*New Paper Materials.** BY M. C. COOKE.

One result may fairly be attributed to the offer of a premium, by one of the daily papers, for a new and available paper-stuff, which should supply the deficiency of rags; and that result an important one. It has stimulated many an effort to supply that want not only at home but abroad; and we are now in a much better position to do without rags for our own paper manufacture than at any other period of our history. It may be true that the premium has never been paid, but it is equally true that we are nationally full the thousand pounds richer on account of that offer. Why it has not been paid, forms no part of this inquiry, neither to whom it should have been awarded. Let it suffice to point to some of its results. Out of the numerous efforts to furnish good paper with only a per centage of rags, one of the most successful with which I am acquainted is that of Dr. Collyer, which was patented in 1857. It consists in applying the residue of the beet-root left in the process of sugar-making and distillation to the manufacture of paper, papier mache, millboard, and other paper manufactures. One feature pointed out in the process of this manufacture is, that no sizing is necessary, on account of the nature of the material used. In consequence of the whole mass being permeated, instead of the surface alone being covered, it is, from its compactness, solidity, and elasticity, not liable to crack, and for the same reason will resist damp and moisture when in the form of paper. The patentee states, "The extraordinary tendency which the cellulose, starchy, and proteine substances have to enlarge when exposed to heat and moisture, renders them very valuable for giving strength to other material, especially to cotton, which is deficient in these properties. When thus mixed each fibre of the cotton becomes cylindrical and thick, and attains the strength of hemp and flax, and no longer loses its shape through pressure. A similar improvement is evident when it is combined with other materials. A proportion of 10 per cent. of the prepared residue with the other usual material, makes tougher and more flexible paper. Twenty-five per cent. renders packing paper sufficiently waterproof that it will require no other sizing. Fifty per cent. will produce paper nearly or quite as strong as parchment, and which in very thin sheets will preserve articles packed in it from dampness. Strong paper, cardboard, &c., can be made from 75 per cent. of prepared residue and 25 per cent. of cotton; also of 50 per cent. of prepared residue, 40 per cent. of raw residue, and 10 per cent. of saw-dust, hay, straw, &c. Fifty per cent. of prepared residue and 50 per cent. of fine cut straw will produce strong packing paper, as will also 50 per cent. of white saw-dust, 30 per cent. of prepared residue, and 20 per cent. of cotton rags. A good, strong, white paper for printing purposes has been made with 50 per cent. of beet-root residue and 50 per cent. of cotton, no sizing being required in the process, and the result has been entirely satisfactory, the paper so made being remarkable for its tenacity. It will, however, have

* From the Lond. Jour. of the Society of Arts, No 321.

been observed that something beside the beet-root residue is required to make good paper, and that the best substance for that addition is cotton or cotton rags, the use of which this patent does not supersede."

Another patent, or rather series of patented paper pulps, worthy of notice, are those of Mr. Plunkett, of Dublin,* in all of which the material, *per sé*, is capable of furnishing serviceable paper. Patented also in 1857, the entire value and capabilities of the materials have not yet been fully ascertained. Mr. Plunkett's papers are made from four different plants, any one of which furnishes a good paper pulp, and may be obtained in almost unlimited quantities. These are the tree-mallow, red clover, hop bine, and yellow water-iris. To the first of these we may look, perhaps, for the most satisfactory results. The order to which the tree-mallow belongs is composed of eminently fibre-producing plants. Independent of the cottons, we have numerous species of *Hibiscus*, *Sida*, *Abutilon*, *Urena*, and *Thespesia*, yielding useful fibres which leads us to expect, perhaps to find in *Lavatera arborea* a good material for pulp.

"The tree-mallow grows wild on several parts of the south-west coast of Britain, as well as on the east coast of Scotland, on rocky cliffs, flowering in July, and often producing a long succession of bloom. In gardens the plant often remains some years without blossoming, but dies in the winter after it has flowered, being naturally biennial. Seeds scattered in the ground will, some of them, keep springing up every season for an undetermined number of years, but the young plants are impatient of the cold, except in maritime situations, and few of them survive even a single winter. The root is deep and much branched; stem, 6 to 10 feet high, upright, straight, round, simple, except in the upper part, where it forms a branched leafy head. It is clothed with clusters of small deflexed bristles. Leaves alternate on long stalks, pliable and downy, of seven shallow crenate lobes. Flower on simple axillary clustered stalks, very much like those of *Malva sylvestris*. Outer calyx deeply divided into three large lobes, but not as in *Malva* formed of three separate leaves. A slight or rather artificial distinction."†

On inquiry, I find that the *Lavatera* will, with the addition of saline manure, grow freely on the deepest bog land. My informant states that he has seen it in perfection on the west coast of Donegal, growing where there was very deep bog, at least thirty feet. A gentleman in Londonderry, who is owner of a large tract of slob land, intends cultivating the plant extensively next season, for which purpose he has about 250 acres at disposal. When this experiment shall have been made, we shall be in possession of facts as to the cost of culture and the produce per acre. The plant, if cultivated, would not only yield hemp enough for home use, but also give, from the hacklings, or tow, and the wood, a large supply of paper material. The quality of the hemp obtained from the bark would command for it a ready sale.

