery with it. The atmosphere is oleaginous, but nowhere is it disagreeable, and everywhere, judging from the appearance of the work-

people, its influences must be healthy. Cylinders oxidising oil, with the aid of steam air-pumps; agitators in tanks swirling to and fro and round and round; caldrons where it is boiled, separators, collectors—every kind of machine is at work. Have you ever witnessed the stage preparations for a great play? To the novice the entire business is one of confusion, doubt, and uncertainty. So it is to the unpractised eye in this oil factory that is incidental to candle-making; but as the curtain goes up on a series of most complete and perfect scenes in the theatre, so does the result of the busy factory come out in almost every variety of lubricating oil, from the delicate preparation used for the sewing-machine and the type-writer, to the lubricatory compounds used for marine engines. There is a point in respect of paraffin that it will be useful to explain. The light yellow shale which we saw in barrels on the wharf is denuded of its light oil before arrival. There is left a small percentage of heavy oil in the solid wax. This is not combustible. It does not ignite, burns only with a wick, and the idea of its inflammability is a popular fiction. Put a light to it and there is no flame; but let your light be a properly supported wick and it will float and burn and no more, even if you set it alight in a vat of the liquid.

Passing by closely packed stores of paraffin wax, we come to what is called the neutral fat department, to distinguish it from the fatty acid department. This opens up fresh vistas of men and machinery and presents new practical solutions of scientific problems. "All fats," remarks our guide, "consist of fatty acid and glycerine, that is to say when they undergo decomposition, but no glycerine is present in fats that are not rancid or decomposed, but we convert fats into this condition by artificial means." Fatty acid is developed with decomposition, and in the early days of candle-making the work was offensive, much rancid fat being used. In this department the solid matter is converted into soap, the liquid goes to make cloth oils, used in wool industries. It is a spacious place, with rows of smoking vats, each holding three and four tons of oil. It might be a floor in a brewery, or the storeroom of a vinegar works, but for the unmistakable oiliness of the atmosphere and the oleaginous grip of the pavement. This should be a fine atmosphere for any one suffering from bronchial trouble. The workmen have clear, healthy complexions. Some of them are old, and in other departments many of them have been employed here for a great number of years. Apart from the hygienic nature of their labour the work-people are well cared for in all other respects. Baths and wash-houses, libraries and reading-rooms, a new lecture-hall, with other privileges, belong to the industrial organisation of the establishment, and bring employer and employed into pleasant relationship. But this is by the way. Leaving the oil vats we come upon a department where cocoa-nut-oil is prepared for night-lights, the process of sweating being much the same as that already described in connection with paraffin, except that this product is so hard it has to be beaten into shape before it can be put into the presses.

And now we are on the other side of the creek which divides the main buildings of the great factory; and whereas when we started on our tour the tide was out, now the swelling water is rising, and on its bosom come forging in the lighters from the docks with cargoes of vegetable and other products for what is called the fatty acid department. And here our guide remarks that each side of the creek is known in the



THE AUTOCLAVE PROCESS OF DECOMPOSING FATS.

factory by their historic names, the one we have just left being known as the Sherwood House side; and that upon which we are now standing, the west side, being known as the York House side. Tradition rightly or wrongly has it that it was at York House where Cardinal Wolsey was surprised by Henry VIII. on the occasion of one of his luxurious entertainments, where for the first time he met Anne Boleyn as represented in Mr. Irving's production of Shakespeare's *Henry VIII.* at the Lyceum. Our guide discusses the probability of the truthful character of the story. "It was quite a palace," he said, "this York House, and within easy drive of Hampton Court; there is not the smallest reason that I can see why the cardinal



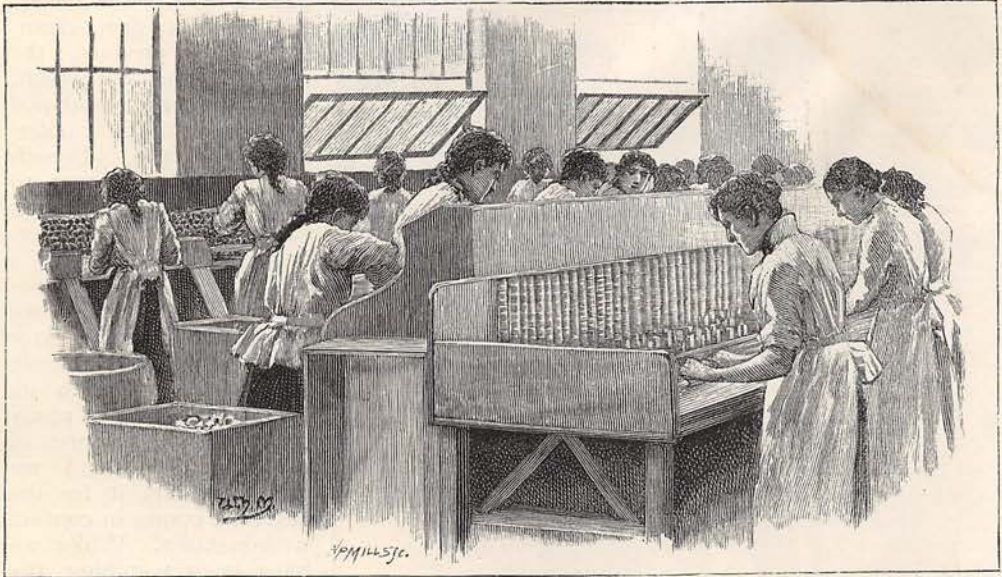
THE OLD METHOD OF CANDLE-DIPPING.

should not have preferred to give certain of his receptions here; and I should say it was quite natural that the king should arrive by barge, and he could have landed where our lighters are lying a little outside the creek." It is no disparagement of his technical knowledge of candle-making to say that our guide was enthusiastic in his speculations about Wolsey, his court, and his king; he went so far as to refer to certain lines of Shakespeare that supported his contention, and he mentioned with admiration the historic play in which the Boleyn incident is given with so much artistic effect at the Lyceum. It is a pleasant thing to find the innate romance of our English character (reference to which has already been made in a passing note) breaking out in such an unexpected place, and it is quite possible, if we had followed it up, we might have found our guide ready with some equally interesting incidents of the historic use of candles in the pomp and pride of ecclesiastical procession, at the festive board of kings, and illuminating royal masques and festivals.

Coming down from these heights of poetry and romance, which we pause for a moment to contemplate with the consciousness that it would be difficult to develop such speculations in this present paper, we observe that whereas the paraffin oil in its solid state was easily tumbled into the underground tanks that await every cargo, the palm and other vegetable oils refuse to budge; they are solid in the barrels, and

have to be coaxed by jets of steam which are directed into their bung-holes, with the result that in due course the coagulated masses melt and run into pipes, whence the oil is drawn off into elevated tanks similar to those in which the melted product of the paraffin wax is stored. Here, in the fatty acid department, the object is to separate the glycerine from the stearic acid, or stearine as it is popularly called; and this process is managed with a dexterity that is the result of many years of experiment and invention, and is the foundation of many patents.

M. E. Chevreul revealed to the world the foundation of our knowledge of the chemistry of the fatty or non-drying oils. His *Recherches Chimiques sur les Corps Gras d'Origine Animale* is well known, and though published in 1823 may—we have it on authority—be still profitably consulted. But it was left for the originators of Price's Patent Candles to practically apply the famous chemist's discoveries to dark-coloured fats such as palm-oil and greases. "The fatty oils,"



MAKING NIGHT-LIGHT CASES.

to quote Professor Mattieu Williams, "whether solid or liquid, animal or vegetable, are with one or two exceptions neutral compounds of glycerine, with substances to which the name of fatty acids has been applied. These acids are composed of carbon, hydrogen, and oxygen, united in varying proportions. Some are solid at ordinary temperatures, others liquid. The solids are pearly crystalline substances, smooth and unctuous to the touch, but not greasy, while all are fusible into oily liquids," and glycerine is produced as a secondary product in the manufacture of candles, and here at Battersea the method of production is on a highly scientific principle, and in such quantity that it has developed into many industrial uses "where its emollient properties and its maintenance of liquidity are due to its non-volatility and absorption of atmospheric moisture." It is used by the modeller to keep his clay soft; ordinary ink is made into copying ink by the addition of glycerine; it is used in paper pulp to make it soft; gas-meters are filled with a solution of glycerine, as it neither evaporates in summer nor freezes in winter; it is used for the sweetening of liqueurs; and treated with sulphuric and nitric acids, it enters into the deadly composition of dynamite. Now the great work of the fatty acid department is to separate the glycerine from the fatty acids, and although on a much more complicated and serious scale, this operation is in a way so much like the paraffin work we have already described that it is only necessary to say that the principal machine engaged in this work is called an autoclave, a construction as formidable as its name. It is, in appearance, a stupendous copper boiler, with mysteriously capped ends, and it goes down into the regions below, as far as it rises above us in this department of the fatty acid. In these curious boilers, or retorts, or autoclaves, the fat is charged