* Specimens of these substances were shown at the Society's last Annual Exhibition of Inventions. See Catalogue for 1858, No. 301.—Ed. J. S. A.

† English Botany, or Colored Figures of British Plants. London, 1803.

Cordage has been made from it experimentally, and so satisfied were the company entrusted with the manufacture of the specimens, that they have guaranteed the purchase of any quantity which may be grown on the Londonderry estate next season. The refuse leaves, wood, and tow, would furnish paper pulp.

The process of manufacture of paper from these substances is that ordinarily pursued. The wood has to be reduced to chips or shavings, and whether wood, leaves, or tow, boiled in caustic alkali and bleached in the ordinary manner. The paper thus made presents no external variation from that made of rags.

Specimens of the plant, wood, hemp, cordage, fine thread, and lace, made from this plant, together with paper made from the wood, I shall be happy to show to any one interested in the experiment.

Another substance used by Mr. Plunkett for paper pulp is the common red clover, *Trifolium pratense*, in order to obtain which, the clover is taken, either in its green state or when dried into hay, and first submitted to a rippling process, by means of which the leaves and blossoms or seeds are saved as fodder for cattle. The stalks are then submitted to the action of caustic alkali, bleached and pulped in the usual manner. Paper and cardboard produced from this pulp is also of a firm and excellent quality.

A third material is subjected by the same gentleman to a similar process with a like result. This substance is the hop bine, or twining stems of the *Humulus lupulus*, a material which, in many parts of the country, may be obtained in almost any quantity, and which has been hitherto regarded rather as a nuisance than as a stock to be converted into a valuable article of trade. Instead of being as heretofore, burnt up for manure, Mr. Plunkett has shown that it may be converted into a useful paper, the dried bine yielding from 70 to 75 per cent. of fibrous matter.

The fourth and last of Mr. Plunkett's papers is made from the yellow water-iris (*Iris pseudacorus*), which is not only a very common weed in Ireland, but is also common enough in the marshy parts of England. It yields when dry, about 60 per cent. of available fibre or half stuff, and, as far as one can judge from unsized specimens made by hand, will make a paper equal to that produced from either of the other sources.

Hence it will be seen, that the Irish patents, in each instance, offer a material, not to be used in conjunction with rags or other fibre, but independently, as substitutes for those substances. In each case the raw material is either common enough, or, as in the instance of the Lavatera, may be easily cultivated on waste lands in sufficient quantities to supply all our wants; and beyond this to furnish us with a fibre for cordage and textile manufactures of a new but valuable kind at home, instead of seeking supplies from Russia and India.*

Independently of "substitutes for paper material" at home, and

* The last patented paper material is that of Mr. Haughton, for converting the refuse of flax straw into pulp. The process consists of an application of an alkali, in a heat of nearly 400 deg. Three tons of flax refuse, at from 20s. to 50s. per ton, can, it appears, be converted into one ton of pulp. The rags for the same amount of pulp would weigh one ton and a third, and the lowest price of rags is £15 per ton.

of the premium before alluded to, the reports of the Paris Universal Exhibition contain an interesting account of a paper material now in course of manufacture by a company established at Florence from the common asphodel (*Asphodelus ramosus*). The roots are first made to undergo a process of distillation, during which alcohol is obtained, and the residuum, together with the other parts of the plant, is converted into card paper, cards and paper, including writing papers of various qualities. The gum which abounds in asphodel, is a highly advantageous ingredient; it gives gloss to cardboard, and prevents writing paper from becoming absorbent. The stoutest cartridge paper which is made from this plant is found to bend without breaking, and is not apt to tear. Corsica, Spain, Algeria, Portugal, all have hastened to follow the example of Tuscany, and to seek to derive advantage from asphodel, either as yielding alcohol or paper-stuff, or both. If even the enormous tracts which are covered with asphodel should in time be exhausted, the culture of the plant is by no means difficult. The manager of the Grand Duke's domain, at Alberese, offered, a few years ago, 40,000 francs for the extirpation of the asphodel, in a comparatively limited territory, and no person was found to undertake the next to impossible task. It is stated, moreover, that the asphodel produces alcohol and paper, at a much cheaper rate than any other material which has yet been tested, and there is good reason to hope that it may yet prove a providential benefit to many sterile and unproductive districts.

From North America, I have just received a series of specimens of what our brethren are doing on the other side of the Atlantic in paper stuffs. This series contains white pulps, made from white pine, yellow pine, white cedar, red cedar, hemlock, spruce, white oak, maple, gum, chestnut, ash, bass, sycamore, birch, catalpa, beech, willow, paper mulberry, mulberry bark, black walnut, elm, tulip poplar, hickory, straw, reed, maize, and sun-flower. The American straw papers seem to possess tenacity and quality superior to those of British manufacture. To what extent these wood papers are made and used in America, I have as yet received no information, the promised papers and particulars not having come to hand.

These remarks on new materials for paper, are essentially fragmentary; there are many other substitutes, and some not generally known to the public, which have been patented and experimented upon within the past two or three years; but to enter into any particulars concerning them, would extend this paper far beyond the limits I have assigned to it.

It would not be an uninteresting or impossible inquiry to ascertain the history and progress of this question of rag substitutes for paper during the past seven years—a subject to which I may return at some future opportunity.