with a percentage of lime in the presence of water, and subjected for five hours to the action of steam pressure of a hundred and twenty pounds to the square inch. The lime combines with the fat and forms a lime soap. The glycerine being set free combines with the water. The contents of the vessels are blown out by steam into tanks where a mechanical separation takes place, the glycerine or "sweet water," as it is technically called, being at the bottom, the lime-soap floating on the top. The sweet water is drawn off by taps, and the lime-soap is easily decomposed. It is attacked with sulphuric acid which now sets the fat free.

Next comes another process of treatment with sulphuric acid, then water washing, followed by distillation, crystallisation and hydraulic pressing. Stearic acid is the result. It is a white, firm, clean, handsome product, the added value of which, when properly combined with paraffin in candle-making, the French have not yet learnt to fully appreciate in their own manufactures. Having been subjected to a similar process of refinement to that which we have noted in the matter of paraffin, we presently meet the stearine in its finished condition ready for its ultimate purpose of candle-making, and we meet it where it for the first time comes in contact with paraffin. While we have been watching the manufacture of these two products, paraffin-wax and stearine, they have been in careful training for formal and permanent introduction to each other. The meeting and marriage of the two chemical bodies takes place almost simultaneously, and with the happiest results. There



FILLING NIGHT-LIGHT CASES.

are paraffin candles, and there are stearine, each made from the individual material; the one is apt to soften and bend as wax will, the other, wanting in that transparency which makes paraffin so attractive. A judicious blend of the two makes a perfect candle, white, transparent, brilliant. During the course of manufacture it will be noticed that these two materials never come in contact until they arrive in the great blending-room. On one hand we notice stacks of paraffin, on the other a store of stearine, the first in large crystallised stacks, the second in white cakes that break clean and dry. They are destined, in carefully calculated quantities, duly mixed, for the giant pans or caldrons, in which they are melted, for the moulding-rooms, that form another section of the factory.

Meanwhile, the glycerine, which we saw separated from its fatty acids, is marching on its way to perfect purification and white splendour, such as may well fit it to be called the Cinderella of Science, or the fairy of the autoclave. After filtration the



sweet water is conducted to the concentrators, where it is converted from sweet water to the denser "candle glycerine," in which shape it goes to the refinery, where it is distilled, refiltered, and distilled again, until it is seen running slow and white and sweet from the stills, ready to be bottled in the warehouse, where it is packed, in company with oils and soaps and candles, in phials of many shapes and variety, in boxes of many colours, for conveyance to many distant lands, not forgetting the villages, towns, and cities of Great Britain herself. We are tempted to taste the liquid as it runs into its bright receptacles, with no unpleasant results, but with a full appreciation of its use in certain liqueurs.

The candle-moulding rooms contain a curious array of inverted mitrailleuse. The candle-moulding rooms are unlike any other part of the factory. Long lines of machines; an army of busy men. The machines, at first blush, might be anything you like to fancy, from the mitrailleuse to some new kind of barrel-organ. On closer inspection you find that the steel barrels are either being steadily filled with the oil from the blending-room, or that out of the barrels candles are being shot and collected for the packing-rooms. These ingeniously contrived moulds, with their cooling arrangements, turn out tons of candles a day, and of all sizes and classes. Nearly four hundred varieties are made, and so comprehensive is the scheme of the firm to satisfy customers, that in a small corner of the works, as we pass the packing-rooms, we come upon the very first method of candle-making, a kind of small chandlery where they are actually making dips. Time does not admit the opportunity of more than a passing mention of the stores, the packing, the box-making, or the engineering works, though we stop *en route* for the night-light and soap factories, to look into a department that is more like a room in a yarn factory. It is the wick-spinning room, where hundreds of bobbins are revolving with a sharp whirr and rattle that is in striking contrast with the repose of the autoclave and the silence of the sweating ovens.

There are few stairs to ascend at these Battersea works. Nearly every department is on the ground floor. Most of them are separated in such a way that they can be isolated in case of fire; but to the night-light casing-room we have to ascend to a floor above; and here we find for the first time a number of girls at work. They are all dressed in white linen frocks with aprons and sleeves. The room is bright and cheerful. There are three kinds of night-lights; two in paper cases, one in glass. In this room the paper cases are being made by nimble fingers aided by small automatic machines. Descending we see the cases filled. In one case a wick and metal sustainer has to be first placed; the material is then poured in; this is done with a dexterity that is remarkable. In another part of the room the other cased light is first moulded like a candle and then simply placed in its outer covering. While these operations are going on, two large drums at the extreme end of the room are revolving with a monotonous motion, making tapers. The wick—miles in length—is slowly wound and rewound about these drums, passing *en route* from one to the other through a melted waxy preparation that adheres on the principle of the repeated dipping of the original candle; and when the deposit is sufficient, the taper is cut into the required lengths. I have heard travellers speak of the usefulness of both tapers and night-lights, more especially on expeditions beyond the confines of civilisation. The paraffin-moulded light, which is simply fitted into its case and only requires lighting under any circumstances, is a very handy companion.

A long interesting day has almost come to an end. When we step once more into the open air, with a somewhat bewildered sense of a new knowledge of many things,



WICK SPINNING.

our guide intimates that it might now be well to "take in the soap-works." "Why, that is a new industry altogether?" "Often goes with candles," our guide replies, smiling. "Don't you remember a certain combination in the neutral fat department that was reserved for soap?" "Why, certainly," we say, and as we chat, lo and behold we are in the boiling-room and the frame-room! Here are made several soaps—soft soap, carbolic soap, and some other ordinary soaps of commerce; but moving on to the next work of the soap-maker, we enter a clean well-lighted apartment, the atmosphere of which is sweet with a delicate perfume. We are in the toilet and fancy soap factory. The machines are turning out the "Regina" speciality, and very tempting it looks. In the ordinary method of scented soap manufacture, the perfumes are introduced while the soap is hot. The mode at Battersea is a great improvement on this. First the bars are torn into shreds, which are placed on trays, and put into ovens to dry. From the ovens the soap is packed into a machine with large solid granite rollers, between which it passes, getting crushed and ground, and coming out from the mill in continuous lengths of yellow tape. You may take it into your hands and it does not break, it is tender but quite solid. In this dry and cool condition the perfume is added; nothing is thus lost by heat and excessive evaporation; the perfume is retained, and at the same time the treatment which the soap undergoes serves to improve its quality in a remarkable way. But we came to Battersea to describe and illustrate candle-making; soap deserves separate and special treatment at some future day.

The rise of the candle trade in England may be said to date from 1831, when the manufacture was set free from Excise supervision. Soon after this date, Messrs. Price and Company established steam mills in Ceylon for crushing cocoa-nuts, to extract the oil as raw material for the London factory. In 1840 Mr. J. P. Wilson, a member of the firm, while endeavouring to produce a cheap self-snuffing candle for the illumination in honour of the marriage of Queen Victoria, succeeded in making the required light with a mixture of stearic acid and cocoa-nut stearine. This was the well-known "composite" candle. Then came the practical application of the Chevreul processes to which reference has already been made; and with numberless improvements arising out of these discoveries, the trade grew from year to year. From 1847 to 1851, the first five years of its existence, the Company sold 14,220 tons of finished produce. This amount has gone on increasing in a remarkable way; in the five years 1882 to 1886, it had risen to 80,205 tons, and in the five years ending 1890, the finished saleable produce amounted to 83,225 tons. But this great out-put was not the work of Battersea alone. In 1853 the Company bought an estate of sixty acres at Bromborough Pool, near Birkenhead, on which they erected a new factory. Liverpool being the chief palm-oil port, the Company found a great saving in the manufacture of this material in a large and exclusive way, where the material could be purchased without land carriage. Here the Company employs five hundred operatives who have some advantage over the workers at Battersea. Bromborough has a recreation ground and a set of allotment gardens. The growth of buildings at Battersea does not admit of this at the London factory, but each establishment has an efficient company of rifle volunteers. Football and cricket are among their outdoor games, and both in their sports and their work, there is an evident *esprit de corps* among the firm's employés, on the Thames and on the Mersey, which has no doubt been a valuable influence in the successful development of the candle industry.

